

Programming Exercises For Chapter 3

THIS PAGE CONTAINS programming exercises based on material from [Chapter 3](#) of this [on-line Java textbook](#). Each exercise has a link to a discussion of one possible solution of that exercise.

Exercise 3.1: How many times do you have to roll a pair of dice before they come up snake eyes? You could do the experiment by rolling the dice by hand. Write a computer program that simulates the experiment. The program should report the number of rolls that it makes before the dice come up snake eyes. (Note: "Snake eyes" means that both dice show a value of 1.) [Exercise 2.2](#) explained how to simulate rolling a pair of dice.

[See the solution!](#)

Exercise 3.2: Which integer between 1 and 10000 has the largest number of divisors, and how many divisors does it have? Write a program to find the answers and print out the results. It is possible that several integers in this range have the same, maximum number of divisors. Your program only has to print out one of them. One of the examples from [Section 3.4](#) discussed divisors. The source code for that example is [CountDivisors.java](#).

You might need some hints about how to find a maximum value. The basic idea is to go through all the integers, keeping track of the largest number of divisors that you've seen *so far*. Also, keep track of the integer that had that number of divisors.

[See the solution!](#)

Exercise 3.3: Write a program that will evaluate simple expressions such as $17 + 3$ and $3.14159 * 4.7$. The expressions are to be typed in by the user. The input always consist of a number, followed by an operator, followed by another number. The operators that are allowed are $+$, $-$, $*$, and $/$. You can read the numbers with `TextIO.getDouble()` and

the operator with `TextIO.getChar()`. Your program should read an expression, print its value, read another expression, print its value, and so on. The program should end when the user enters 0 as the first number on the line.

[See the solution!](#)

Exercise 3.4: Write a program that reads one line of input text and breaks it up into words. The words should be output one per line. A word is defined to be a sequence of letters. Any characters in the input that are not letters should be discarded. For example, if the user inputs the line

```
He said, "That's not a good idea."
```

then the output of the program should be

```
He
said
that
s
not
a
good
idea
```

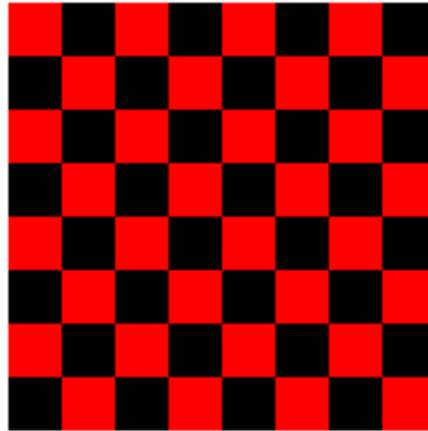
(An improved version of the program would list "that's" as a word. An apostrophe can be considered to be part of a word if there is a letter on each side of the apostrophe. But that's not part of the assignment.)

To test whether a character is a letter, you might use `(ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z')`. However, this only works in English and similar languages. A better choice is to call the standard function `Character.isLetter(ch)`, which returns a boolean value of `true` if `ch` is a letter and `false` if it is not. This works for any Unicode character. For example, it counts an accented e, é, as a letter.

[See the solution!](#)

Exercise 3.5: Write an applet that draws a checkerboard. Assume that the size of the applet is 160 by 160 pixels. Each square in the checkerboard is 20 by 20 pixels. The

checkerboard contains 8 rows of squares and 8 columns. The squares are red and black. Here is a tricky way to determine whether a given square is red or black: If the row number and the column number are either both even or both odd, then the square is red. Otherwise, it is black. Note that a square is just a rectangle in which the height is equal to the width, so you can use the subroutine `g.fillRect()` to draw the squares. Here is an image of the checkerboard:



(To run an applet, you need a Web page to display it. A very simple page will do. Assume that your applet class is called `Checkerboard`, so that when you compile it you get a class file named `Checkerboard.class`. Make a file that contains only the lines:

```
<applet code="Checkerboard.class" width=160
height=160>
</applet>
```

Call this file `Checkerboard.html`. This is the source code for a simple Web page that shows nothing but your applet. You can open the file in a Web browser or with Sun's `appletviewer` program. The compiled class file, `Checkerboard.class`, must be in the same directory with the Web-page file, `Checkerboard.html`.)

[See the solution!](#)

Exercise 3.6: Write an animation applet that shows a checkerboard pattern in which the even numbered rows slide to the left while the odd numbered rows slide to the right. You can assume that the applet is 160 by 160 pixels. Each row should be offset from its usual position by the amount `getFrameNumber() % 40`. Hints: Anything you draw outside the boundaries of the applet will be invisible, so you can draw more than 8 squares in a row. You can use negative values of `x` in `g.fillRect(x,y,w,h)`. Here is a working solution to this exercise:

Your applet will extend the non-standard class, `SimpleAnimationApplet2`, which was introduced in [Section 7](#). When you run your applet, the compiled class files, `SimpleAnimationApplet2.class` and `SimpleAnimationApplet2$1.class`, must be in the same directory as your Web-page source file and the compiled class file for your own class. These files are produced when you compile [SimpleAnimationApplet2.java](#). Assuming that the name of your class is `SlidingCheckerboard`, then the source file for the Web page should contain the lines:

```
        <applet code="SlidingCheckerboard.class"
width=160 height=160>
        </applet>
```

[See the solution!](#)

[[Chapter Index](#) | [Main Index](#)]

Chapter 3

Programming in the Small II

Control

THE BASIC BUILDING BLOCKS of programs -- variables, expressions, assignment statements, and subroutine call statements -- were covered in the previous chapter. Starting with this chapter, we look at how these building blocks can be put together to build complex programs with more interesting behavior.

Since we are still working on the level of "programming in the small" in this chapter, we are interested in the kind of complexity that can occur within a single subroutine. On this level, complexity is provided by **control structures**. The two types of control structures, loop and branches, can be used to repeat a sequence of statements over and over or to choose among two or more possible courses of action. Java includes several control structures of each type, and we will look at each of them in some detail.

This chapter will also begin the study of program design. Given a problem, how can you come up with a program to solve that problem? We'll look at a partial answer to this question in Section 2. In the following sections, we'll apply the techniques from Section 2 to a variety of examples.

Contents of Chapter 3:

- Section 1: [Blocks, Loops, and Branches](#)
 - Section 2: [Algorithm Development](#)
 - Section 3: [The while and do..while Statements](#)
 - Section 4: [The for Statement](#)
 - Section 5: [The if Statement](#)
 - Section 6: [The switch Statement](#)
 - Section 7: [Introduction to Applets and Graphics](#)
 - [Programming Exercises](#)
 - [Quiz on this Chapter](#)
-

[[First Section](#) | [Next Chapter](#) | [Previous Chapter](#) | [Main Index](#)]

Section 3.1

Blocks, Loops, and Branches

THE ABILITY OF A COMPUTER TO PERFORM complex tasks is built on just a few ways of combining simple commands into control structures. In Java, there are just six such structures -- and, in fact, just three of them would be enough to write programs to perform any task. The six control structures are: the **block**, the **while loop**, the **do..while loop**, the **for loop**, the **if statement**, and the **switch statement**. Each of these structures is considered to be a single "statement," but each is in fact a **structured** statement that can contain one or more other statements inside itself.

The **block** is the simplest type of structured statement. Its purpose is simply to group a sequence of statements into a single statement. The format of a block is:

```
{  
    statements  
}
```

That is, it consists of a sequence of statements enclosed between a pair of braces, "{" and "}". (In fact, it is possible for a block to contain no statements at all; such a block is called an **empty block**, and can actually be useful at times. An empty block consists of nothing but an empty pair of braces.) Block statements usually occur inside other statements, where their purpose is to group together several statements into a unit. However, a block can be legally used wherever a statement can occur. There is one place where a block is required: As you might have already noticed in the case of the `main` subroutine of a program, the definition of a subroutine is a block, since it is a sequence of statements enclosed inside a pair of braces.

I should probably note at this point that Java is what is called a free-format language. There are no syntax rules about how the language has to be arranged on a page. So, for example, you could write an entire block on one line if you want. But as a matter of good programming style, you should lay out your program on the page in a way that will make its structure as clear as possible. In general, this means putting one statement per line and using indentation to indicate statements that are contained inside control structures. This is the format that I will generally use in my examples.

Here are two examples of blocks:

```

{
    System.out.print("The answer is ");
    System.out.println(ans);
}

{ // This block exchanges the values of x and y
  int temp;           // A temporary variable for use
in this block.
    temp = x;         // Save a copy of the value of x
in temp.
    x = y;            // Copy the value of y into x.
    y = temp;         // Copy the value of temp into y.
}

```

In the second example, a variable, `temp`, is declared inside the block. This is perfectly legal, and it is good style to declare a variable inside a block if that variable is used nowhere else but inside the block. A variable declared inside a block is completely inaccessible and invisible from outside that block. When the computer executes the variable declaration statement, it allocates memory to hold the value of the variable. When the block ends, that memory is discarded (that is, made available for reuse). The variable is said to be **local** to the block. There is a general concept called the "scope" of an identifier. The **scope** of an identifier is the part of the program in which that identifier is valid. The scope of a variable defined inside a block is limited to that block, and more specifically to the part of the block that comes after the declaration of the variable.

The block statement by itself really doesn't affect the flow of control in a program. The five remaining control structures do. They can be divided into two classes: loop statements and branching statements. You really just need one control structure from each category in order to have a completely general-purpose programming language. More than that is just convenience. In this section, I'll introduce the `while` loop and the `if` statement. I'll give the full details of these statements and of the other three control structures in later sections.

A **while loop** is used to repeat a given statement over and over. Of course, its not likely that you would want to keep repeating it forever. That would be an **infinite loop**, which is generally a bad thing. (There is an old story about computer pioneer Grace Murray Hopper, who read instructions on a bottle of shampoo telling her to "lather, rinse, repeat." As the story goes, she claims that she tried to follow the directions, but she ran out of

shampoo. (In case you don't get it, this is a joke about the way that computers mindlessly follow instructions.))

To be more specific, a `while` loop will repeat a statement over and over, but only so long as a specified condition remains true. A `while` loop has the form:

```
while (boolean-expression)
    statement
```

Since the statement can be, and usually is, a block, many `while` loops have the form:

```
while (boolean-expression) {
    statements
}
```

The semantics of this statement go like this: When the computer comes to a `while` statement, it evaluates the **boolean-expression**, which yields either `true` or `false` as the value. If the value is `false`, the computer skips over the rest of the `while` loop and proceeds to the next command in the program. If the value of the expression is `true`, the computer executes the **statement** or block of **statements** inside the loop. Then it returns to the beginning of the `while` loop and repeats the process. That is, it re-evaluates the **boolean-expression**, ends the loop if the value is `false`, and continues it if the value is `true`. This will continue over and over until the value of the expression is `false`; if that never happens, then there will be an infinite loop.

Here is an example of a `while` loop that simply prints out the numbers 1, 2, 3, 4, 5:

```
int number;    // The number to be printed.
number = 1;    // Start with 1.
while ( number < 6 ) { // Keep going as long as
number is < 6.
    System.out.println(number);
    number = number + 1; // Go on to the next
number.
}
System.out.println("Done!");
```

The variable `number` is initialized with the value 1. So the first time through the `while` loop, when the computer evaluates the expression "`number < 6`", it is asking whether 1 is less than 6, which is `true`. The computer therefor proceeds to execute the two statements inside the loop. The first statement prints out "1". The second statement adds 1 to `number` and stores the result back into the variable `number`; the value of `number` has

been changed to 2. The computer has reached the end of the loop, so it returns to the beginning and asks again whether `number` is less than 6. Once again this is true, so the computer executes the loop again, this time printing out 2 as the value of `number` and then changing the value of `number` to 3. It continues in this way until eventually `number` becomes equal to 6. At that point, the expression "`number < 6`" evaluates to false. So, the computer jumps past the end of the loop to the next statement and prints out the message "Done!". Note that when the loop ends, the value of `number` is 6, but the last value that was printed was 5.

By the way, you should remember that you'll never see a `while` loop standing by itself in a real program. It will always be inside a subroutine which is itself defined inside some class. As an example of a `while` loop used inside a complete program, here is a little program that computes the interest on an investment over several years. This is an improvement over examples from the previous chapter that just reported the results for one year:

```
public class Interest3 {

    /*
       This class implements a simple program that
       will compute the amount of interest that is
       earned on an investment over a period of
       5 years.  The initial amount of the investment
       and the interest rate are input by the user.
       The value of the investment at the end of each
       year is output.
    */

    public static void main(String[] args) {

        double principal; // The value of the investment.
        double rate;       // The annual interest rate.

        /* Get the initial investment and interest rate
        from the user. */

        TextIO.put("Enter the initial investment: ");
        principal = TextIO.getlnDouble();

        TextIO.put("Enter the annual interest rate: ");
        rate = TextIO.getlnDouble();

        /* Simulate the investment for 5 years. */
```

```

        int years;    // Counts the number of years that
        have passed.

        years = 0;
        while (years < 5) {
            double interest; // Interest for this year.
            interest = principal * rate;
            principal = principal + interest;    // Add
it to principal.
            years = years + 1;    // Count the current
year.

            System.out.print("The value of the investment
after ");

            System.out.print(years);
            System.out.print(" years is $");
            System.out.println(principal);
        } // end of while loop

    } // end of main()

} // end of class Interest3

```

And here is the applet which simulates this program:

(Applet "Interest3Console" would be displayed here
if Java were available.)

You should study this program, and make sure that you understand what the computer does step-by-step as it executes the while loop.

An **if statement** tells the computer to take one of two alternative courses of action, depending on whether the value of a given boolean-valued expression is true or false. It is an example of a "branching" or "decision" statement. An if statement has the form:

```

if ( boolean-expression )
    statement
else
    statement

```

When the computer executes an `if` statement, it evaluates the boolean expression. If the value is `true`, the computer executes the first statement and skips the statement that follows the `else`. If the value of the expression is `false`, then the computer skips the first statement and executes the second one. Note that in any case, one and only one of the two statements inside the `if` statement is executed. The two statements represent alternative courses of action; the computer decides between these courses of action based on the value of the boolean expression.

In many cases, you want the computer to choose between doing something and not doing it. You can do this with an `if` statement that omits the `else` part:

```
if ( boolean-expression )
    statement
```

To execute this statement, the computer evaluates the expression. If the value is `true`, the computer executes the **statement** that is contained inside the `if` statement; if the value is `false`, the computer skips that **statement**.

Of course, either or both of the **statement**'s in an `if` statement can be a block, so that an `if` statement often looks like:

```
if ( boolean-expression ) {
    statements
}
else {
    statements
}
```

or:

```
if ( boolean-expression ) {
    statements
}
```

As an example, here is an `if` statement that exchanges the value of two variables, `x` and `y`, but only if `x` is greater than `y` to begin with. After this `if` statement has been executed, we can be sure that the value of `x` is definitely less than or equal to the value of `y`:

```
if ( x > y ) {
    int temp;           // A temporary variable for use
in this block.
```

```

        temp = x;           // Save a copy of the value of x
in temp.
        x = y;             // Copy the value of y into x.
        y = temp;         // Copy the value of temp into y.
    }

```

Finally, here is an example of an `if` statement that includes an `else` part. See if you can figure out what it does, and why it would be used:

```

        if ( years > 1 ) { // handle case for 2 or more
years
            System.out.print("The value of the investment
after ");
            System.out.print(years);
            System.out.print(" years is $");
        }
        else { // handle case for 1 year
            System.out.print("The value of the investment
after 1 year is $");
        } // end of if statement
        System.out.println(principal); // this is done in
any case

```

I'll have more to say about control structures later in this chapter. But you already know the essentials. If you never learned anything more about control structures, you would already know enough to perform any possible computing task. Simple looping and branching are all you really need!

[[Next Section](#) | [Previous Chapter](#) | [Chapter Index](#) | [Main Index](#)]

Section 3.2

Algorithm Development

PROGRAMMING IS DIFFICULT (like many activities that are useful and worthwhile -- and like most of those activities, it can also be rewarding and a lot of fun). When you write a program, you have to tell the computer every small detail of what to do. And you have to get everything exactly right, since the computer will blindly follow your program exactly as written. How, then, do people write any but the most simple programs? It's not a big mystery, actually. It's a matter of learning to think in the right way.

A program is an expression of an idea. A programmer starts with a general idea of a task for the computer to perform. Presumably, the programmer has some idea of how to perform the task by hand, at least in general outline. The problem is to flesh out that outline into a complete, unambiguous, step-by-step procedure for carrying out the task. Such a procedure is called an "algorithm." (Technically, an **algorithm** is an unambiguous, step-by-step procedure that terminates after a finite number of steps; we don't want to count procedures that go on forever.) An algorithm is not the same as a program. A program is written in some particular programming language. An algorithm is more like the **idea** behind the program, but it's the idea of the **steps** the program will take to perform its task, not just the idea of the **task** itself. The steps of the algorithm don't have to be filled in in complete detail, as long as the steps are unambiguous and it's clear that carrying out the steps will accomplish the assigned task. An algorithm can be expressed in any language, including English. Of course, an algorithm can only be expressed as a program if all the details have been filled in.

So, where do algorithms come from? Usually, they have to be developed, often with a lot of thought and hard work. Skill at algorithm development is something that comes with practice, but there are techniques and guidelines that can help. I'll talk here about some techniques and guidelines that are relevant to "programming in the small," and I will return to the subject several times in later chapters.

When programming in the small, you have a few basics to work with: variables, assignment statements, and input-output routines. You might also have some subroutines, objects, or other building blocks that have already been written by you or someone else. (Input/output routines fall into this class.) You can build sequences of these basic instructions, and you can also combine them into more complex control structures such as `while` loops and `if` statements.

Suppose you have a task in mind that you want the computer to perform. One way to proceed is to write a description of the task, and take that description as an outline of the algorithm you want to develop. Then you can refine and elaborate that description, gradually adding steps and detail, until you have a complete algorithm that can be translated directly into programming language. This method is called **stepwise refinement**, and it is a type of top-down design. As you proceed through the stages of stepwise refinement, you can write out descriptions of your algorithm in **pseudocode** -- informal instructions that imitate the structure of programming languages without the complete detail and perfect syntax of actual program code.

As an example, let's see how one might develop the program from the previous section, which computes the value of an investment over five years. The task that you want the program to perform is: "Compute and display the value of an investment for each of the next five years, where the initial investment and interest rate are to be specified by the user." You might then write -- or at least think -- that this can be expanded as:

```

    Get the user's input
    Compute the value of the investment after
1 year
    Display the value
    Compute the value after 2 years
    Display the value
    Compute the value after 3 years
    Display the value
    Compute the value after 4 years
    Display the value
    Compute the value after 5 years
    Display the value

```

This is correct, but rather repetitive. And seeing that repetition, you might notice an opportunity to use a loop. A loop would take less typing. More important, it would be more **general**: Essentially the same loop will work no matter how many years you want to process. So, you might rewrite the above sequence of steps as:

```

    Get the user's input
    while there are more years to process:
        Compute the value after the next year
        Display the value

```

Now, for a computer, we'll have to be more explicit about how to "Get the user's input," how to "Compute the value after the next year," and what it means to say "there are more

years to process." We can expand the step, "Get the user's input" into

```

Ask the user for the initial investment
Read the user's response
Ask the user for the interest rate
Read the user's response

```

To fill in the details of the step "Compute the value after the next year," you have to know how to do the computation yourself. (Maybe you need to ask your boss or professor for clarification?) Let's say you know that the value is computed by adding some interest to the previous value. Then we can refine the while loop to:

```

while there are more years to process:
    Compute the interest
    Add the interest to the value
    Display the value

```

As for testing whether there are more years to process, the only way that we can do that is by counting the years ourselves. This displays a very common pattern, and you should expect to use something similar in a lot of programs: We have to start with zero years, add one each time we process a year, and stop when we reach the desired number of years. So the while loop becomes:

```

years = 0
while years < 5:
    years = years + 1
    Compute the interest
    Add the interest to the value
    Display the value

```

We still have to know how to compute the interest. Let's say that the interest is to be computed by multiplying the interest rate by the current value of the investment. Putting this together with the part of the algorithm that gets the user's inputs, we have the complete algorithm:

```

Ask the user for the initial investment
Read the user's response
Ask the user for the interest rate
Read the user's response
years = 0
while years < 5:
    years = years + 1

```



```

        Compute interest = value * interest
rate
        Add the interest to the value
        Display the value

```

Finally, we are at the point where we can translate pretty directly into proper programming-language syntax. We still have to choose names for the variables, decide exactly what we want to say to the user, and so forth. Having done this, we could express our algorithm in Java as:

```

        double principal, rate, interest; //
declare the variables
        int years;
        System.out.print("Type initial investment:
");

        principal = TextIO.getlnDouble();
        System.out.print("Type interest rate: ");
        rate = TextIO.getlnDouble();
        years = 0;
        while (years < 5) {
            years = years + 1;
            interest = principal * rate;
            principal = principal + interest;
            System.out.println(principal);
        }

```

This still needs to be wrapped inside a complete program, it still needs to be commented, and it really needs to print out more information for the user. But it's essentially the same program as the one in the previous section. (Note that the pseudocode algorithm uses indentation to show which statements are inside the loop. In Java, indentation is completely ignored by the computer, so you need a pair of braces to tell the computer which statements are in the loop. If you leave out the braces, the only statement inside the loop would be `years = years + 1;`. The other statements would only be executed once, after the loop ends. The nasty thing is that the computer won't notice this error for you, like it would if you left out the parentheses around `(years < 5)`. The parentheses are required by the syntax of the `while` statement. The braces are only required semantically. The computer can recognize syntax errors but not semantic errors.)

One thing you should have noticed here is that my original specification of the problem -- "Compute and display the value of an investment for each of the next five years" -- was far from being complete. Before you start writing a program, you should make sure you have a complete specification of exactly what the program is supposed to do. In particular, you need to know what information the program is going to input and output and what

computation it is going to perform. Here is what a reasonably complete specification of the problem might look like in this example:

"Write a program that will compute and display the value of an investment for each of the next five years. Each year, interest is added to the value. The interest is computed by multiplying the current value by a fixed interest rate. Assume that the initial value and the rate of interest are to be input by the user when the program is run."

Let's do another example, working this time with a program that you haven't already seen. The assignment here is an abstract mathematical problem that is one of my favorite programming exercises. This time, we'll start with a more complete specification of the task to be performed:

"Given a positive integer, N , define the ' $3N+1$ ' sequence starting from N as follows: If N is an even number, then divide N by two; but if N is odd, then multiply N by 3 and add 1. Continue to generate numbers in this way until N becomes equal to 1. For example, starting from $N = 3$, which is odd, we multiply by 3 and add 1, giving $N = 3*3+1 = 10$. Then, since N is even, we divide by 2, giving $N = 10/2 = 5$. We continue in this way, stopping when we reach 1, giving the complete sequence: 3, 10, 5, 16, 8, 4, 2, 1.

"Write a program that will read a positive integer from the user and will print out the $3N+1$ sequence starting from that integer. The program should also count and print out the number of terms in the sequence."

A general outline of the algorithm for the program we want is:

```

    Get a positive integer N from the user;
    Compute, print, and count each number in
the sequence;
    Output the number of terms;
```

The bulk of the program is in the second step. We'll need a loop, since we want to keep computing numbers until we get 1. To put this in terms appropriate for a `while` loop, we want to **continue** as long as the number is **not** 1. So, we can expand our pseudocode algorithm to:

```

    Get a positive integer N from the user;
    while N is not 1:
```

```

    Compute N = next term;
    Output N;
    Count this term;
Output the number of terms;

```

In order to compute the next term, the computer must take different actions depending on whether N is even or odd. We need an `if` statement to decide between the two cases:

```

Get a positive integer N from the user;
while N is not 1:
    if N is even:
        Compute N = N/2;
    else
        Compute N = 3 * N + 1;
    Output N;
    Count this term;
Output the number of terms;

```

We are almost there. The one problem that remains is counting. Counting means that you start with zero, and every time you have something to count, you add one. We need a variable to do the counting. (Again, this is a common pattern that you should expect to see over and over.) With the counter added, we get:

```

Get a positive integer N from the user;
Let counter = 0;
while N is not 1:
    if N is even:
        Compute N = N/2;
    else
        Compute N = 3 * N + 1;
    Output N;
    Add 1 to counter;
Output the counter;

```

We still have to worry about the very first step. How can we get a **positive** integer from the user? If we just read in a number, it's possible that the user might type in a negative number or zero. If you follow what happens when the value of N is negative or zero, you'll see that the program will go on forever, since the value of N will never become equal to 1. This is bad. In this case, the problem is probably no big deal, but in general you should try to write programs that are foolproof. One way to fix this is to keep reading in numbers until the user types in a positive number:

```

Ask user to input a positive number;
Let N be the user's response;
while N is not positive:
    Print an error message;
    Read another value for N;
Let counter = 0;
while N is not 1:
    if N is even:
        Compute N = N/2;
    else
        Compute N = 3 * N + 1;
    Output N;
    Add 1 to counter;
Output the counter;

```

The first `while` loop will end only when `N` is a positive number, as required. (A common beginning programmer's error is to use an `if` statement instead of a `while` statement here: "If `N` is not positive, ask the user to input another value." The problem arises if the second number input by the user is also non-positive. The `if` statement is only executed once, so the second input number is never tested. With the `while` loop, after the second number is input, the computer jumps back to the beginning of the loop and tests whether the second number is positive. If not, it asks the user for a third number, and it will continue asking for numbers until the user enters an acceptable input.)

Here is a Java program implementing this algorithm. It uses the operators `<=` to mean "is less than or equal to" and `!=` to mean "is not equal to." To test whether `N` is even, it uses "`N % 2 == 0`". All the operators used here were discussed in [Section 2.5](#).

```

public class ThreeN {

    /* This program prints out a 3N+1 sequence
       starting from a positive integer specified
       by the user. It also counts the number
       of terms in the sequence, and prints out
       that number.    */

    public static void main(String[] args)
    {

        int N;          // for computing terms in the
sequence
        int counter;    // for counting the terms

```

```

        TextIO.put("Starting point for sequence: ");
        N = TextIO.getlnInt();
        while (N <= 0) {
            TextIO.put("The starting point must be
positive. "
                                + " Please try again:
");
            N = TextIO.getlnInt();
        }
        // At this point, we know that N > 0

        counter = 0;
        while (N != 1) {
            if (N % 2 == 0)
                N = N / 2;
            else
                N = 3 * N + 1;
            TextIO.putln(N);
            counter = counter + 1;
        }

        TextIO.putln();
        TextIO.put("There were ");
        TextIO.put(counter);
        TextIO.putln(" terms in the sequence.");

    } // end of main()

} // end of class ThreeN

```

As usual, you can try this out in an applet that simulates the program. Try different starting values for N, including some negative values:

(Applet "ThreeN1Console" would be displayed here
if Java were available.)

Two final notes on this program: First, you might have noticed that the first term of the sequence -- the value of N input by the user -- is not printed or counted by this program. Is this an error? It's hard to say. Was the specification of the program careful enough to decide? This is the type of thing that might send you back to the boss/professor for clarification. The problem (if it is one!) can be fixed easily enough. Just replace the line "counter = 0" before the while loop with the two lines:

```

        TextIO.putln(N);    // print out initial
term
        counter = 1;       // and count it

```

Second, there is the question of why this problem is at all interesting. Well, it's interesting to mathematicians and computer scientists because of a simple question about the problem that they haven't been able to answer: Will the process of computing the $3N+1$ sequence finish after a finite number of steps for all possible starting values of N ? Although individual sequences are easy to compute, no one has been able to answer the general question. (To put this another way, no one knows whether the process of computing $3N+1$ sequences can properly be called an algorithm, since an algorithm is required to terminate after a finite number of steps!)

Coding, Testing, Debugging

It would be nice if, having developed an algorithm for your program, you could relax, press a button, and get a perfectly working program. Unfortunately, the process of turning an algorithm into Java source code doesn't always go smoothly. And when you do get to the stage of a working program, it's often only working in the sense that it does something. Unfortunately not what you want it to do.

After program design comes coding: translating the design into a program written in Java or some other language. Usually, no matter how careful you are, a few syntax errors will creep in from somewhere, and the Java compiler will reject your program with some kind of error message. Unfortunately, while a compiler will always detect syntax errors, it's not very good about telling you exactly what's wrong. Sometimes, it's not even good about telling you where the real error is. A spelling error or missing "{" on line 45 might cause the compiler to choke on line 105. You can avoid lots of errors by making sure that you really understand the syntax rules of the language and by following some basic programming guidelines. For example, I never type a "{" without typing the matching "}". Then I go back and fill in the statements between the braces. A missing or extra brace can be one of the hardest errors to find in a large program. Always, always indent your program nicely. If you change the program, change the indentation to match. It's worth the trouble. Use a consistent naming scheme, so you don't have to struggle to remember whether you called that variable `interestrates` or `interestRate`. In general, when the compiler gives multiple error messages, don't try to fix the second error message from the compiler until you've fixed the first one. Once the compiler hits an error in your program, it can get confused, and the rest of the error messages might just be guesses. Maybe the best advice is: Take the time to understand the error before you try to fix it.

Programming is not an experimental science.

When your program compiles without error, you are still not done. You have to test the program to make sure it works correctly. Remember that the goal is not to get the right output for the two sample inputs that the professor gave in class. The goal is a program that will work correctly for all reasonable inputs. Ideally, when faced with an unreasonable input, it will respond by gently chiding the user rather than by crashing. Test your program on a wide variety of inputs. Try to find a set of inputs that will test the full range of functionality that you've coded into your program. As you begin writing larger programs, write them in stages and test each stage along the way. You might even have to write some extra code to do the testing -- for example to call a subroutine that you've just written. You don't want to be faced, if you can avoid it, with 500 newly written lines of code that have an error in there *somewhere*.

The point of testing is to find **bugs** -- semantic errors that show up as incorrect behavior rather than as compilation errors. And the sad fact is that you will probably find them. Again, you can minimize bugs by careful design and careful coding, but no one has found a way to avoid them altogether. Once you've detected a bug, it's time for **debugging**. You have to track down the cause of the bug in the program's source code and eliminate it. Debugging is a skill that, like other aspects of programming, requires practice to master. So don't be afraid of bugs. Learn from them. One essential debugging skill is the ability to read source code -- the ability to put aside preconceptions about what you *think* it does and to follow it the way the computer does -- mechanically, step-by-step -- to see what it really does. This is hard. I can still remember the time I spent hours looking for a bug only to find that a line of code that I had looked at ten times had a "l" where it should have had an "i", or the time when I wrote a subroutine named `WindowClosing` which would have done exactly what I wanted except that the computer was looking for `windowClosing` (with a lower case "w"). Sometimes it can help to have someone who doesn't share your preconceptions look at your code.

Often, it's a problem just to find the part of the program that contains the error. Most programming environments come with a **debugger**, which is a program that can help you find bugs. Typically, your program can be run under the control of the debugger. The debugger allows you to set "breakpoints" in your program. A breakpoint is a point in the program where the debugger will pause the program so you can look at the values of the program's variables. The idea is to track down exactly when things start to go wrong during the program's execution. The debugger will also let you execute your program one line at a time, so that you can watch what happens in detail once you know the general area in the program where the bug is lurking.

I will confess that I only rarely use debuggers myself. A more traditional approach to debugging is to insert **debugging statements** into your program. These are output statements that print out information about the state of the program. Typically, a

debugging statement would say something like `System.out.println("At start of while loop, N = " + N)`. You need to be able to tell where in your program the output is coming from, and you want to know the value of important variables. Sometimes, you will find that the computer isn't even getting to a part of the program that you think it should be executing. Remember that the goal is to find the first point in the program where the state is not what you expect it to be. That's where the bug is.

And finally, remember the golden rule of debugging: If you are absolutely sure that everything in your program is right, and if it still doesn't work, then one of the things that you are absolutely sure of is wrong.

[[Next Section](#) | [Previous Section](#) | [Chapter Index](#) | [Main Index](#)]

Section 2.5

Details of Expressions

THIS SECTION TAKES A CLOSER LOOK at expressions. Recall that an expression is a piece of program code that represents or computes a value. An expression can be a literal, a variable, a function call, or several of these things combined with operators such as `+` and `>`. The value of an expression can be assigned to a variable, used as the output value in an output routine, or combined with other values into a more complicated expression. (The value can even, in some cases, be ignored, if that's what you want to do; this is more common than you might think.) Expressions are an essential part of programming. So far, these notes have dealt only informally with expressions. This section tells you the more-or-less complete story.

The basic building blocks of expressions are literals (such as `674`, `3.14`, `true`, and `'X'`), variables, and function calls. Recall that a function is a subroutine that returns a value. You've already seen some examples of functions: the input routines from the `TextIO` class and the mathematical functions from the `Math` class.

Literals, variables, and function calls are simple expressions. More complex expressions can be built up by using **operators** to combine simpler expressions. Operators include `+` for adding two numbers, `>` for comparing two values, and so on. When several operators appear in an expression, there is a question of **precedence**, which determines how the operators are grouped for evaluation. For example, in the expression `"A + B * C"`, `B * C` is computed first and then the result is added to `A`. We say that multiplication (`*`) has **higher precedence** than addition (`+`). If the default precedence is not what you want, you can use parentheses to explicitly specify the grouping you want. For example, you could use `"(A + B) * C"` if you want to add `A` to `B` first and then multiply the result by `C`.

The rest of this section gives details of operators in Java. The number of operators in Java is quite large, and I will not cover them all here. Most of the important ones are here; a few will be covered in later chapters as they become relevant.

Arithmetic Operators

Arithmetic operators include addition, subtraction, multiplication, and division. They are indicated by `+`, `-`, `*`, and `/`. These operations can be used on values of any numeric type:

byte, short, int, long, float, or double. When the computer actually calculates one of these operations, the two values that it combines must be of the same type. If your program tells the computer to combine two values of different types, the computer will convert one of the values from one type to another. For example, to compute $37.4 + 10$, the computer will convert the integer 10 to a real number 10.0 and will then compute $37.4 + 10.0$. (The computer's internal representations for 10 and 10.0 are very different, even though people think of them as representing the same number.) Ordinarily, you don't have to worry about type conversion, because the computer does it automatically.

When two numerical values are combined (after doing type conversion on one of them, if necessary), the answer will be of the same type. If you multiply two `ints`, you get an `int`; if you multiply two `doubles`, you get a `double`. This is what you would expect, but you have to be very careful when you use the division operator `/`. When you divide two integers, the answer will always be an integer; if the quotient has a fractional part, it is discarded. For example, the value of $7 / 2$ is 3, not 3.5. If `N` is an integer variable, then $N / 100$ is an integer, and $1 / N$ is equal to zero for any `N` greater than one! This fact is a common source of programming errors. You can force the computer to compute a real number as the answer by making one of the operands real: For example, when the computer evaluates $1.0 / N$, it first converts `N` to a real number in order to match the type of `1.0`, so you get a real number as the answer.

Java also has an operator for computing the remainder when one integer is divided by another. This operator is indicated by `%`. If `A` and `B` are integers, then $A \% B$ represents the remainder when `A` is divided by `B`. For example, $7 \% 2$ is 1, while $34577 \% 100$ is 77, and $50 \% 8$ is 2. A common use of `%` is to test whether a given integer is even or odd. `N` is even if $N \% 2$ is zero, and it is odd if $N \% 2$ is 1. More generally, you can check whether an integer `N` is evenly divisible by an integer `M` by checking whether $N \% M$ is zero.

Finally, you might need the **unary minus** operator, which takes the negative of a number. For example, $-X$ has the same value as $(-1) * X$. For completeness, Java also has a unary plus operator, as in $+X$, even though it doesn't really do anything.

Increment and Decrement

You'll find that adding 1 to a variable is an extremely common operation in programming. Subtracting 1 from a variable is also pretty common. You might perform the operation of adding 1 to a variable with assignment statements such as:

```
counter = counter + 1;
```

```
goalsScored = goalsScored + 1;
```

The effect of the assignment statement `x = x + 1` is to take the old value of the variable `x`, compute the result of adding 1 to that value, and store the answer as the new value of `x`. The same operation can be accomplished by writing `x++` (or, if you prefer, `++x`). This actually changes the value of `x`, so that it has the same effect as writing "`x = x + 1`". The two statements above could be written

```
counter++;
goalsScored++;
```

Similarly, you could write `x--` (or `--x`) to subtract 1 from `x`. That is, `x--` performs the same computation as `x = x - 1`. Adding 1 to a variable is called **incrementing** that variable, and subtracting 1 is called **decrementing**. The operators `++` and `--` are called the increment operator and the decrement operator, respectively. These operators can be used on variables belonging to any of the numerical types and also on variables of type `char`.

Usually, the operators `++` or `--`, are used in statements like "`x++;`" or "`x--;`". These statements are commands to change the value of `x`. However, it is also legal to use `x++`, `++x`, `x--`, or `--x` as expressions, or as parts of larger expressions. That is, you can write things like:

```
y = x++;
y = ++x;
TextIO.putln(--x);
z = (++x) * (y--);
```

The statement "`y = x++;`" has the effects of adding 1 to the value of `x` and, in addition, assigning some value to `y`. The value assigned to `y` is the value of the expression `x++`, which is defined to be the **old** value of `x`, before the 1 is added. Thus, if the value of `x` is 6, the statement "`y = x++;`" will change the value of `x` to 7, but it will change the value of `y` to 6 since the value assigned to `y` is the *old* value of `x`. On the other hand, the value of `++x` is defined to be the **new** value of `x`, after the 1 is added. So if `x` is 6, then the statement "`y = ++x;`" changes the values of both `x` and `y` to 7. The decrement operator, `--`, works in a similar way.

This can be confusing. My advice is: Don't be confused. Use `++` and `--` only in stand-alone statements, not in expressions. I will follow this advice in all the examples in these notes.

Relational Operators

Java has boolean variables and boolean-valued expressions that can be used to express conditions that can be either `true` or `false`. One way to form a boolean-valued expression is to compare two values using a **relational operator**. Relational operators are used to test whether two values are equal, whether one value is greater than another, and so forth. The relation operators in Java are: `==`, `!=`, `<`, `>`, `<=`, and `>=`. The meanings of these operators are:

<code>A == B</code>	Is A "equal to" B?
<code>A != B</code>	Is A "not equal to" B?
<code>A < B</code>	Is A "less than" B?
<code>A > B</code>	Is A "greater than" B?
<code>A <= B</code>	Is A "less than or equal to" B?
<code>A >= B</code>	Is A "greater than or equal to"

B?

These operators can be used to compare values of any of the numeric types. They can also be used to compare values of type `char`. For characters, `<` and `>` are defined according the numeric Unicode values of the characters. (This might not always be what you want. It is not the same as alphabetical order because all the upper case letters come before all the lower case letters.)

When using boolean expressions, you should remember that as far as the computer is concerned, there is nothing special about boolean values. In the next chapter, you will see how to use them in loop and branch statements. But you can also assign boolean-valued expressions to boolean variables, just as you can assign numeric values to numeric variables.

By the way, the operators `==` and `!=` can be used to compare boolean values. This is occasionally useful. For example, can you figure out what this does:

```
boolean sameSign;
sameSign = ((x > 0) == (y > 0));
```

One thing that you **cannot** do with the relational operators `<`, `>`, `<=`, and `>=` is to use them to compare values of type `String`. You can legally use `==` and `!=` to compare `Strings`, but because of peculiarities in the way objects behave, they might not give the results you want. (The `==` operator checks whether two objects are stored in the same memory location, rather than whether they contain the same value. Occasionally, for some objects, you do want to make such a check -- but rarely for strings. I'll get back to this in a later chapter.) Instead, you should use the subroutines `equals()`,

`equalsIgnoreCase()`, and `compareTo()`, which were described in [Section 3](#), to compare two `Strings`.

Boolean Operators

In English, complicated conditions can be formed using the words "and", "or", and "not." For example, "If there is a test **and** you did **not** study for it...". "And", "or", and "not" are boolean operators, and they exist in Java as well as in English.

In Java, the boolean operator "and" is represented by `&&`. The `&&` operator is used to combine two boolean values. The result is also a boolean value. The result is `true` if **both** of the combined values are `true`, and the result is `false` if **either** of the combined values is `false`. For example, `(x == 0) && (y == 0)` is `true` if and only if both `x` is equal to 0 and `y` is equal to 0.

The boolean operator "or" is represented by `||`. (That's supposed to be two of the vertical line characters, `|`.) The expression `A || B` is `true` if either `A` is `true` or `B` is `true`, or if both are `true`. `A || B` is `false` only if both `A` and `B` are `false`.

The operators `&&` and `||` are said to be **short-circuited** versions of the boolean operators. This means that the second operand of `&&` or `||` is not necessarily evaluated. Consider the test

```
(x != 0) && (y/x > 1)
```

Suppose that the value of `x` is in fact zero. In that case, the division `y/x` is illegal, since division by zero is not allowed. However, the computer will never perform the division, since when the computer evaluates `(x != 0)`, it finds that the result is `false`, and so it knows that `((x != 0) && anything)` has to be `false`. Therefore, it doesn't bother to evaluate the second operand, `(y/x > 1)`. The evaluation has been short-circuited and the division by zero is avoided. Without the short-circuiting, there would have been a division-by-zero error. (This may seem like a technicality, and it is. But at times, it will make your programming life a little easier. To be even more technical: There are actually non-short-circuited versions of `&&` and `||`, which are written as `&` and `|`. Don't use them unless you have a particular reason to do so.)

The boolean operator "not" is a unary operator. In Java, it is indicated by `!` and is written in front of its single operand. For example, if `test` is a boolean variable, then

```
test = ! test;
```

will reverse the value of `test`, changing it from `true` to `false`, or from `false` to `true`.

Conditional Operator

Any good programming language has some nifty little features that aren't really necessary but that let you feel cool when you use them. Java has the conditional operator. It's a ternary operator -- that is, it has three operands -- and it comes in two pieces, `?` and `:`, that have to be used together. It takes the form

`boolean-expression ? expression-1 : expression-2`

The computer tests the value of **`boolean-expression`**. If the value is `true`, it evaluates **`expression-1`**; otherwise, it evaluates **`expression-2`**. For example:

```
next = (N % 2 == 0) ? (N/2) : (3*N+1);
```

will assign the value `N/2` to `next` if `N` is even (that is, if `N % 2 == 0` is `true`), and it will assign the value `(3*N+1)` to `next` if `N` is odd.

Assignment Operators and Type-Casts

You are already familiar with the assignment statement, which uses the symbol `=` to assign the value of an expression to a variable. In fact, `=` is really an operator in the sense that an assignment can itself be used as an expression or as part of a more complex expression. The value of an assignment such as `A=B` is the same as the value that is assigned to `A`. So, if you want to assign the value of `B` to `A` and test at the same time whether that value is zero, you could say:

```
if ( (A=B) == 0 )
```

Usually, I would say, **don't do things like that!**

In general, the type of the expression on the right-hand side of an assignment statement must be the same as the type of the variable on the left-hand side. However, in some cases, the computer will automatically convert the value computed by the expression to match the type of the variable. Consider the list of numeric types: `byte`, `short`, `int`,

long, float, double. A value of a type that occurs earlier in this list can be converted automatically to a value that occurs later. For example:

```
int A;
double X;
short B;
A = 17;
X = A;    // OK; A is converted to a double
B = A;    // illegal; no automatic conversion
           //           from int to short
```

The idea is that conversion should only be done automatically when it can be done without changing the semantics of the value. Any `int` can be converted to a `double` with the same numeric value. However, there are `int` values that lie outside the legal range of `short`s. There is simply no way to represent the `int` 100000 as a `short`, for example, since the largest value of type `short` is 32767.

In some cases, you might want to force a conversion that wouldn't be done automatically. For this, you can use what is called a **type cast**. A type cast is indicated by putting a type name, in parentheses, in front of the value you want to convert. For example,

```
int A;
short B;
A = 17;
B = (short)A; // OK; A is explicitly type
cast
                //           to a value of type
short
```

You can do type casts from any numeric type to any other numeric type. However, you should note that you might change the numeric value of a number by type-casting it. For example, `(short)100000` is 34464. (The 34464 is obtained by taking the 4-byte `int` 100000 and throwing away two of those bytes to obtain a `short` -- you've lost the real information that was in those two bytes.)

As another example of type casts, consider the problem of getting a random integer between 1 and 6. The function `Math.random()` gives a real number between 0.0 and 0.9999..., and so `6*Math.random()` is between 0.0 and 5.9999.... The type-cast operator, `(int)`, can be used to convert this to an integer: `(int)(6*Math.random())`. A real number is cast to an integer by discarding the fractional part. Thus, `(int)(6*Math.random())` is one of the integers 0, 1, 2, 3, 4, and 5. To get a number between 1 and 6, we can add 1: `"(int)(6*Math.random()) + 1"`.

You can also type-cast between the type `char` and the numeric types. The numeric value of a `char` is its Unicode code number. For example, `(char)97` is `'a'`, and `(int)'+'` is 43.

Java has several variations on the assignment operator, which exist to save typing. For example, `"A += B"` is defined to be the same as `"A = A + B"`. Every operator in Java that applies to two operands gives rise to a similar assignment operator. For example:

```

    x -= y;        // same as:    x = x - y;
    x *= y;        // same as:    x = x * y;
    x /= y;        // same as:    x = x / y;
    x %= y;        // same as:    x = x % y;    (for
integers x and y)
    q &&= p;        // same as:    q = q && p;    (for
booleans q and p)

```

The combined assignment operator `+=` even works with strings. You will recall from [Section 3](#) that when the `+` operator is used with a string as the first operand, it represents concatenation. Since `str += x` is equivalent to `str = str + x`, when `+=` is used with a string on the left-hand side, it appends the value on the right-hand side onto the string. For example, if `str` has the value `"tire"`, then the statement `str += 'd';` changes the value of `str` to `"tired"`.

Precedence Rules

If you use several operators in one expression, and if you don't use parentheses to explicitly indicate the order of evaluation, then you have to worry about the precedence rules that determine the order of evaluation. (Advice: don't confuse yourself or the reader of your program; use parentheses liberally.)

Here is a listing of the operators discussed in this section, listed in order from highest precedence (evaluated first) to lowest precedence (evaluated last):

Unary operators:	<code>++</code> , <code>--</code> , <code>!</code> , unary <code>-</code> and <code>+</code> , type-cast
Multiplication and division:	<code>*</code> , <code>/</code> , <code>%</code>
Addition and subtraction:	<code>+</code> , <code>-</code>
Relational operators:	<code><</code> , <code>></code> , <code><=</code> , <code>>=</code>
Equality and inequality:	<code>==</code> , <code>!=</code>

Boolean and:	&&
Boolean or:	
Conditional operator:	?:
Assignment operators:	=, +=, -=, *=, /=, %=

Operators on the same line have the same precedence. When they occur together, unary operators and assignment operators are evaluated right-to-left, and the remaining operators are evaluated left-to-right. For example, $A*B/C$ means $(A*B)/C$, while $A=B=C$ means $A=(B=C)$. (Can you see how the expression $A=B=C$ might be useful, given that the value of $B=C$ as an expression is the same as the value that is assigned to B ?)

End of Chapter 2

[[Next Chapter](#) | [Previous Section](#) | [Chapter Index](#) | [Main Index](#)]

Section 2.3

Strings, Objects, and Subroutines

THE PREVIOUS SECTION introduced the eight primitive data types and the type `String`. There is a fundamental difference between the primitive types and the `String` type: Values of type `String` are objects. While we will not study objects in detail until [Chapter 5](#), it will be useful for you to know a little about them and about a closely related topic: classes. This is not just because strings are useful but because objects and classes are essential to understanding another important programming concept, subroutines.

Recall that a subroutine is a set of program instructions that have been chunked together and given a name. In [Chapter 4](#), you'll learn how to write your own subroutines, but you can get a lot done in a program just by calling subroutines that have already been written for you. In Java, every subroutine is contained in a class or in an object. Some classes that are standard parts of the Java language contain predefined subroutines that you can use. A value of type `String`, which is an object, contains subroutines that can be used to manipulate that string. You can call all these subroutines without understanding how they were written or how they work. Indeed, that's the whole point of subroutines: A subroutine is a "black box" which can be used without knowing what goes on inside.

Classes in Java have two very different functions. First of all, a class can group together variables and subroutines that are contained in that class. These variables and subroutines are called **static members** of the class. You've seen one example: In a class that defines a program, the `main()` routine is a static member of the class. The parts of a class definition that define static members are marked with the reserved word `"static"`, just like the `main()` routine of a program. However, classes have a second function. They are used to describe objects. In this role, the class of an object specifies what subroutines and variables are contained in that object. The class is a **type** -- in the technical sense of a specification of a certain type of data value -- and the object is a value of that type. For example, `String` is actually the name of a class that is included as a standard part of the Java language. It is also a type, and actual strings such as `"Hello World"` are values of type `String`.

So, every subroutine is contained either in a class or in an object. Classes **contain** subroutines called static member subroutines. Classes also **describe** objects and the subroutines that are contained in those objects.

This dual use can be confusing, and in practice most classes are designed to perform

primarily or exclusively in only one of the two possible roles. For example, although the `String` class does contain a few rarely-used static member subroutines, it exists mainly to specify a large number of subroutines that are contained in objects of type `String`. Another standard class, named `Math`, exists entirely to group together a number of static member subroutines that compute various common mathematical functions.

To begin to get a handle on all of this complexity, let's look at the subroutine `System.out.print` as an example. As you have seen earlier in this chapter, this subroutine is used to display information to the user. For example, `System.out.print("Hello World")` displays the message, Hello World.

`System` is one of Java's standard classes. One of the static member variables in this class is named `out`. Since this variable is contained in the class `System`, its full name -- which you have to use to refer to it in your programs -- is `System.out`. The variable `System.out` refers to an object, and that object in turn contains a subroutine named `print`. The compound identifier `System.out.print` refers to the subroutine `print` in the object `out` in the class `System`.

(As an aside, I will note that the object referred to by `System.out` is an object of the class `PrintStream`. `PrintStream` is another class that is a standard part of Java. **Any** object of type `PrintStream` is a destination to which information can be printed; **any** object of type `PrintStream` has a `print` subroutine that can be used to send information to that destination. The object `System.out` is just one possible destination, and `System.out.print` is the subroutine that sends information to that destination. Other objects of type `PrintStream` might send information to other destinations such as files or across a network to other computers. This is object-oriented programming: Many different things which have something in common -- they can all be used as destinations for information -- can all be used in the same way -- through a `print` subroutine. The `PrintStream` class expresses the commonalities among all these objects.)

Since class names and variable names are used in similar ways, it might be hard to tell which is which. All the built-in, predefined names in Java follow the rule that class names begin with an upper case letter while variable names begin with a lower case letter. While this is not a formal syntax rule, I recommend that you follow it in your own programming. Subroutine names should also begin with lower case letters. There is no possibility of confusing a variable with a subroutine, since a subroutine name in a program is always followed by a left parenthesis.

Classes can contain static member subroutines, as well as static member variables. For example, the `System` class contains a subroutine named `exit`. In a program, of course, this subroutine must be referred to as `System.exit`. Calling this subroutine will terminate the program. You could use it if you had some reason to terminate the program before the end of the `main` routine. (For historical reasons, this subroutine takes an integer as a parameter, so the subroutine call statement might look like `"System.exit (0) ;"` or `"System.exit(1) ;"`. The parameter tells the computer why the program is being terminated. A parameter value of 0 indicates that the program is ending normally. Any other value indicates that the program is being terminated because an error has been detected.)

Every subroutine performs some specific task. For some subroutines, that task is to compute or retrieve some data value. Subroutines of this type are called **functions**. We say that a function **returns** a value. The returned value must then be used somehow in the program.

You are familiar with the mathematical function that computes the square root of a number. Java has a corresponding function called `Math.sqrt`. This function is a static member subroutine of the class named `Math`. If `x` is any numerical value, then `Math.sqrt(x)` computes and returns the square root of that value. Since `Math.sqrt(x)` represents a value, it doesn't make sense to put it on a line by itself in a subroutine call statement such as

```
Math.sqrt(x);    // This doesn't make sense!
```

What, after all, would the computer do with the value computed by the function in this case? You have to tell the computer to do something with the value. You might tell the computer to display it:

```
System.out.print( Math.sqrt(x) );    // Display
the square root of x.
```

or you might use an assignment statement to tell the computer to store that value in a variable:

```
lengthOfSide = Math.sqrt(x);
```

The function call `Math.sqrt(x)` represents a value of type `double`, and it can be used anywhere where a numerical value of type `double` could be used.

The `Math` class contains many static member functions. Here is a list of some of the more

important of them:

- `Math.abs(x)`, which computes the absolute value of `x`.
- The usual trigonometric functions, `Math.sin(x)`, `Math.cos(x)`, and `Math.tan(x)`. (For all the trigonometric functions, angles are measured in radians, not degrees.)
- The inverse trigonometric functions `arcsin`, `arccos`, and `arctan`, which are written as: `Math.asin(x)`, `Math.acos(x)`, and `Math.atan(x)`.
- The exponential function `Math.exp(x)` for computing the number `e` raised to the power `x`, and the natural logarithm function `Math.log(x)` for computing the logarithm of `x` in the base `e`.
- `Math.pow(x, y)` for computing `x` raised to the power `y`.
- `Math.floor(x)`, which rounds `x` down to the nearest integer value that is less than or equal to `x`. (For example, `Math.floor(3.76)` is `3.0`.)
- `Math.random()`, which returns a randomly chosen double in the range `0.0 <= Math.random() < 1.0`. (The computer actually calculates so-called "pseudorandom" numbers, which are not truly random but are random enough for most purposes.)

For these functions, the type of the parameter -- the value inside parentheses -- can be of any numeric type. For most of the functions, the value returned by the function is of type `double` no matter what the type of the parameter. However, for `Math.abs(x)`, the value returned will be the same type as `x`. If `x` is of type `int`, then so is `Math.abs(x)`. (So, for example, while `Math.sqrt(9)` is the double value `3.0`, `Math.abs(9)` is the `int` value `9`.)

Note that `Math.random()` does not have any parameter. You still need the parentheses, even though there's nothing between them. The parentheses let the computer know that this is a subroutine rather than a variable. Another example of a subroutine that has no parameters is the function `System.currentTimeMillis()`, from the `System` class. When this function is executed, it retrieves the current time, expressed as the number of milliseconds that have passed since a standardized base time (the start of the year 1970 in Greenwich Mean Time, if you care). One millisecond is one thousandth second. The value of `System.currentTimeMillis()` is of type `long`. This function can be used to measure the time that it takes the computer to perform a task. Just record the time at which the task is begun and the time at which it is finished and take the difference.

Here is a sample program that performs a few mathematical tasks and reports the time that it takes for the program to run. On some computers, the time reported might be zero, because it is too small to measure in milliseconds. Even if it's not zero, you can be sure that most of the time reported by the computer was spent doing output or working on tasks other than the program, since the calculations performed in this program occupy only a

tiny fraction of a second of a computer's time.

```

public class TimedComputation {

    /* This program performs some mathematical
    computations and displays
       the results.  It then reports the number of
seconds that the
       computer spent on this task.
    */

    public static void main(String[] args) {

        long startTime; // Starting time of program, in
milliseconds.
        long endTime;   // Time when computations are
done, in milliseconds.
        double time;     // Time difference, in seconds.

        startTime = System.currentTimeMillis();

        double width, height, hypotenuse; // sides of a
triangle
        width = 42.0;
        height = 17.0;
        hypotenuse = Math.sqrt( width*width +
height*height );
        System.out.print("A triangle with sides 42 and
17 has hypotenuse ");
        System.out.println(hypotenuse);

        System.out.println("\nMathematically, sin(x)*sin
(x) + "
                                + "cos(x)*cos
(x) - 1 should be 0.");
        System.out.println("Let's check this for x =
1:");
        System.out.print("          sin(1)*sin(1) + cos(1)
*cos(1) - 1 is ");
        System.out.println( Math.sin(1)*Math.sin(1)
                                + Math.cos(1)
*Math.cos(1) - 1 );
        System.out.println("(There can be round-off

```

```

errors when "
                                + " computing
with real numbers!))");

    System.out.print("\nHere is a random number:  ");
    System.out.println( Math.random() );

    endTime = System.currentTimeMillis();
    time = (endTime - startTime) / 1000.0;

    System.out.print("\nRun time in seconds was:  ");
    System.out.println(time);

    } // end main()

} // end class TimedComputation

```

Here is a simulated version of this program. If you run it several times, you should see a different random number in the output each time.

(Applet "TimedComputationConsole" would be displayed here
if Java were available.)

A value of type `String` is an object. That object contains data, namely the sequence of characters that make up the string. It also contains subroutines. All of these subroutines are in fact functions. For example, `length` is a subroutine that computes the length of a string. Suppose that `str` is a variable that refers to a `String`. For example, `str` might have been declared and assigned a value as follows:

```

String str;
str = "Seize the day!";

```

Then `str.length()` is a function call that represents the number of characters in the string. The value of `str.length()` is an `int`. Note that this function has no parameter; the string whose length is being computed is `str`. The `length` subroutine is defined by the class `String`, and it can be used with any value of type `String`. It can even be used with `String` literals, which are, after all, just constant values of type `String`. For example, you could have a program count the characters in "Hello World" for you by saying

```

        System.out.print("The number of characters in
");
        System.out.println("the string \"Hello World\"
is ");
        System.out.println("Hello World".length());

```

The `String` class defines a lot of functions. Here are some that you might find useful. Assume that `s1` and `s2` refer to values of type `String`:

- `s1.equals(s2)` is a function that returns a boolean value. It returns `true` if `s1` consists of exactly the same sequence of characters as `s2`, and returns `false` otherwise.
- `s1.equalsIgnoreCase(s2)` is another boolean-valued function that checks whether `s1` is the same string as `s2`, but this function considers upper and lower case letters to be equivalent. Thus, if `s1` is `"cat"`, then `s1.equals("Cat")` is `false`, while `s1.equalsIgnoreCase("Cat")` is `true`.
- `s1.length()`, as mentioned above, is an integer-valued function that gives the number of characters in `s1`.
- `s1.charAt(N)`, where `N` is an integer, returns a value of type `char`. It returns the `N`-th character in the string. Positions are numbered starting with 0, so `s1.charAt(0)` is the actually the first character, `s1.charAt(1)` is the second, and so on. The final position is `s1.length() - 1`. For example, the value of `"cat".charAt(1)` is `'a'`. An error occurs if the value of the parameter is less than zero or greater than `s1.length() - 1`.
- `s1.substring(N,M)`, where `N` and `M` are integers, returns a value of type `String`. The returned value consists of the characters in `s1` in positions `N`, `N + 1`, ..., `M - 1`. Note that the character in position `M` is not included. The returned value is called a substring of `s1`.
- `s1.indexOf(s2)` returns an integer. If `s2` occurs as a substring of `s1`, then the returned value is the starting position of that substring. Otherwise, the returned value is `-1`. You can also use `s1.indexOf(ch)` to search for a particular character, `ch`, in `s1`. To find the first occurrence of `x` at or after position `N`, you can use `s1.indexOf(x,N)`.
- `s1.compareTo(s2)` is an integer-valued function that compares the two strings. If the strings are equal, the value returned is zero. If `s1` is less than `s2`, the value returned is a number less than zero, and if `s1` is greater than `s2`, the value returned is some number greater than zero. (If both of the strings consist entirely of lowercase letters, then "less than" and "greater than" refer to alphabetical order. Otherwise, the ordering is more complicated.)
- `s1.toUpperCase()` is a `String`-valued function that returns a new string that is equal to `s1`, except that any lower case letters in `s1` have been converted to upper case. For example, `"Cat".toUpperCase()` is the string `"CAT"`. There is also a

method `s1.toLowerCase()`.

- `s1.trim()` is a `String`-valued function that returns a new string that is equal to `s1` except that any non-printing characters such as spaces and tabs have been trimmed from the beginning and from the end of the string. Thus, if `s1` has the value "fred ", then `s1.trim()` is the string "fred".

For the methods `s1.toUpperCase()`, `s1.toLowerCase()`, and `s1.trim()`, note that the value of `s1` is not changed. Instead a new string is created and returned as the value of the function. The returned value could be used, for example, in an assignment statement such as `"s2 = s1.toLowerCase();"`.

Here is another extremely useful fact about strings: You can use the plus operator, `+`, to **concatenate** two strings. The concatenation of two strings is a new string consisting of all the characters of the first string followed by all the characters of the second string. For example, `"Hello" + "World"` evaluates to `"HelloWorld"`. (Gotta watch those spaces, of course.) Let's suppose that `name` is a variable of type `String` and that it already refers to the name of the person using the program. Then, the program could greet the user by executing the statement:

```
System.out.println("Hello, " + name + ".
Pleased to meet you!");
```

Even more surprising is that you can concatenate values belonging to one of the primitive types onto a `String` using the `+` operator. The value of primitive type is converted to a string, just as it would be if you printed it to the standard output, and then it is concatenated onto the string. For example, the expression `"Number" + 42` evaluates to the string `"Number42"`. And the statements

```
System.out.print("After ");
System.out.print(years);
System.out.print(" years, the value is ");
System.out.print(principal);
```

can be replaced by the single statement:

```
System.out.print("After " + years +
                " years, the value is " +
principal);
```

Obviously, this is very convenient. It would have shortened several of the examples used

earlier in this chapter.

[[Next Section](#) | [Previous Section](#) | [Chapter Index](#) | [Main Index](#)]

Chapter 5

Programming in the Large II Objects and Classes

WHEREAS A SUBROUTINE represents a single task, an object can encapsulate both data (in the form of instance variables) and a number of different tasks or "behaviors" related to that data (in the form of instance methods). Therefore objects provide another, more sophisticated type of structure that can be used to help manage the complexity of large programs.

This chapter covers the creation and use of objects in Java. Section 4 covers the central ideas of object-oriented programming: inheritance and polymorphism. However, in this textbook, we will generally use these ideas in a limited form, by creating independent classes and building on existing classes rather than by designing entire hierarchies of classes from scratch. Sections 5 and 6 cover some of the many details of object oriented programming in Java. Although these details are used occasionally later in the book, you might want to skim through them now and return to them later when they are actually needed.

Contents of Chapter 5:

- Section 1: [Objects, Instance Methods, and Instance Variables](#)
 - Section 2: [Constructors and Object Initialization](#)
 - Section 3: [Programming with Objects](#)
 - Section 4: [Inheritance, Polymorphism, and Abstract Classes](#)
 - Section 5: [this and super](#)
 - Section 6: [Interfaces, Nested Classes and Other Details](#)
 - [Programming Exercises](#)
 - [Quiz on this Chapter](#)
-

Section 5.1

Objects, Instance Methods, and Instance Variables

OBJECT-ORIENTED PROGRAMMING (OOP) represents an attempt to make programs more closely model the way people think about and deal with the world. In the older styles of programming, a programmer who is faced with some problem must identify a computing task that needs to be performed in order to solve the problem. Programming then consists of finding a sequence of instructions that will accomplish that task. But at the heart of object-oriented programming, instead of tasks we find objects -- entities that have behaviors, that hold information, and that can interact with one another. Programming consists of designing a set of objects that somehow model the problem at hand. Software objects in the program can represent real or abstract entities in the problem domain. This is supposed to make the design of the program more natural and hence easier to get right and easier to understand.

To some extent, OOP is just a change in point of view. We can think of an object in standard programming terms as nothing more than a set of variables together with some subroutines for manipulating those variables. In fact, it is possible to use object-oriented techniques in any programming language. However, there is a big difference between a language that makes OOP possible and one that actively supports it. An object-oriented programming language such as Java includes a number of features that make it very different from a standard language. In order to make effective use of those features, you have to "orient" your thinking correctly.

Objects are closely related to classes. We have already been working with classes for several chapters, and we have seen that a class can contain variables and subroutines. If an object is also a collection of variables and subroutines, how do they differ from classes? And why does it require a different type of thinking to understand and use them effectively? In the one section where we worked with objects rather than classes, [Section 3.7](#), it didn't seem to make much difference: We just left the word "static" out of the subroutine definitions!

I have said that classes "describe" objects, or more exactly that the non-static portions of classes describe objects. But it's probably not very clear what this means. The more usual terminology is to say that objects **belong to** classes, but this might not be much clearer. (There is a real shortage of English words to properly distinguish all the concepts

involved. An object certainly doesn't "belong" to a class in the same way that a member variable "belongs" to a class.) From the point of view of programming, it is more exact to say that classes are used to create objects. A class is a kind of factory for constructing objects. The non-static parts of the class specify, or describe, what variables and subroutines the objects will contain. This is part of the explanation of how objects differ from classes: Objects are created and destroyed as the program runs, and there can be many objects with the same structure, if they are created using the same class.

Consider a simple class whose job is to group together a few static member variables. For example, the following class could be used to store information about the person who is using the program:

```
class UserData {
    static String name;
    static int age;
}
```

In a program that uses this class, there is only one copy of each of the variables `UserData.name` and `UserData.age`. There can only be one "user," since we only have memory space to store data about one user. The class, `UserData`, and the variables it contains exist as long as the program runs. Now, consider a similar class that includes non-static variables:

```
class PlayerData {
    String name;
    int age;
}
```

In this case, there is no such variable as `PlayerData.name` or `PlayerData.age`, since `name` and `age` are not static members of `PlayerData`. So, there is nothing much in the class at all -- except the potential to create objects. But, it's a lot of potential, since it can be used to create any number of objects! Each object will have its **own** variables called `name` and `age`. There can be many "players" because we can make new objects to represent new players on demand. A program might use this class to store information about multiple players in a game. Each player has a name and an age. When a player joins the game, a new `PlayerData` object can be created to represent that player. If a player leaves the game, the `PlayerData` object that represents that player can be destroyed. A system of objects in the program is being used to dynamically model what is happening in the game. You can't do this with "static" variables!

In [Section 3.7](#), we worked with applets, which are objects. The reason they didn't seem to be any different from classes is because we were only working with one applet in each

class that we looked at. But one class can be used to make many applets. Think of an applet that scrolls a message across a Web page. There could be several such applets on the same page, all created from the same class. If the scrolling message in the applet is stored in a non-static variable, then each applet will have its own variable, and each applet can show a different message. The situation is even clearer if you think about windows, which, like applets, are objects. As a program runs, many windows might be opened and closed, but all those windows can belong to the same class. Here again, we have a dynamic situation where multiple objects are created and destroyed as a program runs.

An object that belongs to a class is said to be an **instance** of that class. The variables that the object contains are called **instance variables**. The subroutines that the object contains are called **instance methods**. (Recall that in the context of object-oriented programming, "method" is a synonym for "subroutine". From now on, for subroutines in objects, I will prefer the term "method.") For example, if the `PlayerData` class, as defined above, is used to create an object, then that object is an instance of the `PlayerData` class, and `name` and `age` are instance variables in the object. It is important to remember that the class of an object determines the **types** of the instance variables; however, the actual data is contained inside the individual objects, not the class. Thus, each object has its own set of data.

An applet that scrolls a message across a Web page might include a subroutine named `scroll()`. Since the applet is an object, this subroutine is an instance method of the applet. The source code for the method is in the class that is used to create the applet. Still, it's better to think of the instance method as belonging to the object, not to the class. The non-static subroutines in the class merely specify the instance methods that every object created from the class will contain. The `scroll()` methods in two different applets do the same thing in the sense that they both scroll messages across the screen. But there is a real difference between the two `scroll()` methods. The messages that they scroll can be different. (You might say that the subroutine definition in the class specifies what type of behavior the objects will have, but the specific behavior can vary from object to object, depending on the values of their instance variables.)

As you can see, the static and the non-static portions of a class are very different things and serve very different purposes. Many classes contain only static members, or only non-static. However, it is possible to mix static and non-static members in a single class, and we'll see a few examples later in this chapter where it is reasonable to do so. By the way, static member variables and static member subroutines in a class are sometimes called **class variables** and **class methods**, since they belong to the class itself, rather than to instances of that class. This terminology is most useful when the class contains both static and non-static members.

So far, I've been talking mostly in generalities, and I haven't given you much idea what you have to put in a program if you want to work with objects. Let's look at a specific example to see how it works. Consider this extremely simplified version of a `Student` class, which could be used to store information about students taking a course:

```
class Student {  
  
    String name;    // Student's name.  
    double test1, test2, test3;    // Grades on three  
tests.  
  
    double getAverage() {    // compute average test  
grade  
        return (test1 + test2 + test3) / 3;  
    }  
  
}    // end of class Student
```

None of the members of this class are declared to be `static`, so the class exists only for creating objects. This class definition says that any object that is an instance of the `Student` class will include instance variables named `name`, `test1`, `test2`, and `test3`, and it will include an instance method named `getAverage()`. The names and tests in different objects will generally have different values. When called for a particular student, the method `getAverage()` will compute an average using **that student's** test grades. Different students can have different averages. (Again, this is what it means to say that an instance method belongs to an individual object, not to the class.)

In Java, a class is a **type**, similar to the built-in types such as `int` and `boolean`. So, a class name can be used to specify the type of a variable in a declaration statement, the type of a formal parameter, or the return type of a function. For example, a program could define a variable named `std` of type `Student` with the statement

```
Student std;
```

However, declaring a variable does **not** create an object! This is an important point, which is related to this Very Important Fact:

**In Java, no variable can ever hold an object.
A variable can only hold a reference to an object.**

You should think of objects as floating around independently in the computer's memory. In fact, there is a special portion of memory called the **heap** where objects live. Instead of holding an object itself, a variable holds the information necessary to find the object in memory. This information is called a **reference** or **pointer** to the object. In effect, a reference to an object is the address of the memory location where the object is stored. When you use a variable of class type, the computer uses the reference in the variable to find the actual object.

Objects are actually created by an operator called `new`, which creates an object and returns a reference to that object. For example, assuming that `std` is a variable of type `Student`, declared as above, the assignment statement

```
std = new Student();
```

would create a new object which is an instance of the class `Student`, and it would store a reference to that object in the variable `std`. The value of the variable is a reference to the object, not the object itself. It is not quite true, then, to say that the object is the "value of the variable `std`" (though sometimes it is hard to avoid using this terminology). It is certainly **not at all true** to say that the object is "stored in the variable `std`." The proper terminology is that "the variable `std` **refers to** the object," and I will try to stick to that terminology as much as possible.

So, suppose that the variable `std` refers to an object belonging to the class `Student`. That object has instance variables `name`, `test1`, `test2`, and `test3`. These instance variables can be referred to as `std.name`, `std.test1`, `std.test2`, and `std.test3`. This follows the usual naming convention that when `B` is part of `A`, then the full name of `B` is `A.B`. For example, a program might include the lines

```
System.out.println("Hello, " + std.name
                    + ". Your test grades
are:");
System.out.println(std.test1);
System.out.println(std.test2);
System.out.println(std.test3);
```

This would output the name and test grades from the object to which `std` refers. Similarly, `std` can be used to call the `getAverage()` instance method in the object by saying `std.getAverage()`. To print out the student's average, you could say:

```
System.out.println("Your average is " + std.
getAverage());
```


More generally, you could use `std.name` any place where a variable of type `String` is legal. You can use it in expressions. You can assign a value to it. You can even use it to call subroutines from the `String` class. For example, `std.name.length()` is the number of characters in the student's name.

It is possible for a variable like `std`, whose type is given by a class, to refer to no object at all. We say in this case that `std` holds a **null reference**. The null reference is written in Java as `"null"`. You can store a null reference in the variable `std` by saying

```
std = null;
```

and you could test whether the value of `std` is null by testing

```
if (std == null) . . .
```

If the value of a variable is `null`, then it is, of course, illegal to refer to instance variables or instance methods through that variable -- since there is no object, and hence no instance variables to refer to. For example, if the value of the variable `std` is `null`, then it would be illegal to refer to `std.test1`. If your program attempts to use a null reference illegally like this, the result is an error called a **null pointer exception**.

Let's look at a sequence of statements that work with objects:

```

Student std, std1,          // Declare four variables of
        std2, std3;         //   type Student.
std = new Student();        // Create a new object
belonging                   //   to the class Student,
and                          //   store a reference to
                             //   object in the variable
that                         //
std.                         //
std1 = new Student();        // Create a second Student
object                      //
                             //   and store a reference to
                             //   it in the variable std1.
std2 = std1;                // Copy the reference value
in std1                     //
                             //   into the variable std2.
std3 = null;                // Store a null reference in

```

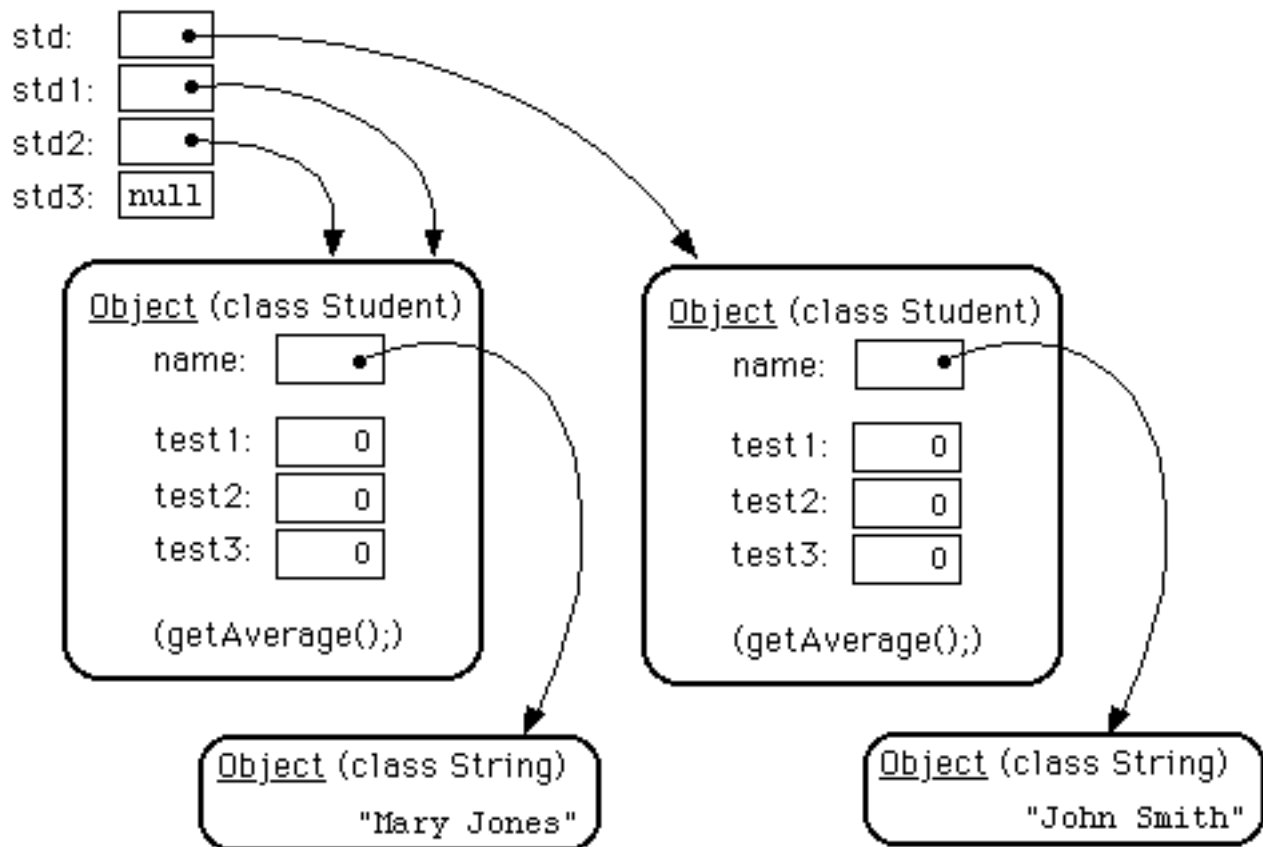
the

```
//      variable std3.

std.name = "John Smith"; // Set values of some
instance variables.
std1.name = "Mary Jones";

// (Other instance variables have default
//      initial values of zero.)
```

After the computer executes these statements, the situation in the computer's memory looks like this:



This picture shows variables as little boxes, labeled with the names of the variables. Objects are shown as boxes with round corners. When a variable contains a reference to an object, the value of that variable is shown as an arrow pointing to the object. The variable `std3`, with a value of `null`, doesn't point anywhere. The arrows from `std1` and `std2` both point to the same object. This illustrates a Very Important Point:

When one object variable is assigned to another, only a reference is copied.

The object referred to is not copied.

When the assignment `std2 = std1;` was executed, no new object was created. Instead, `std2` was set to refer to the very same object that `std1` refers to. This has some consequences that might be surprising. For example, `std1.name` and `std2.name` refer to exactly the same variable, namely the instance variable in the object that both `std1` and `std2` refer to. After the string "Mary Jones" is assigned to the variable **`std1.name`**, it is also be true that the value of **`std2.name`** is "Mary Jones". There is a potential for a lot of confusion here, but you can help protect yourself from it if you keep telling yourself, "The object is not in the variable. The variable just holds a pointer to the object."

You can test objects for equality and inequality using the operators `==` and `!=`, but here again, the semantics are different from what you are used to. When you make a test `if (std1 == std2)`, you are testing whether the values stored in `std1` and `std2` are the same. But the values are references to objects, not objects. So, you are testing whether `std1` and `std2` refer to the same object, that is, whether they point to the same location in memory. This is fine, if its what you want to do. But sometimes, what you want to check is whether the instance variables in the objects have the same values. To do that, you would need to ask whether `std1.test1 == std2.test1 && std1.test2 == std2.test2 && std1.test3 == std2.test3 && std1.name.equals(std2.name)`

I've remarked previously that `Strings` are objects, and I've shown the strings "Mary Jones" and "John Smith" as objects in the above illustration. A variable of type `String` can only hold a reference to a string, not the string itself. It could also hold the value `null`, meaning that it does not refer to any string at all. This explains why using the `==` operator to test strings for equality is not a good idea. Suppose that `greeting` is a variable of type `String`, and that the string it refers to is "Hello". Then would the test `greeting == "Hello"` be true? Well, maybe, maybe not. The variable `greeting` and the `String` literal "Hello" each refer to a string that contains the characters H-e-l-l-o. But the strings could still be different objects, that just happen to contain the same characters. The function `greeting.equals("Hello")` tests whether `greeting` and "Hello" contain the same characters, which is almost certainly the question you want to ask. The expression `greeting == "Hello"` tests whether `greeting` and "Hello" contain the same characters **stored in the same memory location**.

The fact that variables hold references to objects, not objects themselves, has a couple of other consequences that you should be aware of. They follow logically, if you just keep in mind the basic fact that the object is not stored in the variable. The object is somewhere

else; the variable points to it.

Suppose that a variable that refers to an object is declared to be `final`. This means that the value stored in the variable can never be changed, once the variable has been initialized. The value stored in the variable is a reference to the object. So the variable will continue to refer to the same object as long as the variable exists. However, this does not prevent the data **in the object** from changing. The variable is `final`, not the object. It's perfectly legal to say

```
final Student stu = new Student();
stu.name = "John Doe"; // Change data in the
object;
// The value stored in stu
is not changed.
```

Next, suppose that `obj` is a variable that refers to an object. Let's consider what happens when `obj` is passed as an actual parameter to a subroutine. The value of `obj` is assigned to a formal parameter in the subroutine, and the subroutine is executed. The subroutine has no power to change the value stored in the variable, `obj`. It only has a copy of that value. However, that value is a reference to an object. Since the subroutine has a reference to the object, it can change the data stored in the object. After the subroutine ends, `obj` still points to the same object, but the data stored **in the object** might have changed. Suppose `x` is a variable of type `int` and `stu` is a variable of type `Student`. Compare:

```
void dontChange(int z) {
(Student s) {
    z = 42;
    "Fred";
}
```

The lines:

```
x = 17;
"Jane";
dontChange(x);
System.out.println(x);
println(stu.name);
```

output the value 17.
"Fred".

The value of `x` is not
is not

```
void change
s.name =
}
```

The lines:

```
stu.name =
change(stu);
System.out.
```

output the value

The value of `stu`

changed by the subroutine,
name is.

which is equivalent to
equivalent to

```
z = x;  
z = 42;  
"Fred";
```

changed, but stu.

This is

```
s = stu;  
s.name =
```

[[Next Section](#) | [Previous Chapter](#) | [Chapter Index](#) | [Main Index](#)]

Section 3.7

Introduction to Applets and Graphics

FOR THE PAST TWO CHAPTERS, you've been learning the sort of programming that is done inside a single subroutine. In the rest of the text, we'll be more concerned with the larger scale structure of programs, but the material that you've already learned will be an important foundation for everything to come.

In this section, before moving on to programming-in-the-large, we'll take a look at how programming-in-the-small can be used in other contexts besides text-based, command-line-style programs. We'll do this by taking a short, introductory look at applets and graphical programming.

An **applet** is a Java program that runs on a Web page. An applet is not a stand-alone application, and it does not have a `main()` routine. In fact, an applet is an **object** rather than a **class**. When an applet is placed on a Web page, it is assigned a rectangular area on the page. It is the job of the applet to draw the contents of that rectangle. When the region needs to be drawn, the Web page calls a subroutine in the applet to do so. This is not so different from what happens with stand-alone programs. When a program needs to be run, the system calls the `main()` routine of the program. Similarly, when an applet needs to be drawn, the Web page calls the `paint()` routine of the applet. The programmer specifies what happens when these routines are called by filling in the bodies of the routines. Programming in the small! Applets can do other things besides draw themselves, such as responding when the user clicks the mouse on the applet. Each of the applet's behaviors is defined by a subroutine in the applet object. The programmer specifies how the applet behaves by filling in the bodies of the appropriate subroutines.

A very simple applet, which does nothing but draw itself, can be defined by a class that contains nothing but a `paint()` routine. The source code for the class would have the form:

```
import java.awt.*;
import java.applet.*;

public class name-of-applet extends Applet {

    public void paint(Graphics g) {
        statements
    }
```

```
}
```

where **name-of-applet** is an identifier that names the class, and the **statements** are the code that actually draws the applet. This looks similar to the definition of a stand-alone program, but there are a few things here that need to be explained, starting with the first two lines.

When you write a program, there are certain built-in classes that are available for you to use. These built-in classes include `System` and `Math`. If you want to use one of these classes, you don't have to do anything special. You just go ahead and use it. But Java also has a large number of standard classes that are there if you want them but that are not automatically available to your program. (There are just too many of them.) If you want to use these classes in your program, you have to ask for them first. The standard classes are grouped into so-called "packages." Two of these packages are called "java.awt" and "java.applet". The directive "import java.awt.*;" makes all the classes from the package java.awt available for use in your program. The java.awt package contains classes related to graphical user interface programming, including a class called `Graphics`. The `Graphics` class is referred to in the `paint()` routine above. The java.applet package contains classes specifically related to applets, including the class named `Applet`.

The first line of the class definition above says that the class "extends `Applet`." `Applet` is a standard class that is defined in the java.applet package. It defines all the basic properties and behaviors of applet objects. By extending the `Applet` class, the new class we are defining inherits all those properties and behaviors. We only have to define the ways in which our class differs from the basic `Applet` class. In our case, the only difference is that our applet will draw itself differently, so we only have to define the `paint()` routine. This is one of the main advantages of object-oriented programming.

(Actually, most of our applets will be defined to extend `JApplet` rather than `Applet`. The `JApplet` class is itself an extension of `Applet`. The `Applet` class has existed since the original version of Java, while `JApplet` is part of the newer "Swing" set of graphical user interface components. For the moment, the distinction is not important.)

One more thing needs to be mentioned -- and this is a point where Java's syntax gets unfortunately confusing. Applets are objects, not classes. Instead of being static members of a class, the subroutines that define the applet's behavior are part of the applet object. We say that they are "non-static" subroutines. Of course, objects are related to classes because every object is described by a class. Now here is the part that can get confusing: Even though a non-static subroutine is not actually part of a class (in the sense of being part of the behavior of the class), it is nevertheless defined in a class (in the sense that the Java code that defines the subroutine is part of the Java code that defines the class). Many

objects can be described by the same class. Each object has its own non-static subroutine. But the common definition of those subroutines -- the actual Java source code -- is physically part of the class that describes all the objects. To put it briefly: static subroutines in a class definition say what the class does; non-static subroutines say what all the objects described by the class do. An applet's `paint()` routine is an example non-static subroutine. A stand-alone program's `main()` routine is an example of a static subroutine. The distinction doesn't really matter too much at this point: When working with stand-alone programs, mark everything with the reserved word, "static"; leave it out when working with applets. However, the distinction between static and non-static will become more important later in the course.

Let's write an applet that draws something. In order to write an applet that draws something, you need to know what subroutines are available for drawing, just as in writing text-oriented programs you need to know what subroutines are available for reading and writing text. In Java, the built-in drawing subroutines are found in objects of the class `Graphics`, one of the classes in the `java.awt` package. In an applet's `paint()` routine, you can use the `Graphics` object `g` for drawing. (This object is provided as a parameter to the `paint()` routine when that routine is called.) `Graphics` objects contain many subroutines. I'll mention just three of them here. You'll find more listed in [Section 6.3](#).

`g.setColor(c)`, is called to set the color that is used for drawing. The parameter, `c` is an object belonging to a class named `Color`, another one of the classes in the `java.awt` package. About a dozen standard colors are available as static member variables in the `Color` class. These standard colors include `Color.black`, `Color.white`, `Color.red`, `Color.green`, and `Color.blue`. For example, if you want to draw in red, you would say "`g.setColor(Color.red);`". The specified color is used for all drawing operations up until the next time `setColor` is called.

`g.drawRect(x,y,w,h)` draws the outline of a rectangle. The parameters `x`, `y`, `w`, and `h` must be integers. This draws the outline of the rectangle whose top-left corner is `x` pixels from the left edge of the applet and `y` pixels down from the top of the applet. The width of the rectangle is `w` pixels, and the height is `h` pixels.

`g.fillRect(x,y,w,h)` is similar to `drawRect` except that it fills in the inside of the rectangle instead of just drawing an outline.

This is enough information to write the applet shown here:

Sorry, Java is not available.

But here's the picture that the applet draws:

Oops! Your browser doesn't do graphics either!

This applet first fills its entire rectangular area with red. Then it changes the drawing color to black and draws a sequence of rectangles, where each rectangle is nested inside the previous one. The rectangles can be drawn with a `while` loop. Each time through the loop, the rectangle gets smaller and it moves down and over a bit. We'll need variables to hold the width and height of the rectangle and a variable to record how far the top-left corner of the rectangle is inset from the edges of the applet. The while loop ends when the rectangle shrinks to nothing. In general outline, the algorithm for drawing the applet is

```

    Set the drawing color to red  (using the g.setColor
subroutine)
    Fill in the entire applet (using the g.fillRect
subroutine)
    Set the drawing color to black
    Set the top-left corner inset to be 0
    Set the rectangle width and height to be as big as
the applet
    while the width and height are greater than zero:
        draw a rectangle (using the g.drawRect subroutine)
        increase the inset
        decrease the width and the height

```

In my applet, each rectangle is 15 pixels away from the rectangle that surrounds it, so the inset is increased by 15 each time through the `while` loop. The rectangle shrinks by 15 pixels on the left **and** by 15 pixels on the right, so the width of the rectangle shrinks by 30 each time through the loop. The height also shrinks by 30 pixels each time through the loop.

It is not hard to code this algorithm into Java and use it to define the `paint ()` method of

an applet. I've assumed that the applet has a height of 160 pixels and a width of 300 pixels. The size is actually set in the source code of the Web page where the applet appears. In order for an applet to appear on a page, the source code for the page must include a command that specifies which applet to run and how big it should be. (The commands that can be used on a Web page are discussed in [Section 6.2](#).) It's not a great idea to assume that we know how big the applet is going to be. On the other hand, it's also not a great idea to write an applet that does nothing but draw a static picture. I'll address both these issues before the end of this section. But for now, here is the source code for the applet:

```
import java.awt.*;
import java.applet.Applet;

public class StaticRects extends Applet {

    public void paint(Graphics g) {

        // Draw a set of nested black rectangles on a
red background.
        // Each nested rectangle is separated by 15
pixels on
        // all sides from the rectangle that encloses
it.

        int inset;      // Gap between borders of applet
                        // and one of the rectangles.

        int rectWidth, rectHeight;  // The size of one of
the rectangles.

        g.setColor(Color.red);
        g.fillRect(0,0,300,160);  // Fill the entire
applet with red.

        g.setColor(Color.black);  // Draw the rectangles
in black.

        inset = 0;

        rectWidth = 299;      // Set size of first rect to
size of applet.
        rectHeight = 159;
```

```

        while (rectWidth >= 0 && rectHeight >= 0) {
            g.drawRect(inset, inset, rectWidth, rectHeight);
            inset += 15;           // Rects are 15 pixels apart.
            rectWidth -= 30;       // Width decreases by 15
pixels                                // on left and
15 on right.
            rectHeight -= 30;     // Height decreases by 15
pixels                                // on top and 15
on bottom.
        }

    } // end paint()

} // end class StaticRects

```

(You might wonder why the initial `rectWidth` is set to 299, instead of to 300, since the width of the applet is 300 pixels. It's because rectangles are drawn as if with a pen whose nib hangs below and to the right of the point where the pen is placed. If you run the pen exactly along the right edge of the applet, the line it draws is actually outside the applet and therefore is not seen. So instead, we run the pen along a line one pixel to the left of the edge of the applet. The same reasoning applies to `rectHeight`. Careful graphics programming demands attention to details like these.)

When you write an applet, you get to build on the work of the people who wrote the `Applet` class. The `Applet` class provides a framework on which you can hang your own work. Any programmer can create additional frameworks that can be used by other programmers as a basis for writing specific types of applets or stand-alone programs. One example is the applets in previous sections that simulate text-based programs. All these applets are based on a class called `ConsoleApplet`, which itself is based on the standard `Applet` class. You can write your own console applet by filling in this simple framework (which leaves out just a couple of bells and whistles):

```

public class name-of-applet extends ConsoleApplet
{

    public void program() {
        statements
    }
}

```

```
}
```

The statements in the `program()` subroutine are executed when the user of the applet clicks the applet's "Run Program" button. This "program" can't use `TextIO` or `System.out` to do input and output. However, the `ConsoleApplet` framework provides an object named `console` for doing text input/output. This object contains exactly the same set of subroutines as the `TextIO` class. For example, where you would say `TextIO.putln("Hello World")` in a stand-alone program, you could say `console.putln("Hello World")` in a console applet. The `console` object just displays the output on the applet instead of on standard output. Similarly, you can substitute `x = console.getInt()` for `x = TextIO.getInt()`, and so on. As a simple example, here's a console applet that gets two numbers from the user and prints their product:

```
public class PrintProduct extends ConsoleApplet
{
    public void program() {
        double x,y;    // Numbers input by the
user.
        double prod;  // The product, x*y.

        console.put("What is your first number?
");
        x = console.getlnDouble();
        console.put("What is your second number?
");
        y = console.getlnDouble();

        prod = x * y;
        console.putln();
        console.put("The product is ");
        console.putln(prod);

    } // end program()

} // end class PrintProduct
```

And here's what this applet looks like on a Web page:

(Applet "PrintProduct" would be displayed here
if Java were available.)

Now, any console-style applet that you write depends on the `ConsoleApplet` class, which is not a standard part of Java. This means that the compiled class file, `ConsoleApplet.class` must be available to your applet when it is run. As a matter of fact, `ConsoleApplet` uses two other non-standard classes, `ConsolePanel` and `ConsoleCanvas`, so the compiled class files `ConsolePanel.class` and `ConsoleCanvas.class` must also be available to your applet. This just means that all four class files -- your own class and the three classes it depends on -- must be in the same directory with the source code for the Web page on which your applet appears.

I've written another framework that makes it possible to write applets that display simple animations. An example is given by the applet at the bottom of this page, which is an animated version of the nested squares applet from earlier in this section.

A **computer animation** is really just a sequence of still images. The computer displays the images one after the other. Each image differs a bit from the preceding image in the sequence. If the differences are not too big and if the sequence is displayed quickly enough, the eye is tricked into perceiving continuous motion.

In the example, rectangles shrink continually towards the center of the applet, while new rectangles appear at the edge. The perpetual motion is, of course, an illusion. If you think about it, you'll see that the applet loops through the same set of images over and over. In each image, there is a gap between the borders of the applet and the outermost rectangle. This gap gets wider and wider until a new rectangle appears at the border. Only it's not a new rectangle. What has really happened is that the applet has started over again with the first image in the sequence.

The problem of creating an animation is really just the problem of drawing each of the still images that make up the animation. Each still image is called a **frame**. In my framework for animation, which is based on a non-standard class called `SimpleAnimationApplet2`, all you have to do is fill in the code that says how to draw one frame. The basic format is as follows:

```
import java.awt.*;

public class name-of-class extends
SimpleAnimationApplet2 {

    public void drawFrame(Graphics g) {
        statements // to draw one frame of the
animation
```

```

    }

}

```

The `"import java.awt.*;"` is required to get access to graphics-related classes such as `Graphics` and `Color`. You get to fill in any name you want for the class, and you get to fill in the statements inside the subroutine. The `drawFrame()` subroutine will be called by the system each time a frame needs to be drawn. All you have to do is say what happens when this subroutine is called. Of course, you have to draw a different picture for each frame, and to do that you need to know which frame you are drawing. The class `SimpleAnimationApplet2` provides a function named `getFrameNumber()` that you can call to find out which frame to draw. This function returns an integer value that represents the frame number. If the value returned is 0, you are supposed to draw the first frame; if the value is 1, you are supposed to draw the second frame, and so on.

In the sample applet, the thing that differs from one frame to another is the distance between the edges of the applet and the outermost rectangle. Since the rectangles are 15 pixels apart, this distance increases from 0 to 14 and then jumps back to 0 when a "new" rectangle appears. The appropriate value can be computed very simply from the frame number, with the statement `"inset = getFrameNumber() % 15;"`. The value of the expression `getFrameNumber() % 15` is between 0 and 14. When the frame number reaches 15, the value of `getFrameNumber() % 15` jumps back to 0.

Drawing one frame in the sample animated applet is very similar to drawing the single image of the `StaticRects` applet, as given above. The `paint()` method in the `StaticRects` applet becomes, with only minor modification, the `drawFrame()` method of my `MovingRects` animation applet. I've chosen to make one improvement: The `StaticRects` applet assumes that the applet is 300 by 160 pixels. The `MovingRects` applet will work for any applet size. To implement this, the `drawFrame()` routine has to know how big the applet is. There are two functions that can be called to get this information. The function `getWidth()` returns an integer value representing the width of the applet, and the function `getHeight()` returns the height. The width and height, together with the frame number, are used to compute the size of the first rectangle that is drawn. Here is the complete source code:

```

import java.awt.*;

public class MovingRects extends SimpleAnimationApplet2 {

    public void drawFrame(Graphics g) {

        // Draw one frame in the animation by filling
        in the background
    }
}

```

```

        // with a solid red and then drawing a set of
nested black
        // rectangles. The frame number tells how much
the first
        // rectangle is to be inset from the borders of
the applet.

```

```

    int width;      // Width of the applet, in pixels.
    int height;     // Height of the applet, in pixels.

    int inset;      // Gap between borders of applet and
a rectangle.
                    // The inset for the outermost
rectangle goes
                    // from 0 to 14 then back to 0,
and so on,
                    // as the frameNumber varies.

```

```

    int rectWidth, rectHeight; // The size of one of
the rectangles.

```

```

    width = getWidth();      // Find out the size of
the drawing area.
    height = getHeight();

```

```

    g.setColor(Color.red);      // Fill the frame
with red.
    g.fillRect(0,0,width,height);

```

```

    g.setColor(Color.black);    // Switch color
to black.

```

```

    inset = getFrameNumber() % 15; // Get the inset
for the
                                   //
outermost rect.

```

```

    rectWidth = width - 2*inset - 1; // Set size of
outermost rect.
    rectHeight = height - 2*inset - 1;

```

```

    while (rectWidth >= 0 && rectHeight >= 0) {
        g.drawRect(inset,inset,rectWidth,rectHeight);
    }

```

```

        inset += 15;           // Rects are 15 pixels apart.
        rectWidth -= 30;       // Width decreases by 15
pixels
                                //
                                // on left
and 15 on right.
        rectHeight -= 30;     // Height decreases by 15
pixels
                                //
                                // on top
and 15 on bottom.
    }

    } // end drawFrame()

} // end class MovingRects

```

(The [SimpleAnimationApplet2](#) class uses Swing and requires Java version 1.3 or better. There is an older version named [SimpleAnimationApplet](#) that provides the same functionality but works with any version of Java. You could use SimpleAnimationApplet to write animations that will work on older Web browsers.)

The main point here is that by building on an existing framework, you can do interesting things using the type of local, inside-a-subroutine programming that was covered in Chapters 2 and 3. As you learn more about programming and more about Java, you'll be able to do more on your own -- but no matter how much you learn, you'll always be dependent on other people's work to some extent.

End of Chapter 3

[[Next Chapter](#) | [Previous Section](#) | [Chapter Index](#) | [Main Index](#)]

Section 6.3

Graphics and Painting

EVERYTHING YOU SEE ON A COMPUTER SCREEN has to be drawn there, even the text. The Java API includes a range of classes and methods that are devoted to drawing. In this section, I'll look at some of the most basic of these.

An applet is an example of a GUI component. The term **component** refers to a visual element in a GUI, including buttons, menus, text-input boxes, scroll bars, check boxes, and so on. In Java, GUI components are represented by objects belonging to subclasses of the class `java.awt.Component`. Most components in the Swing GUI -- although not top-level components like `JApplet` -- belong to subclasses of the class `javax.swing.JComponent`. Every component is responsible for drawing itself. For example, if you want to use a standard component, you only have to add it to your applet. You don't have to worry about painting it on the screen. That will happen automatically.

Sometimes, however, you do want to draw on a component. You will have to do this whenever you want to display something that is not included among the standard, pre-defined component classes. When you want to do this, you have to define your own component class and provide a method in that class for drawing the component.

As we have seen in [Section 6.1](#) and in [Section 3.7](#), when painting on a plain, non-Swing Applet, the drawing is done in a `paint()` method. To do custom drawing, you have to define a subclass of `Applet` and include a `paint()` method to do the drawing. However, when it comes to Swing and JApplets, things are a little more complicated. You should not draw directly on JApplets or on other top-level Swing components. Instead, you should make a separate component to use as a drawing surface, and you should add that component to the JApplet. You will have to write a class to represent the drawing surface, so programming a JApplet that does custom drawing will always involve writing at least two classes: a class for the applet itself and a class for the drawing surface. Typically, the class for the drawing surface will be defined as a subclass of `javax.swing.JPanel`, which by default is nothing but a blank area on the screen. A `JPanel`, like any `JComponent`, draws its content in the method

```
public void paintComponent(Graphics g)
```

To create a drawing surface, you should define a subclass of `JPanel` and provide a custom `paintComponent()` method. Create an object belonging to your new class,

and add it to your JApplet. When the time comes for your component to be drawn on the screen, the system will call its `paintComponent()` to do the drawing. All this is not really as complicated as it might sound. We will go over this in more detail when the time comes.

Note that the `paintComponent()` method has a parameter of type `Graphics`. The `Graphics` object will be provided by the system when it calls your method. You need this object to do the actual drawing. To do any drawing at all in Java, you need a **graphics context**. A graphics context is an object belonging to the class, `java.awt.Graphics`. Instance methods are provided in this class for drawing shapes, text, and images. Any given `Graphics` object can draw to only one location. In this chapter, that location will always be a GUI component belonging to some subclass of `JComponent`. The `Graphics` class is an abstract class, which means that it is impossible to create a graphics context directly, with a constructor. There are actually two ways to get a graphics context for drawing on a component: First of all, of course, when the `paintComponent()` method of a component is called by the system, the parameter to that method is a graphics context for drawing on the component. Second, each component has an instance method called `getGraphics()`. This method is a function that returns a graphics context that can be used for drawing on the component outside its `paintComponent()` method. The official line is that you should **not** do this, and I will avoid it for the most part. But I have found it convenient to use `getGraphics()` in some cases, since it can mean better performance for certain types of drawing. (Anyway, if the people who designed Java really didn't want us to use it, they shouldn't have made the `getGraphics()` method `public`!)

Most components do, in fact, do all drawing operations in their `paintComponent()` methods. What happens if, in the middle of some other method, you realize that the content of the component needs to be changed? You should **not** call `paintComponent()` directly to make the change; this method is meant to be called only by the system. Instead, you have to inform the system that the component needs to be redrawn, and let the system do its job by calling `paintComponent()`. You do this by calling the `repaint()` method. The method

```
public void repaint();
```

is defined in the `Component` class, and so can be used with any component. You should call `repaint()` to inform the system that the component needs to be redrawn. The `repaint()` method returns immediately, without doing any painting itself. The system will call the component's `paintComponent()` method *later*, as soon as it gets a chance to do so, after processing other pending events if there are any.

Note that the system can also call `paintComponent()` for other reasons. It is called when the component first appears on the screen. It will also be called if the component is covered up by another window and then uncovered. The system does not save a copy of the component's contents when it is covered. When it is uncovered, the component is responsible for redrawing itself. (As you will see, some of our early examples will not be able to do this correctly.)

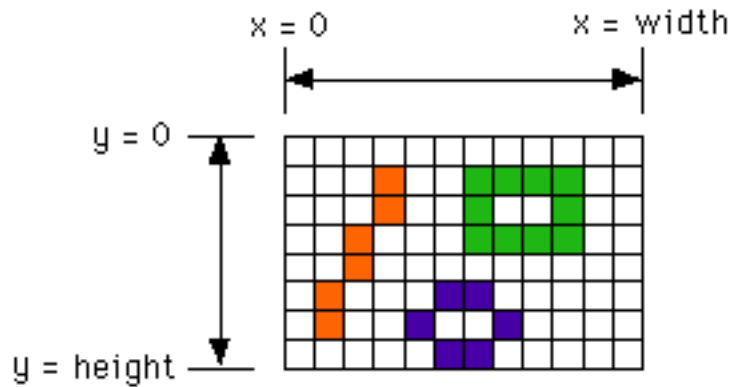
This means that, to work properly, the `paintComponent()` method must be smart enough to correctly redraw the component at any time. To make this possible, a program should store data about the state of the component in its instance variables. These variables should contain all the information necessary to redraw the component completely. The `paintComponent()` method should use the data in these variables to decide what to draw. When the program wants to change the content of the component, it should not simply draw the new content. It should change the values of the relevant variables and call `repaint()`. When the system calls `paintComponent()`, this method will use the new values of the variables and will draw the component with the desired modifications. This might seem a roundabout way of doing things. Why not just draw the modifications directly? There are at least two reasons. First of all, it really does turn out to be easier to get things right if all drawing is done in one method. Second, even if you did make modifications directly, you would still have to make the `paintComponent()` method aware of them in some way so that it will be able to redraw the component correctly when it is covered and uncovered.

You will see how all this works in practice as we work through examples in the rest of this chapter. For now, we will spend the rest of this section looking at how to get some actual drawing done.

Coordinates

The screen of a computer is a grid of little squares called **pixels**. The color of each pixel can be set individually, and drawing on the screen just means setting the colors of individual pixels.

A graphics context draws in a rectangle made up of pixels. A position in the rectangle is specified by a pair of integer coordinates, (x, y) . The upper left corner has coordinates $(0, 0)$. The x coordinate increases from left to right, and the y coordinate increases from top to bottom. The illustration on the right shows a 12-by-8 pixel component (with very large pixels). A small line, rectangle, and oval are shown as they would be drawn by coloring individual pixels. (Note that, properly speaking, the coordinates don't belong to the pixels but to the grid lines between them.)



For any component, you can find out the size of the rectangle that it occupies by calling the instance method `getSize()`. This method returns an object that belongs to the class, `java.awt.Dimension`. A `Dimension` object has two integer instance variables, `width` and `height`. The width of the component is `getSize().width` pixels, and its height is `getSize().height` pixels.

When you are writing an applet, you don't necessarily know the applet's size. The size of an applet is usually specified in an `<APPLET>` tag in the source code of a Web page, and it's easy for the Web-page author to change the specified size. In some cases, when the applet is displayed in some other kind of window instead of on a Web page, the applet can even be resized while it is running. So, it's not good form to depend on the size of the applet being set to some particular value. For other components, you have even less chance of knowing the component's size in advance. This means that it's good form to check the size of a component before doing any drawing on that component. For example, you can use a `paintComponent()` method that looks like:

```
public void paintComponent(Graphics g) {
    int width = getSize().width;    // Find out the
width of component.
    int height = getSize().height;  // Find out its
height.
    . . .    // Draw the contents of the component.
}
```

Of course, your drawing commands will have to take the size into account. That is, they will have to use (x, y) coordinates that are calculated based on the actual height and width of the applet.

Colors

Java is designed to work with the **RGB color system**. An RGB color is specified by three numbers that give the level of red, green, and blue, respectively, in the color. A color in Java is an object of the class, `java.awt.Color`. You can construct a new color by specifying its red, blue, and green components. For example,

```
myColor = new Color(r,g,b);
```

There are two constructors that you can call in this way. In the one that I almost always use, `r`, `g`, and `b` are integers in the range 0 to 255. In the other, they are numbers of type `float` in the range 0.0F to 1.0F. (You might recall that a literal of type `float` is written with an "F" to distinguish it from a `double` number.) Often, you can avoid constructing new colors altogether, since the `Color` class defines several named constants representing common colors: `Color.white`, `Color.black`, `Color.red`, `Color.green`, `Color.blue`, `Color.cyan`, `Color.magenta`, `Color.yellow`, `Color.pink`, `Color.orange`, `Color.lightGray`, `Color.gray`, and `Color.darkGray`.

An alternative to RGB is the **HSB color system**. In the HSB system, a color is specified by three numbers called the **hue**, the **saturation**, and the **brightness**. The hue is the basic color, ranging from red through orange through all the other colors of the rainbow. The brightness is pretty much what it sounds like. A fully saturated color is a pure color tone. Decreasing the saturation is like mixing white or gray paint into the pure color. In Java, the hue, saturation and brightness are always specified by values of type `float` in the range from 0.0F to 1.0F. The `Color` class has a static member function named `getHSBColor` for creating HSB colors. To create the color with HSB values given by `h`, `s`, and `b`, you can say:

```
myColor = Color.getHSBColor(h,s,b);
```

For example, you could make a random color that is as bright and as saturated as possible with

```
myColor = Color.getHSBColor( (float)Math.random(), 1.0F,
                             1.0F );
```

The type cast is necessary because the value returned by `Math.random()` is of type `double`, and `Color.getHSBColor()` requires values of type `float`. (By the way, you might ask why RGB colors are created using a constructor while HSB colors are created using a static member function. The problem is that we would need two different constructors, both of them with three parameters of type `float`. Unfortunately, this is

impossible. You can only have two constructors if the number of parameters or the parameter types differ.)

The RGB system and the HSB system are just different ways of describing the same set of colors. It is possible to translate between one system and the other. The best way to understand the color systems is to experiment with them. In the following applet, you can use the scroll bars to control the RGB and HSB values of a color. A sample of the color is shown on the right side of the applet. Computer monitors differ as to the number of different colors they can display, so you might not get to see the full range of colors in this applet.

(Applet "ColorChooserApplet" would be displayed here if Java were available.)

One of the instance variables in a `Graphics` object is the current drawing color, which is used for all drawing of shapes and text. If `g` is a graphics context, you can change the current drawing color for `g` using the method `g.setColor(c)`, where `c` is a `Color`. For example, if you want to draw in green, you would just say `g.setColor(Color.green)` before doing the drawing. The graphics context continues to use the color until you explicitly change it with another `setColor()` command. If you want to know what the current drawing color is, you can call the function `g.getColor()`, which returns an object of type `Color`. This can be useful if you want to change to another drawing color temporarily and then restore the previous drawing color.

Every component has an associated **foreground color** and **background color**. Generally, the component is filled with the background color before anything else is drawn (although some components are "transparent," meaning that the background color is ignored). When a new graphics context is created for a component, the current drawing color is set to the foreground color. Note that the foreground color and background color are properties of the component, not of a graphics context.

The foreground and background colors can be set by instance methods `setForeground(c)` and `setBackground(c)`, which are defined in the `Component` class and therefore are available for use with any component.

Fonts

A **font** represents a particular size and style of text. The same character will appear different in different fonts. In Java, a font is characterized by a font name, a style, and a size. The available font names are system dependent, but you can always use the

following four strings as font names: "Serif", "SansSerif", "Monospaced", and "Dialog". In the original Java 1.0, the font names were "TimesRoman", "Helvetica", and "Courier". You can still use the older names if you want. (A "serif" is a little decoration on a character, such as a short horizontal line at the bottom of the letter i. "SansSerif" means "without serifs." "Monospaced" means that all the characters in the font have the same width. The "Dialog" font is the one that is typically used in dialog boxes.)

The style of a font is specified using named constants that are defined in the `Font` class. You can specify the style as one of the four values:

- `Font.PLAIN`,
- `Font.ITALIC`,
- `Font.BOLD`, or
- `Font.BOLD + Font.ITALIC`.

The size of a font is an integer. Size typically ranges from about 10 to 36, although larger sizes can also be used. The size of a font is usually about equal to the height of the largest characters in the font, in pixels, but this is not a definite rule. The size of the default font is 12.

Java uses the class named `java.awt.Font` for representing fonts. You can construct a new font by specifying its font name, style, and size in a constructor:

```
Font plainFont = new Font("Serif", Font.PLAIN, 12);
Font bigBoldFont = new Font("SansSerif", Font.
BOLD, 24);
```

Every graphics context has a current font, which is used for drawing text. You can change the current font with the `setFont()` method. For example, if `g` is a graphics context and `bigBoldFont` is a font, then the command `g.setFont(bigBoldFont)` will set the current font of `g` to `bigBoldFont`. You can find out the current font of `g` by calling the method `g.getFont()`, which returns an object of type `Font`.

Every component has an associated font. It can be set with the instance method `setFont(font)`, which is defined in the `Component` class. When a graphics context is created for drawing on a component, the graphic context's current font is set equal to the font of the component.

Shapes

The `Graphics` class includes a large number of instance methods for drawing various shapes, such as lines, rectangles, and ovals. The shapes are specified using the (x, y) coordinate system described above. They are drawn in the current drawing color of the graphics context. The current drawing color is set to the foreground color of the component when the graphics context is created, but it can be changed at any time using the `setColor()` method.

Here is a list of some of the most important drawing methods. With all these commands, any drawing that is done outside the boundaries of the component is ignored. Note that all these methods are in the `Graphics` class, so they all must be called through an object of type `Graphics`.

`drawString(String str, int x, int y)` -- Draws the text given by the string `str`. The string is drawn using the current color and font of the graphics context. `x` specifies the position of the left end of the string. `y` is the y-coordinate of the baseline of the string. The baseline is a horizontal line on which the characters rest. Some parts of the characters, such as the tail on a `y` or `g`, extend below the baseline.

`drawLine(int x1, int y1, int x2, int y2)` -- Draws a line from the point $(x1, y1)$ to the point $(x2, y2)$. The line is drawn as if with a pen that hangs one pixel to the right and one pixel down from the (x, y) point where the pen is located. For example, if `g` refers to an object of type `Graphics`, then the command `g.drawLine(x, y, x, y)`, which corresponds to putting the pen down at a point, draws the single pixel located at the point (x, y) .

`drawRect(int x, int y, int width, int height)` -- Draws the outline of a rectangle. The upper left corner is at (x, y) , and the width and height of the rectangle are as specified. If `width` equals `height`, then the rectangle is a square. If the width or the height is negative, then nothing is drawn. The rectangle is drawn with the same pen that is used for `drawLine()`. This means that the actual width of the rectangle as drawn is `width+1`, and similarly for the height. There is an extra pixel along the right edge and the bottom edge. For example, if you want to draw a rectangle around the edges of the component, you can say `"g.drawRect(0, 0, getSize().width-1, getSize().height-1);"`, where `g` is a graphics context for the component.

`drawOval(int x, int y, int width, int height)` -- Draws the outline of an oval. The oval is one that just fits inside the rectangle specified by `x, y, width, and height`. If `width` equals

height, the oval is a circle.

`drawRoundRect(int x, int y, int width, int height, int xdiam, int ydiam)` -- Draws the outline of a rectangle with rounded corners. The basic rectangle is specified by `x`, `y`, `width`, and `height`, but the corners are rounded. The degree of rounding is given by `xdiam` and `ydiam`. The corners are arcs of an ellipse with horizontal diameter `xdiam` and vertical diameter `ydiam`. A typical value for `xdiam` and `ydiam` is 16. But the value used should really depend on how big the rectangle is.

`draw3DRect(int x, int y, int width, int height, boolean raised)` -- Draws the outline of a rectangle that is supposed to have a three-dimensional effect, as if it is raised from the screen or pushed into the screen. The basic rectangle is specified by `x`, `y`, `width`, and `height`. The `raised` parameter tells whether the rectangle seems to be raised from the screen or pushed into it. The 3D effect is achieved by using brighter and darker versions of the drawing color for different edges of the rectangle. The documentation recommends setting the drawing color equal to the background color before using this method. The effect won't work well for some colors.

`drawArc(int x, int y, int width, int height, int startAngle, int arcAngle)` -- Draws part of the oval that just fits inside the rectangle specified by `x`, `y`, `width`, and `height`. The part drawn is an arc that extends `arcAngle` degrees from a starting angle at `startAngle` degrees. Angles are measured with 0 degrees at the 3 o'clock position (the positive direction of the horizontal axis). Positive angles are measured counterclockwise from zero, and negative angles are measured clockwise. To get an arc of a circle, make sure that `width` is equal to `height`.

`fillRect(int x, int y, int width, int height)` -- Draws a filled-in rectangle. This fills in the interior of the rectangle that would be drawn by `drawRect(x,y,width,height)`. The extra pixel along the bottom and right edges is not included. The `width` and `height` parameters give the exact width and height of the rectangle. For example, if you wanted to fill in the entire component, you could say `"g.fillRect(0, 0, getSize().width, getSize().height);"`

`fillOval(int x, int y, int width, int height)` -- Draws a filled-in oval.

`fillRoundRect(int x, int y, int width, int height, int xdiam, int ydiam)` -- Draws a filled-in rounded rectangle.

`fill3DRect(int x, int y, int width, int height, boolean raised)` -- Draws a filled-in three-dimensional rectangle.

`fillArc(int x, int y, int width, int height, int startAngle, int arcAngle)` -- Draw a filled-in arc. This looks like a wedge of pie, whose crust is the arc that would be drawn by the `drawArc` method.

Let's use some of the material covered in this section to write a JApplet. Since we will be drawing on the applet, we will need to create a drawing surface. The drawing surface will be a `JComponent` belonging to a subclass of the `JPanel` class. We will define this class as a nested class inside the main applet class. Nested classes were introduced in [Section 5.6](#). All the drawing is done in the `paintComponent()` method of the drawing surface class. I will use nested classes consistently to define drawing surfaces, although it is perfectly legal to use an independent class instead of a nested class to define the drawing surface. A nested class can be either static or non-static. In general, a non-static class must be used if it needs access to instance variables or instance methods that are defined in the main class. This will be the case in most of my examples.

The applet will draw multiple copies of a message on a black background. Each copy of the message is in a random color. Five different fonts are used, with different sizes and styles. The displayed message is the string "Java!", but a different message can be specified in an applet param. (Applet params were discussed at the end of the [previous section](#).) The applet works OK no matter what size is specified for the applet in the `<applet>` tag. Here's the applet:

(Applet "RandomStrings" would be displayed here if Java were available.)

The applet does have a problem. When the drawing surface's `paintComponent()` method is called, it chooses random colors, fonts, and locations for the messages. The information about which colors, fonts, and locations are used is not stored anywhere. The next time `paintComponent()` is called, it will make different random choices and will draw a different picture. For this particular applet, the problem only really appears when the applet is *partially* covered and then uncovered. Only the part that was covered will be redrawn, and in the part that's not redrawn, the old picture will remain. Try it. You'll see

partial messages, cut off by the dividing line between the new picture and the old. (Actually, in some browsers, the entire applet might be repainted, even if only part of it was covered.) A better approach would be to compute the contents of the picture elsewhere, outside the `paintComponent()` method. Information about the picture should be stored in instance variables, and the `paintComponent()` method should use that information to draw the picture. If `paintComponent()` is called twice, it should draw the same picture twice, unless the data has changed in the meantime. Unfortunately, to store the data for the picture in this applet, we would need to use either arrays, which will not be covered until [Chapter 8](#), or off-screen images, which will not be covered until [Section 7.1](#). Other applets in this chapter will suffer from the same problem.

The source for the applet is shown below. I use an instance variable called `message` to hold the message that the applet will display. There are five instance variables of type `Font` that represent different sizes and styles of text. These variables are initialized in the applet's `init()` method and are used in the drawing surface's `paintComponent()` method. I also use the `init()` method to create the drawing surface, add it to the applet, and set its background color to black.

The `paintComponent()` method for the drawing surface simply draws 25 copies of the message. For each copy, it chooses one of the five fonts at random, and it calls `g.setFont()` to select that font for drawing the text. It creates a random HSB color and uses `g.setColor()` to select that color for drawing. It then chooses random (x, y) coordinates for the location of the message. The x coordinate gives the horizontal position of the left end of the string. The formula used for the x coordinate, `"-50 + (int)(Math.random() * (width+40))"` gives a random integer in the range from -50 to $width-10$. This makes it possible for the string to extend beyond the left edge or the right edge of the applet. Similarly, the formula for y allows the string to extend beyond the top and bottom of the applet.

The drawing surface class, which is named `Display`, defines the `paintComponent()` method that draws all the strings that appear in the applet. The drawing surface is created in the applet's `init()` method as an object of type `Display`. This object is set to be the "content pane" of the applet. A `JApplet`'s content pane fills the entire applet, except for an optional menu bar. An applet comes with a default content pane, and you can add components to that content pane. However, any `JComponent` can be a content pane, and in a case like this where a single component fills the applet, it makes sense to replace the content pane with the `setContentPane()` method.

The `paintComponent()` method in the `Display` class begins with a call to `super.paintComponent(g)`. The special variable `super` was discussed in [Section 5.5](#). The command `super.paintComponent(g)` simply calls the `paintComponent()` method that is defined in the superclass, `JPanel`. The effect of this is to fill the

component with its background color. Most `paintComponent()` methods begin with a call to `super.paintComponent(g)`, but this is not necessary if the drawing commands in the method cover the background of the component completely.

Here is the complete source code for the `RandomStrings` applet:

```
/* This applet displays 25 copies of a message. The
color and
position of each message is selected at random. The
font
of each message is randomly chosen from among five
possible
fonts. The messages are displayed on a black
background.
```

```
Note: This applet uses bad style, because every time
the paintComponent() method is called, new random
values are
used. This means that a different picture will be
drawn each
time. This is particularly bad if only part of the
applet
needs to be redrawn, since then the applet will
contain
cut-off pieces of messages.
```

```
When this file is compiled, it produces two classes,
RandomStrings.class and RandomStrings$Display.class.
Both
classes are required to use the applet.
*/
```

```
import java.awt.*;
import javax.swing.*;

public class RandomStrings extends JApplet {

    String message; // The message to be displayed.
    This can be set in
    // an applet param with name
    "message". If no
    // value is provided in the applet
```

tag, then

// the string "Java!" is used as the default.

Font font1, font2, font3, font4, font5; // The five fonts.

Display drawingSurface; // This is the component on which the

done. It // drawing will actually be

class that // is defined by a nested

// can be found below.

```
public void init() {
    // Called by the system to initialize the
    applet.
```

```
    message = getParameter("message");
    if (message == null)
        message = "Java!";
```

```
    font1 = new Font("Serif", Font.BOLD, 14);
    font2 = new Font("SansSerif", Font.BOLD + Font.
ITALIC, 24);
    font3 = new Font("Monospaced", Font.PLAIN, 20);
    font4 = new Font("Dialog", Font.PLAIN, 30);
    font5 = new Font("Serif", Font.ITALIC, 36);
```

drawingSurface = new Display(); // Create the drawing surface.

```
    drawingSurface.setBackground(Color.black);
```

```
    setContentPane(drawingSurface); // Since
drawingSurface will fill
```

// the entire applet, we simply

// replace the applet's content

// pane with drawingSurface.

```
    } // end init()
```

```

class Display extends JPanel {
    // This nested class defines a JPanel that is
used
    // for displaying the content of the applet. An
    // object of this class is used as the content
pane
    // of the applet. Note that since this is a
nested
    // non-static class, it has access to the
instance
    // variables of the main class such as message
and font1.

    public void paintComponent(Graphics g) {

        super.paintComponent(g); // Call the
paintComponent method from
                                // the superclass,
JPanel. This simply
                                // fills the entire
component with the
                                // component's
background color.

        int width = getSize().width; // Get this
component's width.
        int height = getSize().height; // Get this
component's height.

        for (int i = 0; i < 25; i++) {

            // Draw one string. First, set the font to
be one of the five
            // available fonts, at random.

            int fontNum = (int)(5*Math.random()) + 1;
            switch (fontNum) {
                case 1:
                    g.setFont(font1);
                    break;
                case 2:

```

```

        g.setFont(font2);
        break;
    case 3:
        g.setFont(font3);
        break;
    case 4:
        g.setFont(font4);
        break;
    case 5:
        g.setFont(font5);
        break;
    } // end switch

    // Set the color to a bright, saturated
color, with random hue.

    float hue = (float)Math.random();
    g.setColor( Color.getHSBColor(hue, 1.0F,
1.0F) );

    // Select the position of the string, at
random.

    int x,y;
    x = -50 + (int)(Math.random()*(width+40));
    y = (int)(Math.random()*(height+20));

    // Draw the message.

    g.drawString(message,x,y);

    } // end for

    } // end paintComponent()

    } // end nested class Display

    } // end class RandomStrings

```

[[Next Section](#) | [Previous Section](#) | [Chapter Index](#) | [Main Index](#)]

Section 6.1

The Basic Java Applet and JApplet

JAVA APPLET¹S ARE SMALL PROGRAMS that are meant to run on a page in a Web browser. Very little of that statement is completely accurate, however. An applet is not a complete program. It doesn't have to be small. And while applets are generally meant to be used on Web pages, there are other ways to use them. A technically more correct, but not very useful, definition would say simply that an applet is an object that belongs to the class `java.applet.Applet` or to one of its subclasses. Either definition still leaves us a long way to go to really understand applets.

An applet is inherently part of a graphical user interface. It is a type of graphical component that can be displayed in a window (whether belonging to a Web browser or to some other program). When shown in a window, an applet is a rectangular area that can contain other components, such as buttons and text boxes. It can display graphical elements such as images, rectangles, and lines. And it can respond to certain "events," such as when the user clicks on the applet with a mouse.

The `Applet` class, defined in the package `java.applet`, is really only useful as a basis for making subclasses. An object of type `Applet` has certain basic behaviors, but doesn't actually do anything useful. It's just a blank area on the screen that doesn't respond to any events. To create a useful applet, a programmer must define a subclass that extends the `Applet` class. There are several methods in the `Applet` class that are defined to do nothing at all. The programmer must override at least some of these methods and give them something to do.

Back in [Section 2.1](#), when you first learned about Java programs, you encountered the idea of a `main()` routine, which is not meant to be called by the programmer. The `main()` routine of a program is there to be called by "the system" when it needs to execute the program. The programmer writes the main routine to say what happens when the system runs the program. An applet needs no `main()` routine, since it is not a stand-alone program. However, many of the methods in an applet are similar to `main()` in that they are meant to be called by the system, and the job of the programmer is to say what happens in response to the system's calls.

In this section, we'll look at a few of the things that applets can do. We'll spend the rest of this chapter and the next filling in the details.

One of the methods that is defined in the `Applet` class to do nothing is the `paint()` method. You've already encountered this method briefly in [Section 3.7](#). The `paint()` method is called by the system when the applet needs to be drawn. In a subclass of `Applet`, the `paint()` method can be redefined to draw various graphical elements such as rectangles, lines, and text on the applet. The definition of this method must have the form:

```
public void paint(Graphics g) {
    // draw some stuff
}
```

The parameter `g`, of type `Graphics`, is provided by the system when it calls the `paint()` method. In Java, all drawing of any kind is done using methods provided by a `Graphics` object. There are many such methods. I will discuss graphics in more detail in [Section 3](#).

As a first example of an applet, let's go the traditional route and look at an applet that displays the string "Hello World!". We'll use the `paint()` method to display this string. The `import` statements at the beginning make it possible to use the short names `Applet` and `Graphics` instead of the full names of the classes `java.applet.Applet` and `java.awt.Graphics`. (See [Section 4.5](#) for a discussion of "packages," such as `java.awt` and `java.applet`.)

```
import java.awt.*;
import java.applet.*;

public class HelloWorldApplet extends Applet {

    // An applet that simply displays the string
    Hello World!

    public void paint(Graphics g) {
        g.drawString("Hello World!", 10, 30);
    }

} // end of class HelloWorldApplet
```

The `drawString()` method, defined in the `Graphics` class, actually does the drawing. The parameters of this method specify the string to be drawn and the point in the applet where the string is to be placed. More about this later.

Now, an applet is an object, not a class. So far we have only defined a class. Where does an actual applet object come from? It is possible, of course, to create such objects:

```
Applet hw = new HelloWorldApplet();
```

This might even be useful if you are writing a program and would like to add an applet to a window you've created. Most often, however, applet objects are created by "the system." For example, when an applet appears on a page in a Web browser, "the system" means the Web browser. It is up to the browser program to create the applet object and to add it to a Web page. The Web browser, in turn, gets instructions about what is to appear on a given Web page from the source document for that page. For an applet to appear on a Web page, the source document for that page must specify the name of the applet and its size. This specification, like the rest of the document, is written in a language called HTML. I will discuss HTML in more detail in [Section 2](#). Here is some HTML code that instructs a Web browser to display a HelloWorldApplet:

```
<center>
<applet code="HelloWorldApplet.class" width=200
height=50>
</applet>
</center>
```

and here is the applet that this code displays:

(Applet "HelloWorldApplet" would be displayed here
if Java were available.)

If you are viewing this page with a web browser that supports Java, you should see the message "Hello world!". The message is displayed in a rectangle that is 200 pixels in width and 50 pixels in height. You shouldn't be able to see the rectangle as such, since by default, an applet has a background color that is the same as the color of the Web page on which it is displayed. (This might not actually be the case in your browser.)

The Applet class defines another method that is essential for programming applets, the `init()` method. This method is called just after the applet object has been created and before it appears on the screen. Its purpose is to give the applet a chance to do any necessary initialization. Again, this method is called by the system, not by your program. Your job as a programmer is just to provide a definition of the `init()` method. The definition of the method must have the form:

```
public void init() {
    // do initialization
```

```
}
```

(You might wonder, by the way, why initialization is done in the `init()` method rather than in a constructor. In fact, it is possible to define a constructor for your applet class. To create the applet object, the system calls the constructor that has no parameters. You can write such a constructor for an applet class and can do initializations in the constructor as well as in the `init()` method. The most significant difference is that when the constructor is called, the size of the applet is not available. By the time `init()` is called, the size is known and can be used to customize the initialization according to the size. In general, though, it is customary to do applet initialization in the `init()` method.)

Suppose, for example, that we want to change the colors used by the `HelloWorldApplet`. An applet has a "background color" which is used to fill the entire area of the applet before any other drawing is done, and it has a "foreground color" which is used as the default color for drawing in the applet. It is convenient to set these colors in the `init()` method. Here is a version of the `HelloWorldApplet` that does this:

(Applet "HelloWorldApplet2" would be displayed here if Java were available.)

and here is the source code for this applet, including the `init()` method:

```
import java.awt.*;
import java.applet.*;

public class HelloWorldApplet2 extends Applet {

    public void init() {
        // Initialize the applet by setting it
to use blue
        // and yellow as background and
foreground colors.
        setBackground(Color.blue);
        setForeground(Color.yellow);
    }

    public void paint(Graphics g) {
        g.drawString("Hello World!", 10, 30);
    }

} // end of class HelloWorldApplet2
```

JApplets and Swing

The AWT (Abstract Windowing Toolkit) has been part of Java from the beginning, but, almost from the beginning, it has been clear that the AWT was not powerful or flexible enough for writing complex, sophisticated applications. This does not prevent it from being useful -- especially for applets, which are generally not as complex as full-scale, independent applications. The Swing graphical user interface library was created to address the problems with the AWT. With the release of Java version 1.2, Swing became an official part of Java. (Versions of Java starting with 1.2 are also called, rather confusingly, "Java 2.") There are still good reasons to write applets based on the AWT, such as the lack of support in many Web browsers for Java 2. However, at this point, anyone writing a stand-alone graphical application in Java should almost certainly be using Swing, and it is Swing that I will concentrate on in this book. If you want to write applets using the AWT, you might want to look at the previous version of this book, which can be found on the web at <http://math.hws.edu/eck/cs124/javanotes3/>.

The classes that make up the Swing library can be found in the package `javax.swing`. Swing includes the class `javax.swing.JApplet` to be used as a basis for writing applets. `JApplet` is actually a subclass of `Applet`, so JApplets are in fact Applets in the usual sense. However, JApplets have a lot of extra structure that plain Applets don't have. Because of this structure, the painting of a `JApplet` is a more complex affair and is handled by the system. So, when you make a subclass of `JApplet` you should **not** write a `paint()` method for it. As we will see, if you want to draw on a `JApplet`, you should add a component to the applet to be used for that purpose. On the other hand, you **can** and generally should write an `init()` method for a subclass of `JApplet`.

In this book, I will use a plain `Applet` in only a few examples. In almost all cases, I will use a `JApplet` even where a plain applet might make more sense (that is, when the applet is just being used as a simple drawing surface).

Let's take a look at a simple `JApplet` that uses Swing. This applet demonstrates some of the basic ideas of GUI programming. Although you won't understand everything in it at this time, it will give you a preliminary idea of how things work.

GUI programs use "components" such as buttons to allow interaction with the user. Our sample applet contains a button. In fact, the button is the only thing in the applet, and it fills the entire rather small applet. Here's our sample `JApplet`, which is named `HelloSwing`:

(Applet "HelloSwing" would be displayed here if Java were available.)

If you click this button, a new window will open with a message and an "OK" button. Click the "OK" button to dismiss the window.

The button in this applet is an object that belongs to the class `JButton` (more properly, `javax.swing.JButton`). When the applet is created, the button must be created and added to the applet. This is part of the process of initializing the applet and is done in the applet's `init()` method. In this method, the button is created with the statement:

```
JButton btn = new JButton("Click Me!");
```

The parameter to the constructor specifies the text that is displayed on the button. The button does not automatically appear on the screen. It has to be added to the applet's "content pane." This is done with the statement:

```
getContentPane().add(btn);
```

Once it has been added to the applet, a `JButton` object mostly takes care of itself. In particular, it draws itself, so you don't have to worry about drawing it. When the user clicks the button, it generates an event. The applet (or, in fact, any object) can be programmed to respond to this event. Event-handling is the major topic in GUI programming, and I will cover it in detail later. But in outline, it works like this: The type of event generated by a button is called an `ActionEvent`. For the applet to respond to an event of this type, it must define a method

```
public void actionPerformed(ActionEvent evt)
{ . . . }
```

Furthermore, the button must be told that the applet will be "listening" for action events from the button. This is done by calling one of the button object's instance methods, `addActionListener()`, in the applet's `init()` method.

What should the applet do in its `actionPerformed()` method? When the user clicks the button, we want a message window to appear on the screen. Fortunately, Swing makes this easy. The class `swing.javax.JOptionPane` has a static method named `showMessageDialog()` that can be used for this purpose, so all we have to do in `actionPerformed()` is call that method.

Given all this, you can understand a lot of what goes on in the source code for the

HelloSwing applet. This example shows several aspects of applet programming: An `init()` method sets up the applet and adds components, the components generate events, and event-handling methods say what happens in response to those events. Here is the source code:

```
// An applet that appears on the page as a button that
says
// "Click Me!".  When the button is clicked, an
informational
// dialog box appears to say Hello from Swing.

import javax.swing.*;    // Swing GUI classes are
defined here.
import java.awt.event.*; // Event handling class are
defined here.

public class HelloSwing extends JApplet implements
ActionListener {

    public void init() {
        // This method is called by the system before
the applet
        // appears.  It is used here to create the
button and add
        // it to the "content pane" of the JApplet.
The applet
        // is also registered as an ActionListener for
the button.

        JButton btnn = new JButton("Click Me!");
        btnn.addActionListener(this);
        getContentPane().add(btnn);

    } // end init()

    public void actionPerformed(ActionEvent evt) {
        // This method is called when an action event
occurs.
        // In this case, the only possible source of
the event
        // is the button.  So, when this method is
called, we know
        // that the button has been clicked.  Respond
```

```

by showing
        // an informational dialog box.  The dialog box
will
        // contain an "OK" button which the user must
click to
        // dismiss the dialog box.

        String title = "Greetings"; // Shown in title bar
of dialog box.
        String message = "Hello from the Swing User
Interface Library.";
        JOptionPane.showMessageDialog(null, message, title,
                                   JOptionPane.
INFORMATION_MESSAGE);
    } // end actionPerformed()

} // end class HelloSwing

```

In this source code, I've set up the applet itself to listen for action events from the button. Some people don't consider this to be very good style. They prefer to create a separate object to listen for and respond to events. This is more "object-oriented" in the sense that each object has its own clearly defined area of responsibility. The most convenient way to make a separate event-handling object is to use a nested anonymous class. These classes were introduced in [Section 5.6](#). We will see more examples of this in the future, but here, for the record, is a version of HelloSwing that uses an anonymous class for event handling. This applet has exactly the same behavior as the original version:

```

import javax.swing.*;    // Swing GUI classes are
defined here.
import java.awt.event.*; // Event handling class are
defined here.

public class HelloSwing2 extends JApplet {

    public void init() {
        // This method is called by the system before
the applet
        // appears.  It is used here to create the
button and add
        // it to the "content pane" of the JApplet.  An
anonymous
        // class is used to create an ActionListener

```


for the button.

```

        JButton btnn = new JButton("Click Me!");

        btnn.addActionListener( new ActionListener() {
            // The "action listener" for the button
is defined
            // by this nested anonymous class.
            public void actionPerformed(ActionEvent evt)
        {
            // This method is called to respond
when the user
            // presses the button.  It displays a
message in
            // a dialog box, along with an "OK"
button which
            // the user can click to dismiss the
dialog box.
            String title = "Greetings"; // Shown in
box's title bar.
            String message = "Another hello from
Swing.";
            JOptionPane.showMessageDialog(null,
message, title,
                                JOptionPane.
INFORMATION_MESSAGE);
            } // end actionPerformed()
        });

        getContentPane().add(btnn);

    } // end init()

} // end class HelloSwing2

```

[[Next Section](#) | [Previous Chapter](#) | [Chapter Index](#) | [Main Index](#)]

Section 2.1

The Basic Java Application

A PROGRAM IS A SEQUENCE OF INSTRUCTIONS that a computer can execute to perform some task. A simple enough idea, but for the computer to make any use of the instructions, they must be written in a form that the computer can use. This means that programs have to be written in **programming languages**. Programming languages differ from ordinary human languages in being completely unambiguous and very strict about what is and is not allowed in a program. The rules that determine what is allowed are called the **syntax** of the language. Syntax rules specify the basic vocabulary of the language and how programs can be constructed using things like loops, branches, and subroutines. A syntactically correct program is one that can be successfully compiled or interpreted; programs that have syntax errors will be rejected (hopefully with a useful error message that will help you fix the problem).

So, to be a successful programmer, you have to develop a detailed knowledge of the syntax of the programming language that you are using. However, syntax is only part of the story. It's not enough to write a program that will run. You want a program that will run and produce the correct result! That is, the **meaning** of the program has to be right. The meaning of a program is referred to as its **semantics**. A semantically correct program is one that does what you want it to.

When I introduce a new language feature in these notes, I will explain both the syntax and the semantics of that feature. You should memorize the syntax; that's the easy part. Then you should try to get a feeling for the semantics by following the examples given, making sure that you understand how they work, and maybe writing short programs of your own to test your understanding.

Of course, even when you've become familiar with all the individual features of the language, that doesn't make you a programmer. You still have to learn how to construct complex programs to solve particular problems. For that, you'll need both experience and taste. You'll find hints about software development throughout this textbook.

We begin our exploration of Java with the problem that has become traditional for such beginnings: to write a program that displays the message "Hello World!". This might seem like a trivial problem, but getting a computer to do this is really a big first step in learning

a new programming language (especially if it's your first programming language). It means that you understand the basic process of:

1. getting the program text into the computer,
2. compiling the program, and
3. running the compiled program.

The first time through, each of these steps will probably take you a few tries to get right. I can't tell you the details here of how you do each of these steps; it depends on the particular computer and Java programming environment that you are using. (See [Appendix 2](#) for information on some common Java programming environments.) But in general, you will type the program using some sort of text editor and save the program in a file. Then, you will use some command to try to compile the file. You'll either get a message that the program contains syntax errors, or you'll get a compiled version of the program. In the case of Java, the program is compiled into Java bytecode, not into machine language. Finally, you can run the compiled program by giving some appropriate command. For Java, you will actually use an interpreter to execute the Java bytecode. Your programming environment might automate some of the steps for you, but you can be sure that the same three steps are being done in the background.

Here is a Java program to display the message "Hello World!". Don't expect to understand what's going on here just yet -- some of it you won't really understand until a few chapters from now:

```
public class HelloWorld {  
  
    // A program to display the message  
    // "Hello World!" on standard output  
  
    public static void main(String[] args) {  
        System.out.println("Hello World!");  
    }  
  
}    // end of class HelloWorld
```

The command that actually displays the message is:

```
System.out.println("Hello World!");
```

This command is an example of a **subroutine call statement**. It uses a "built-in subroutine" named `System.out.println` to do the actual work. Recall that a subroutine consists of the instructions for performing some task, chunked together and given a name. That

name can be used to "call" the subroutine whenever that task needs to be performed. A **built-in subroutine** is one that is already defined as part of the language and therefore automatically available for use in any program.

When you run this program, the message "Hello World!" (without the quotes) will be displayed on standard output. Unfortunately, I can't say exactly what that means! Java is meant to run on many different platforms, and standard output will mean different things on different platforms. However, you can expect the message to show up in some convenient place. (If you use a command-line interface, like that in Sun Microsystems's Java Development Kit, you type in a command to tell the computer to run the program. The computer will type the output from the program, Hello World!, on the next line.)

You must be curious about all the other stuff in the above program. Part of it consists of **comments**. Comments in a program are entirely ignored by the computer; they are there for human readers only. This doesn't mean that they are unimportant. Programs are meant to be read by people as well as by computers, and without comments, a program can be very difficult to understand. Java has two types of comments. The first type, used in the above program, begins with `//` and extends to the end of a line. The computer ignores the `//` and everything that follows it on the same line. Java has another style of comment that can extend over many lines. That type of comment begins with `/*` and ends with `*/`.

Everything else in the program is required by the rules of Java syntax. All programming in Java is done inside "classes." The first line in the above program says that this is a class named `HelloWorld`. "HelloWorld," the name of the class, also serves as the name of the program. Not every class is a program. In order to define a program, a class must include a subroutine called `main`, with a definition that takes the form:

```
public static void main(String[] args) {
    statements
}
```

When you tell the Java interpreter to run the program, the interpreter calls the `main()` subroutine, and the statements that it contains are executed. These statements make up the script that tells the computer exactly what to do when the program is executed. The `main()` routine can call subroutines that are defined in the same class or even in other classes, but it is the `main()` routine that determines how and in what order the other subroutines are used.

The word "public" in the first line of `main()` means that this routine can be called from outside the program. This is essential because the `main()` routine is called by the Java interpreter. The remainder of the first line of the routine is harder to explain at the moment; for now, just think of it as part of the required syntax. The definition of the

subroutine -- that is, the instructions that say what it does -- consists of the sequence of "statements" enclosed between braces, { and }. Here, I've used **statements** as a placeholder for the actual statements that make up the program. Throughout this textbook, I will always use a similar format: anything that you see in **this style of text** (which is green if your browser supports colored text) is a placeholder that describes something you need to type when you write an actual program.

As noted above, a subroutine can't exist by itself. It has to be part of a "class". A program is defined by a public class that takes the form:

```
public class program-name {

    optional-variable-declarations-and-
subroutines

    public static void main(String[] args) {
        statements
    }

    optional-variable-declarations-and-
subroutines

}
```

The name on the first line is the name of the program, as well as the name of the class. If the name of the class is HelloWorld, then the class should be saved in a file called HelloWorld.java. When this file is compiled, another file named HelloWorld.class will be produced. This class file, HelloWorld.class, contains the Java bytecode that is executed by a Java interpreter. HelloWorld.java is called the **source code** for the program. To execute the program, you only need the compiled class file, not the source code.

Also note that according to the above syntax specification, a program can contain other subroutines besides main(), as well as things called "variable declarations." You'll learn more about these later (starting with variables, in the next section).

By the way, recall that one of the neat features of Java is that it can be used to write applets that can run on pages in a Web browser. Applets are very different things from stand-alone programs such as the HelloWorld program, and they are not written in the same way. For one thing, an applet doesn't have a main() routine. Applets will be

covered in [Chapter 6](#) and [Chapter 7](#). In the meantime, you will see applets in this text that **simulate** stand-alone programs. The applets you see are not really the same as the stand-alone programs that they simulate, since they run right on a Web page, but they will have the same behavior as the programs I describe. Here, just for fun, is an applet simulating the HelloWorld program. To run the program, click on the button:

(Applet "ConsoleApplet" would be displayed here
if Java were available.)

[[Next Section](#) | [Previous Chapter](#) | [Chapter Index](#) | [Main Index](#)]

Appendix 2:

Some Notes on Java Programming Environments

ANYONE WHO IS LEARNING to program has to choose a programming environment that makes it possible to create and to run programs. Programming environments can be divided into two very different types: **integrated development environments** and **command-line environments**. All programming environments for Java require some text editing capability, a Java compiler, and a way to run applets and stand-alone applications. An integrated development environment, or IDE, is a graphical user interface program that integrates all these aspects of programming and probably others (such as a debugger, a visual interface builder, and project management). A command-line environment is just a collection of commands that can be typed in to edit files, compile source code, and run programs.

I have programmed using both IDEs and command-line environments, and I have taught programming using both types of environments. Based on my experience, I recommend a command line environment for beginning programmers. IDEs can simplify the management of large numbers of files in a complex project, but they are themselves complex programs that add another level of complications to the already difficult task of learning the fundamentals of programming. Certainly, a serious programmer should have some experience with IDEs, but I think that it's an experience that can be picked up later. This is, of course, just my opinion.

In the rest of this appendix, I'll make a few comments on programming environments. No matter which type of environment you prefer, there is no need to pay for it, so I'll limit my comments to software that is available at no charge. Please note that I am not an expert on Java programming environments. I am including this appendix because people occasionally write to me for help or advice on the matter. In general, however, I *cannot* answer questions about specific programming environments.

The Basics from Sun (and Apple)

Java was developed at Sun Microsystems, Inc., and the primary source for information about Java is Sun's Java Web site, <http://java.sun.com/>. At this site, you can read documentation on-line and you can download documentation and software. You should

find some obvious links on the main page. (As of July 1, 2002, they are labeled "Download Now," and a page with various downloads can be found at <http://java.sun.com/j2se/1.4/download.html>.)

The documentation includes the Java API reference and the Java tutorial. These are not really directed at beginning programmers, but you will need them if you are going to be serious about Java programming.

As I write this, the current version of Java on the Sun site is version 1.4. It is available for the Windows, Linux, and Solaris operating systems. You want to download the "J2SE 1.4 SDK." This is the "Java 2 Platform Standard Edition Version 1.4 Software Development Kit." This package includes a Java compiler, a Java virtual machine that can be used to run Java programs, and all the standard Java packages. You want the "SDK", not the "JRE". The JRE is the "Java Runtime Environment." It only includes the parts of the system that are need to run Java programs. It does not have a compiler. You'll also see the "J2EE SDK." This is the "Enterprise Edition," which includes additional packages that are not needed on a personal computer. *Don't forget to read and follow the installation instructions.*

This textbook is based on Java Version 1.3. If you already have version 1.3, you don't need to download version 1.4 just to use this book.

The Sun site does not have a Java Software Development Kit for Macintosh. However, the Macintosh OS X operating system already includes Java (Version 1.3 as of July 2002). A Java programming environment is available on the Development CD that comes with OS X. Unfortunately, Java 1.3 is not and will never be available for Macintosh OS 9 and earlier. Java 1.1 can be used on older Macintosh systems, and if you are working on one of those, you might want to use the [previous edition](#) of this book. Information about Java on Macintosh can be found at <http://www.apple.com/java>. For Java programming, see <http://developer.apple.com/java>.

Integrated Development Environments

It is really quite remarkable that there are sophisticated IDEs for Java programming that are available for free. Here are the ones that I know about.

- **Borland JBuilder Personal Edition**, for Linux, Solaris, MacOS X, Windows 2000, Windows XP, and Windows NT. Requires a lot of disk space and memory (256 MB memory recommended). Company Web page at <http://www.borland.com>.

JBuilder site at <http://www.borland.com/jbuilder/index.html>. The Personal Edition, which is free, has more than enough features for most programmers.

- **Sun ONE Studio 4 for Java, Community Edition**, for Linux, Solaris, Windows 2000, Windows NT, and Windows 98SE. This was formerly known as "Forte for Java", and you might see it referred under that name. Again, it requires a lot of resources, with a 256 MB memory recommendation. Main site currently at <http://www.sun.com/software/sundev/jde/index.html>. It is available from there and on the J2SE download page, <http://java.sun.com/j2se/1.4/download.html>. The Community Edition is the free version.
- **Mac OS X Project Builder** comes as a standard part of Mac OS X (on the Developer CD). It supports Java as well as some other programming languages.
- **JCreator**, for Windows. I haven't tried it, but it looks like a nice lighter-weight IDE that works on top of Sun's SDK. It was recommended to me by a reader. There is a free version, as well as a shareware version. It is available at <http://www.jcreator.com>.

There are other products similar to JCreator, for Windows and for other operating systems, and you might want to look around if you want some of the convenience of an IDE without all the complexity.

If you want to use any of the sample source code from this book in any of these environments, you will have to figure out how to get the code into the environment. In general, IDEs work with "projects". A project contains all the source code files needed in the project as well as other information. All this is stored in a project directory. To use a source code file from outside the project, you have to "import" it in some way. Usually, you have to copy the file into the project directory or into a source code directory inside the project directory. In addition to this, you have to use an "Add File" command in the IDE to tell it that the file is part of the project. Details vary from one IDE to another. If all else fails, try using a "New File" command to create an empty window in the IDE, and then copy-and-paste the source code from a web browser window into the IDE's window.

Text Editors

If you decide to use a command-line environment for programming, make sure that you have a good text editor. A programmer's text editor is a very different thing from a word processor. Most important, it saves your work in plain text files and it doesn't insert extra carriage returns beyond the ones you actually type. A good programmer's text editor will do a lot more than this. Here are some features to look for:

- **Syntax coloring**. Shows comments, strings, keywords, etc., in different colors to

make the program easier to read and to help you find certain kinds of errors.

- Function menu. A pop-up menu that lists the functions in your source code. Selecting a function from this will take you directly to that function in the code.
- Auto-indentation. When you indent one line, the editor will indent following lines to match, since that's what you want more often than not when you are typing a program.
- Parenthesis matching. When you type a closing parenthesis the cursor jumps back to the matching parenthesis momentarily so you can see where it is. Alternatively, there might be a command that will hilite all the text between matching parentheses. The same thing works for brackets and braces.
- Indent Block and Unindent Block commands. These commands apply to a hilited block of text. They will insert or remove spaces at the beginning of each line to increase or decrease the indentation level of that block of text. When you make changes in your program, these commands can help you keep the indentation in line with the structure of the program.
- Control of tabs. My advice is, don't use tab characters for indentation. A good editor can be configured to insert multiple space characters when you press the tab key.

There are many free text editors that have some or all of these features. Since you are using Java, you should certainly consider **jedit**, a programmer's text editor written entirely in Java. It requires Java 1.3 or better. It has many features listed above, and there are plug-ins available to add additional features. Since it is written in pure Java, it can be used on any operating system that supports Java 1.3. In addition to being a nice text editor, it shows what can be done with the Swing GUI. Jedit is free and can be downloaded from <http://www.jedit.org>.

In my own work on Macintosh, I have used **BBEdit** for Macintosh from Bare Bones Software (<http://www.barebones.com/>). BBEEdit is not free, but there is a free version called BBEEdit Lite.

On Linux, I generally use **nedit**. It has all the above features, except a function menu. If you are using Linux, it is likely that *nedit* is included in your distribution, although it may not have been installed by default. It can be downloaded from <http://www.nedit.org/> and is available for many UNIX platforms in addition to Linux. Features such as syntax coloring and auto-indentation are not turned on by default. You can configure them in the Options menu. Use the "Save Options" command to make the configuration permanent. Of course, as alternatives to nedit, the Gnome and KDE desktops for Linux have their own text editors.

Since I have very little experience with Windows, I don't have a recommendation for a programmer's editor for Windows, other than jedit.

Using the Java SDK

If you have installed Sun's Software Development Kit for Java, you can use the commands "javac", "java", and "appletviewer" for compiling and running Java programs and applets. These commands must be on the "path" where the operating system searches for commands. (See the installation instructions on Sun's Java web site.) The rest of this appendix contains some basic instructions for using these commands with this textbook.

I suggest that you make a directory to hold your Java programs. (You might want to have a different subdirectory for each program that you write.) Create your program with a text editor, or copy the program you want to compile into your program directory. If the program needs any extra files, don't forget to get them as well. For example, most of the programs in the early chapters of this textbook require the file [TextIO.java](#). You should copy this file into the same directory with the main program file that uses it. (Actually, you only need the compiled file, `TextIO.class`, to be in the same directory as your program. So, once you have compiled `TextIO.java`, you can just copy the class file to any directories where you need it.)

If you have downloaded a copy of this textbook, you can simply copy the files you need from the [source](#) directory that is part of the download. If you haven't downloaded the textbook, you can open the source file in a Web browser and use the Web browser's "Save" command to save a copy of the file. Another way to get Java source code off a Web browser page is to highlight the code on the page, use the browser's "Copy" command to place the code on the Clipboard, and then "Paste" the code into your text editor. You can use this last method when you want to get a segment of code out of the middle of a Web page.

To use the SDK, you will have to work in a command window, using a command-line interface. In Windows, this means a DOS window. In Linux/UNIX, it means an "xterm" or "console" or "terminal" window. Open a command Window and change to the directory that contains your Java source code files. Use the "javac" command for compiling Java source code files. For example, to compile `SourceFile.java`, use the command

```
javac SourceFile.java
```

You must be working in the directory that contains the file. If the source code file does not contain any syntax errors, this command will produce one or more compiled class files. If the compiler finds any syntax errors, it will list them. Note that not every message from the javac compiler is an error. In some cases, it generates "warnings" that will not stop it

from compiling the program. If the compiler finds errors in the program, you can edit the source code file and try to compile it again. Note that you can keep the source code file open in a text editor in one window while you compile the program in the command window. Then, it's easy to go back to the editor to edit the file. However, when you do this, don't forget to save the modifications that you make to the file before you try to compile it again! (Some text editors can be configured to issue the compiler command for you, so you don't even have to leave the text editor to run the compiler.)

If your program contains more than a few errors, most of them will scroll out of the window before you see them. In Linux and UNIX, a command window usually has a scroll bar that you can use to review the errors. In Windows 2000/NT/XP (but **not** Windows 95/98), you can save the errors in a file which you can view later in a text editor. The command in Windows is

```
javac SourceFile.java >& errors.txt
```

The ">& errors.txt" redirects the output from the compiler to the file, instead of to the DOS window. **For Windows 95/98** I've written a little Java program that will let you do much the same thing. See the source code for that program, [cef.java](#), for instructions.

It is possible to compile all the Java files in a directory at one time. Use the command "javac *.java".

(By the way, all these compilation commands only work if the classes you are compiling are in the "default package". This means that they will work for any example from this textbook. But if you start defining classes in other packages, the source files must be in subdirectories with corresponding names. For example, if a class is in the package named `utilities.drawing` then the source code file should be in a directory named `drawing`, which is in a directory named `utilities`, which is in the top-level program directory. You should work in the top-level directory and compile the source code file with a command such as `javac utilities/drawing/sourcefile.java` on Linux/UNIX or `javac utilities\drawing\sourcefile.java` on Windows. If you don't do it like this, the compiler might not be able to find other classes that your class uses.)

Once you have your compiled class files, you are ready to run your application or applet. If you are running a stand-alone application -- one that has a `main()` routine -- you can use the "java" command from the SDK to run the application. If the class file that contains the `main()` routine is named `Main.class`, then you can run the program with the command:

```
java Main
```

Note that this command uses the name of the class, "Main", not the full name of the class file, "Main.class". This command assumes that the file "Main.class" is in the current directory, and that any other class files used by the main program are also in that directory. You do **not** need the Java source code files to run the program, only the compiled class files. (Again, all this assumes that the classes you are working with are in the "default package". Classes in other packages should be in subdirectories.)

If your program is an applet, then you need an HTML file to run it. See [Section 6.2](#) for information about how to write an HTML file that includes an applet. As an example, the following code could be used in an HTML file to run the applet "MyApplet.class":

```
<applet code="MyApplet.class" width=300
height=200>
</applet>
```

The "appletviewer" command from the SDK can then be used to view the applet. If the file name is `test.html`, use the command

```
appletviewer test.html
```

This will only show the applet. It will ignore any text or images in the HTML file. In fact, all you really need in the HTML file is a single applet tag, like the example shown above. The applet will be run in a resizable window, but you should remember that many of the applet examples in this textbook assume that the applet will not be resized. Note also that your applet can use standard output, `System.out`, to write messages to the command window. This can be useful for debugging your applet.

You can use the appletviewer command on any file, or even on a web page address. It will find all the applet tags in the file, and will open a window for each applet. If you are using a Web browser that does not support Java 2, you could use appletviewer to see the applets in this book. For example, to see the applets in Section 6.1, use the command

```
appletviewer http://math.hws.edu/javanotes/c6/s1.html
```

to view the applets directly off the web. Or, if you have downloaded the textbook, you can change to the directory `c6` and use the command `appletviewer s1.html` to see the applets.

Of course, it's also possible to view your own applets in a Web browser. Just open the html file that contains the applet tag for your applet. One problem with this is that if you make changes to the applet, you might have to actually quit the browser and restart it in

order to get the changes to take effect. The browser's Reload command might not cause the modified applet to be loaded.

[[Main Index](#)]

/*

The file defines a class TextIO, which provides a simple interface to Java's standard console input and output. This class defines several static methods for reading and writing values of various type.

This class will only work with standard, interactive applications. When it is used in such an application, System.out and System.in should not be used directly, since the TextIO class thinks it has exclusive control of System.out and System.in. (Actually, using System.out will probably not cause any problems, but don't use System.in.)

To use this class in your program, simply include the compiled class file TextIO.class in the same directory with the class file for your main program. (If you are using a development environment such as CodeWarrior or Visual J++, you can include the source file, TextIO.java in your project.) You can then use all the public static methods from the TextIO class in your program. (In your programs, the names of the methods must be prefaced with "TextIO." For example, you should use the name TextIO.getln() rather than simply getln().)

(This class is for use with my on-line introductory java textbook, which is available at <http://math.hws.edu/eck/cs124/notes/index.html>.)

Written by: David Eck
Department of Mathematics and Computer Science
Hobart and William Smith Colleges
Geneva, NY 14456
Email: eck@hws.edu
WWW: <http://math.hws.edu/eck/>

July 16, 1998

Modified February, 2000; getChar() now skips blanks and CR's, and getAnyChar() can be used to read the next char even if it's a blank or CR.

*/

```
import java.io.*;
```

```
public class TextIO {
```

```
// ***** I/O Methods *****
```

```
// Methods for writing the primitive types, plus type String,  
// to the console, with no extra spaces.  
//  
// Note that the real-number data types, float  
// and double, a rounded version is output that will  
// use at most 10 or 11 characters. If you want to  
// output a real number with full accuracy, use  
// "TextIO.put(String.valueOf(x))", for example.
```

```
public static void put(int x)    { put(x,0); } // Note: also handles byte and short!  
public static void put(long x)  { put(x,0); }  
public static void put(double x) { put(x,0); } // Also handles float.  
public static void put(char x)  { put(x,0); }  
public static void put(boolean x) { put(x,0); }  
public static void put(String x) { put(x,0); }
```

```
// Methods for writing the primitive types, plus type String,  
// to the console, followed by a carriage return, with  
// no extra spaces.
```

```
public static void putln(int x)    { put(x,0); newLine(); } // Note: also handles byte and short!  
public static void putln(long x)   { put(x,0); newLine(); }  
public static void putln(double x) { put(x,0); newLine(); } // Also handles float.  
public static void putln(char x)   { put(x,0); newLine(); }  
public static void putln(boolean x) { put(x,0); newLine(); }  
public static void putln(String x) { put(x,0); newLine(); }
```

```
// Methods for writing the primitive types, plus type String,  
// to the console, with a minimum field width of w,  
// and followed by a carriage return.  
// If output value is less than w characters, it is padded  
// with extra spaces in front of the value.
```

```
public static void putln(int x, int w)    { put(x,w); newLine(); } // Note: also handles byte and short!  
public static void putln(long x, int w)   { put(x,w); newLine(); }  
public static void putln(double x, int w) { put(x,w); newLine(); } // Also handles float.  
public static void putln(char x, int w)   { put(x,w); newLine(); }  
public static void putln(boolean x, int w) { put(x,w); newLine(); }
```



```
public static void putln(String x, int w) { put(x,w); newLine(); }
```

```
// Method for outputting a carriage return
```

```
public static void putln() { newLine(); }
```

```
// Methods for writing the primitive types, plus type String,  
// to the console, with minimum field width w.
```

```
public static void put(int x, int w) { dumpString(String.valueOf(x), w); } // Note: also handles byte  
and short!
```

```
public static void put(long x, int w) { dumpString(String.valueOf(x), w); }
```

```
public static void put(double x, int w) { dumpString(realToString(x), w); } // Also handles float.
```

```
public static void put(char x, int w) { dumpString(String.valueOf(x), w); }
```

```
public static void put(boolean x, int w) { dumpString(String.valueOf(x), w); }
```

```
public static void put(String x, int w) { dumpString(x, w); }
```

```
// Methods for reading in the primitive types, plus "words" and "lines".
```

```
// The "getln..." methods discard any extra input, up to and including
```

```
// the next carriage return.
```

```
// A "word" read by getlnWord() is any sequence of non-blank characters.
```

```
// A "line" read by getlnString() or getln() is everything up to next CR;
```

```
// the carriage return is not part of the returned value, but it is
```

```
// read and discarded.
```

```
// Note that all input methods except getAnyChar(), peek(), the ones for lines
```

```
// skip past any blanks and carriage returns to find a non-blank value.
```

```
// getln() can return an empty string; getChar() and getlnChar() can
```

```
// return a space or a linefeed ('\n') character.
```

```
// peek() allows you to look at the next character in input, without
```

```
// removing it from the input stream. (Note that using this
```

```
// routine might force the user to enter a line, in order to
```

```
// check what the next character is.)
```

```
// Acceptable boolean values are the "words": true, false, t, f, yes,
```

```
// no, y, n, 0, or 1; uppercase letters are OK.
```

```
// None of these can produce an error; if an error is found in input,
```

```
// the user is forced to re-enter.
```

```
// Available input routines are:
```

```
//
```

```
//      getByte()   getlnByte()   getShort()   getlnShort()
```

```
//      getInt()    getlnInt()    getLong()    getlnLong()
```

```
//      getFloat()  getInFloat()  getDouble()  getInDouble()
//      getChar()   getInChar()   peek()       getAnyChar()
//      getWord()   getInWord()   getIn()    getString()  getInString()
//
// (getInString is the same as getIn and is only provided for consistency.)
```

```
public static byte getInByte()    { byte x=getByte();    emptyBuffer(); return x; }
public static short getInShort()  { short x=getShort(); emptyBuffer(); return x; }
public static int getInInt()      { int x=getInt();      emptyBuffer(); return x; }
public static long getInLong()    { long x=getLong();    emptyBuffer(); return x; }
public static float getInFloat()  { float x=getFloat();  emptyBuffer(); return x; }
public static double getInDouble() { double x=getDouble(); emptyBuffer(); return x; }
public static char getInChar()    { char x=getChar();    emptyBuffer(); return x; }
public static boolean getInBoolean() { boolean x=getBoolean(); emptyBuffer(); return x; }
public static String getInWord()  { String x=getWord();  emptyBuffer(); return x; }
public static String getInString() { return getIn(); } // same as getIn()
public static String getIn() {
    StringBuffer s = new StringBuffer(100);
    char ch = readChar();
    while (ch != '\n') {
        s.append(ch);
        ch = readChar();
    }
    return s.toString();
}
```

```
public static byte getByte() { return (byte)readInteger(-128L,127L); }
public static short getShort() { return (short)readInteger(-32768L,32767L); }
public static int getInt() { return (int)readInteger((long)Integer.MIN_VALUE, (long)Integer.
MAX_VALUE); }
public static long getLong() { return readInteger(Long.MIN_VALUE, Long.MAX_VALUE); }

public static char getAnyChar(){ return readChar(); }
public static char peek() { return lookChar(); }
```

```
public static char getChar() { // skip spaces & cr's, then return next char
    char ch = lookChar();
    while (ch == ' ' || ch == '\n') {
        readChar();
        if (ch == '\n')
            dumpString("? ",0);
        ch = lookChar();
    }
```

```
}
return readChar();
}

public static float getFloat() {
    float x = 0.0F;
    while (true) {
        String str = readRealString();
        if (str.equals("")) {
            errorMessage("Illegal floating point input.",
                "Real number in the range " + Float.MIN_VALUE + " to " + Float.MAX_VALUE);
        }
        else {
            Float f = null;
            try { f = Float.valueOf(str); }
            catch (NumberFormatException e) {
                errorMessage("Illegal floating point input.",
                    "Real number in the range " + Float.MIN_VALUE + " to " + Float.MAX_VALUE);
                continue;
            }
            if (f.isInfinite()) {
                errorMessage("Floating point input outside of legal range.",
                    "Real number in the range " + Float.MIN_VALUE + " to " + Float.MAX_VALUE);
                continue;
            }
            x = f.floatValue();
            break;
        }
    }
    return x;
}

public static double getDouble() {
    double x = 0.0;
    while (true) {
        String str = readRealString();
        if (str.equals("")) {
            errorMessage("Illegal floating point input",
                "Real number in the range " + Double.MIN_VALUE + " to " + Double.MAX_VALUE);
        }
        else {
            Double f = null;
            try { f = Double.valueOf(str); }
```

```
        catch (NumberFormatException e) {
            errorMessage("Illegal floating point input",
                "Real number in the range " + Double.MIN_VALUE + " to " + Double.
MAX_VALUE);
            continue;
        }
        if (f.isInfinite()) {
            errorMessage("Floating point input outside of legal range.",
                "Real number in the range " + Double.MIN_VALUE + " to " + Double.
MAX_VALUE);
            continue;
        }
        x = f.doubleValue();
        break;
    }
}
return x;
}
```

```
public static String getWord() {
    char ch = lookChar();
    while (ch == ' ' || ch == '\n') {
        readChar();
        if (ch == '\n')
            dumpString("? ",0);
        ch = lookChar();
    }
    StringBuffer str = new StringBuffer(50);
    while (ch != ' ' && ch != '\n') {
        str.append(readChar());
        ch = lookChar();
    }
    return str.toString();
}
```

```
public static boolean getBoolean() {
    boolean ans = false;
    while (true) {
        String s = getWord();
        if ( s.equalsIgnoreCase("true") || s.equalsIgnoreCase("t") ||
            s.equalsIgnoreCase("yes") || s.equalsIgnoreCase("y") ||
            s.equals("1") ) {
            ans = true;
        }
    }
}
```

```
        break;
    }
    else if ( s.equalsIgnoreCase("false") || s.equalsIgnoreCase("f") ||
             s.equalsIgnoreCase("no") || s.equalsIgnoreCase("n") ||
             s.equals("0") ) {
        ans = false;
        break;
    }
    else
        errorMessage("Illegal boolean input value.",
                     "one of: true, false, t, f, yes, no, y, n, 0, or 1");
}
return ans;
}

// ***** Everything beyond this point is private *****

// ***** Utility routines for input/output *****

private static InputStream in = System.in; // rename standard input stream
private static PrintStream out = System.out; // rename standard output stream

private static String buffer = null; // one line read from input
private static int pos = 0; // position of next char in input line that has
                          // not yet been processed

private static String readRealString() { // read chars from input following syntax of real numbers
    StringBuffer s=new StringBuffer(50);
    char ch=lookChar();
    while (ch == ' ' || ch == '\n') {
        readChar();
        if (ch == '\n')
            dumpString("? ",0);
        ch = lookChar();
    }
    if (ch == '-' || ch == '+') {
        s.append(readChar());
        ch = lookChar();
        while (ch == ' ') {
            readChar();
            ch = lookChar();
        }
    }
}
```

```
}
while (ch >= '0' && ch <= '9') {
    s.append(readChar());
    ch = lookChar();
}
if (ch == '.') {
    s.append(readChar());
    ch = lookChar();
    while (ch >= '0' && ch <= '9') {
        s.append(readChar());
        ch = lookChar();
    }
}
if (ch == 'E' || ch == 'e') {
    s.append(readChar());
    ch = lookChar();
    if (ch == '-' || ch == '+') {
        s.append(readChar());
        ch = lookChar();
    }
    while (ch >= '0' && ch <= '9') {
        s.append(readChar());
        ch = lookChar();
    }
}
return s.toString();
}
```

```
private static long readInteger(long min, long max) { // read long integer, limited to specified range
    long x=0;
    while (true) {
        StringBuffer s=new StringBuffer(34);
        char ch=lookChar();
        while (ch == ' ' || ch == '\n') {
            readChar();
            if (ch == '\n');
            dumpString("? ",0);
            ch = lookChar();
        }
        if (ch == '-' || ch == '+') {
            s.append(readChar());
            ch = lookChar();
            while (ch == ' ') {
```

```
        readChar();
        ch = lookChar();
    }
}
while (ch >= '0' && ch <= '9') {
    s.append(readChar());
    ch = lookChar();
}
if (s.equals("")){
    errorMessage("Illegal integer input.",
        "Integer in the range " + min + " to " + max);
}
else {
    String str = s.toString();
    try {
        x = Long.parseLong(str);
    }
    catch (NumberFormatException e) {
        errorMessage("Illegal integer input.",
            "Integer in the range " + min + " to " + max);
        continue;
    }
    if (x < min || x > max) {
        errorMessage("Integer input outside of legal range.",
            "Integer in the range " + min + " to " + max);
        continue;
    }
    break;
}
return x;
}
```

```
private static String realToString(double x) {
    // Goal is to get a reasonable representation of x in at most
    // 10 characters, or 11 characters if x is negative.
    if (Double.isNaN(x))
        return "undefined";
    if (Double.isInfinite(x))
        if (x < 0)
            return "-INF";
        else
            return "INF";
}
```

```
if (Math.abs(x) <= 5000000000.0 && Math rint(x) == x)
    return String.valueOf( (long)x );
String s = String.valueOf(x);
if (s.length() <= 10)
    return s;
boolean neg = false;
if (x < 0) {
    neg = true;
    x = -x;
    s = String.valueOf(x);
}
if (x >= 0.00005 && x <= 50000000 && (s.indexOf('E') == -1 && s.indexOf('e') == -1)) { // trim x
to 10 chars max
    s = round(s,10);
    s = trimZeros(s);
}
else if (x > 1) { // construct exponential form with positive exponent
    long power = (long)Math.floor(Math.log(x)/Math.log(10));
    String exp = "E" + power;
    int numlength = 10 - exp.length();
    x = x / Math.pow(10,power);
    s = String.valueOf(x);
    s = round(s,numlength);
    s = trimZeros(s);
    s += exp;
}
else { // constuct exponential form
    long power = (long)Math.ceil(-Math.log(x)/Math.log(10));
    String exp = "E-" + power;
    int numlength = 10 - exp.length();
    x = x * Math.pow(10,power);
    s = String.valueOf(x);
    s = round(s,numlength);
    s = trimZeros(s);
    s += exp;
}
if (neg)
    return "-" + s;
else
    return s;
}

private static String trimZeros(String num) { // used by realToString
```



```
if (num.indexOf('.') >= 0 && num.charAt(num.length() - 1) == '0') {
    int i = num.length() - 1;
    while (num.charAt(i) == '0')
        i--;
    if (num.charAt(i) == '.')
        num = num.substring(0,i);
    else
        num = num.substring(0,i+1);
}
return num;
}

private static String round(String num, int length) { // used by realToString
    if (num.indexOf('.') < 0)
        return num;
    if (num.length() <= length)
        return num;
    if (num.charAt(length) >= '5' && num.charAt(length) != '.') {
        char[] temp = new char[length+1];
        int ct = length;
        boolean rounding = true;
        for (int i = length-1; i >= 0; i--) {
            temp[ct] = num.charAt(i);
            if (rounding && temp[ct] != '.') {
                if (temp[ct] < '9') {
                    temp[ct]++;
                    rounding = false;
                }
                else
                    temp[ct] = '0';
            }
            ct--;
        }
        if (rounding) {
            temp[ct] = '1';
            ct--;
        }
        // ct is -1 or 0
        return new String(temp,ct+1,length-ct);
    }
    else
        return num.substring(0,length);
}
```

```
}  
private static void dumpString(String str, int w) { // output string to console  
    for (int i=str.length(); i<w; i++)  
        out.print(' ');  
    for (int i=0; i<str.length(); i++)  
        if ((int)str.charAt(i) >= 0x20 && (int)str.charAt(i) != 0x7F) // no control chars or delete  
            out.print(str.charAt(i));  
        else if (str.charAt(i) == '\n' || str.charAt(i) == '\r')  
            newLine();  
}
```

```
private static void errorMessage(String message, String expecting) {  
    // inform user of error and force user to re-enter.  
    newLine();  
    dumpString(" *** Error in input: " + message + "\n", 0);  
    dumpString(" *** Expecting: " + expecting + "\n", 0);  
    dumpString(" *** Discarding Input: ", 0);  
    if (lookChar() == '\n')  
        dumpString("(end-of-line)\n\n",0);  
    else {  
        while (lookChar() != '\n')  
            out.print(readChar());  
        dumpString("\n\n",0);  
    }  
    dumpString("Please re-enter: ", 0);  
    readChar(); // discard the end-of-line character  
}
```

```
private static char lookChar() { // return next character from input  
    if (buffer == null || pos > buffer.length())  
        fillBuffer();  
    if (pos == buffer.length())  
        return '\n';  
    return buffer.charAt(pos);  
}
```

```
private static char readChar() { // return and discard next character from input  
    char ch = lookChar();  
    pos++;  
    return ch;  
}
```

```
private static void newLine() { // output a CR to console
```

```
    out.println();
    out.flush();
}
```

```
private static boolean possibleLinefeedPending = false;
```

```
private static void fillBuffer() {    // Wait for user to type a line and press return,
                                     // and put the typed line into the buffer.
```

```
    StringBuffer b = new StringBuffer();
```

```
    out.flush();
```

```
    try {
```

```
        int ch = in.read();
```

```
        if (ch == '\n' && possibleLinefeedPending)
```

```
            ch = in.read();
```

```
        possibleLinefeedPending = false;
```

```
        while (ch != -1 && ch != '\n' && ch != '\r') {
```

```
            b.append((char)ch);
```

```
            ch = in.read();
```

```
        }
```

```
        possibleLinefeedPending = (ch == '\r');
```

```
        if (ch == -1) {
```

```
            System.out.println("\n*** Found an end-of-file while trying to read from standard input!");
```

```
            System.out.println("*** Maybe your Java system doesn't implement standard input?");
```

```
            System.out.println("*** Program will be terminated.\n");
```

```
            throw new RuntimeException("End-of-file on standard input.");
```

```
        }
```

```
    }
```

```
    catch (IOException e) {
```

```
        System.out.println("Unexpected system error on input.");
```

```
        System.out.println("Terminating program.");
```

```
        System.exit(1);
```

```
    }
```

```
    buffer = b.toString();
```

```
    pos = 0;
```

```
}
```

```
private static void emptyBuffer() {    // discard the rest of the current line of input
```

```
    buffer = null;
```

```
}
```

```
} // end of class Console
```

Introduction to Programming Using Java, Fourth Edition

Source Code

THIS PAGE CONTAINS LINKS to the source code for examples appearing in the free, on-line textbook [Introduction to Programming Using Java](http://math.hws.edu/javanotes/), Version 4.0, which is available at <http://math.hws.edu/javanotes/>. You should be able to compile these files and use them. Note however that some of these examples depend on other classes, such as `TextIO.class` and `MosaicFrame.class`, that are not built into Java. These are classes that I have written. Links to the source code are provided below. To use examples that depend on my classes, you will need to compile the source code for the required classes and place the compiled classes in the same directory with the main class file. If you are using an integrated development environment such as CodeWarrior or JBuilder, you can simply add any required source code files to your project. See [Appendix 2](#) for more information on Java programming environments and how to use them to compile and run these examples.

Most of the solutions to end-of-chapter exercises are **not** listed on this page. Each end-of-chapter exercise has its own Web page, which discusses its solution. The source code of a sample solution of each exercise is given in full on the solution page for that exercise. If you want to compile the solution, you should be able to cut-and-paste the solution out of a Web browser window and into a text editing program. (You can't cut-and-paste from the HTML source of the solution page, since it contains extra HTML markup commands that the Java compiler won't understand.)

Note that many of these examples require Java version 1.3 or later. Some of them were written for older versions, but will still work with current versions. When you compile some of these older programs with current versions of Java, you might get warnings about "deprecated" methods. These warnings are not errors. When a method is deprecated, it means that it should not be used in new code, but it has not yet been removed from the language. It is possible that deprecated methods might be removed from the language at some future time, but for now you just get a warning about using them.

Part 1: Text-oriented Examples

Many of the sample programs in the text are based on console-style input/output, where

the computer and the user type lines of text back and forth to each other. Some of these programs use the standard output object, `System.out`, for output. Most of them use my non-standard class, `TextIO` for both input and output. The programs are stand-alone applications, not applets, but I have written applets that simulate many of the programs. These "console applets" appear on the Web pages that make up the text. The following list includes links to the source code for each applet, as well as links to the source code of the programs that the applets simulate. All of the console applets depend on classes defined in the files [ConsoleApplet.java](#), [ConsolePanel.java](#), and [ConsoleCanvas.java](#). These three files, or the class files compiled from them, must be available when you compile any console applet. The class files must be available when the applet is used. (Being "available" means being in the same directory where you are compiling the program, or being in the same directory as the HTML file that uses the applet.) Most of the standalone programs depend on the `TextIO` class, which is defined in [TextIO.java](#). Either `TextIO.java` or `TextIO.class` must be available when you compile the program, and `TextIO.class` must be available when you run the program. These programs and applets will work with Java 1.1, as well as with later versions.

- [ConsoleApplet.java](#), a basic class that does the HelloWorld program in [Section 2.1](#). (The other console applets, below, are defined as subclasses of `ConsoleApplet`.)
- [Interest1Console.java](#), the first investment example, from [Section 2.2](#). Simulates [Interest.java](#).
- [TimedComputationConsole.java](#), which does some simple computations and reports how long they take, from [Section 2.3](#). Simulates [TimedComputation.java](#).
- [PrintSquareConsole.java](#), the first example that does user input, from [Section 2.4](#). Simulates [PrintSquare.java](#).
- [Interest2Console.java](#), the second investment example, with user input, from [Section 2.4](#). Simulates [Interest2.java](#).
- [Interest3Console.java](#), the third investment example, from [Section 3.1](#). Simulates [Interest3.java](#).
- [ThreeN1Console.java](#), the "3N+1" program from [Section 3.2](#). Simulates [ThreeN1.java](#)
- [ComputeAverageConsole.java](#), which finds the average of numbers entered by the user, from [Section 3.3](#). Simulates [ComputeAverage.java](#)
- [CountDivisorsConsole.java](#), which finds the number of divisors of an integer, from [Section 3.4](#). Simulates [CountDivisors.java](#)
- [ListLettersConsole.java](#), which lists all the letters that occur in a line of text, from [Section 3.4](#). Simulates [ListLetters.java](#)
- [LengthConverterConsole.java](#), which converts length measurements between various units of measure, from [Section 3.5](#). Simulates [LengthConverter.java](#)
- [PrintProduct.java](#), which prints the product of two numbers from [Section 3.7](#). (This

was given as an example of writing console applets, and it does not simulate any stand-alone program example.)

- [GuessingGameConsole.java](#), the guessing game from [Section 4.2](#). Simulates [GuessingGame.java](#). A slight variation of this program, which reports the number of games won by the user, is [GuessingGame2.java](#).
- [RowsOfCharsConsole.java](#), a useless program that illustrates subroutines from [Section 4.3](#). Simulates [RowsOfChars.java](#).
- [TheeN2Console.java](#), an improved $3N+1$ program from [Section 4.4](#). Simulates [ThreeN2.java](#)
- [RollTwoPairsConsole.java](#) rolls two pairs of dice until the totals come up the same, from [Section 5.2](#). Simulates [RollTwoPairs.java](#). The applet and program use the class [PairOfDice.java](#).
- [HighLowConsole.java](#) plays a simple card game, from [Section 5.3](#). Simulates [HighLow.java](#). The applet and program use the classes [Card.java](#) and [Deck.java](#). (The Deck class uses arrays, which are not covered until [Chapter 8](#).)
- [BlackjackConsole.java](#) lets the user play a game of Blackjack, [from the exercises for Chapter 5](#). Uses the classes [Card.java](#), [Hand.java](#), [BlackjackHand.java](#) and [Deck.java](#).
- [BirthdayProblemConsole.java](#) is a small program that uses arrays, from [Section 8.2](#). Simulates [BirthdayProblemDemo.java](#).
- [ReverseIntsConsole.java](#) demonstrates a dynamic array of ints by printing a list of input numbers in reverse order, from [Section 8.3](#). Simulates [ReverseWithDynamicArray.java](#), which uses the dynamic array class defined in [DynamicArrayOfInt.java](#). A version of the program that uses an ordinary array of ints is [ReverseInputNumbers.java](#).
- [LengthConverter2Console.java](#), an improved version of [LengthConverterConsole.java](#). It converts length measurements between various units of measure. From [Section 9.2](#). Simulates [LengthConverter2.java](#)
- [LengthConverter3.java](#) is a version of the previous program, [LengthConverter2.java](#), which uses exceptions to handle errors in the user's input. From the user's point of view, the behavior of LengthConverter3 is identical to that of LengthConverter2, so I didn't include an applet version in the text. From [Section 9.4](#).
- [ReverseFile.java](#), a program that reads a file of numbers and writes another file containing the same numbers in reverse order. From [Section 10.2](#). This file depends on [TextReader.java](#). Since applets cannot manipulate files, there is no applet version of this program.
- [WordList.java](#), a program that makes a list of the words in a file and outputs the words to another file. From [Section 10.3](#). Depends on [TextReader.java](#). There is no

applet version of this program.

- [CopyFile.java](#), a program that copies a file. The input and output files are specified as command line arguments. From [Section 10.3](#). There is no applet version of this program.
- Two pairs of command-line client/server network applications from [Section 10.5](#): [DateServe.java](#) and [DateClient.java](#); [CLChatServer.java](#) and [CLChatClient.java](#). There are no corresponding applets.
- [TowersOfHanoiConsole.java](#), a console applet that gives a very simple demonstration of recursion, from [Section 11.1](#).
- [ListDemoConsole.java](#) demonstrates the list class that is defined in [StringList.java](#), from [Section 11.2](#). Simulates [ListDemo.java](#).
- [PostfixEvalConsole.java](#) uses a stack to evaluate postfix expressions, from [Section 11.3](#). The stack class is defined in [NumberStack.java](#). Simulates [PostfixEval.java](#).
- [SortTreeConsole.java](#) demonstrates some subroutines that process binary sort trees, from [Section 11.4](#). Simulates [SortTreeDemo.java](#).
- [SimpleParser3Console.java](#) reads expressions entered by the user and builds expression trees to represent them. From [Section 11.5](#). Simulates [SimpleParser3.java](#). Related programs, which evaluate expressions without building expression trees, are [SimpleParser1.java](#) and [SimpleParser2.java](#).
- [ListInsert.java](#), a very short program that demonstrates a subroutine for inserting a new item into a sorted generic List, from [Section 12.2](#). There is no corresponding Console applet.
- [WordListWithTreeSet.java](#), another demonstration program from [Section 12.2](#). It makes a list of distinct words from a file. This is a version of [WordList.java](#) that uses a `TreeSet` to store the words. There is no corresponding Console applet.
- [SimpleParser5Console.java](#) uses a `HashMap` as a symbol table in a program that can evaluate expressions that contain variables, from [Section 12.4](#). This applet simulates the program [SimpleParser5.java](#).
- [WordCount.java](#) uses Maps, Sets, and Lists to make a list of all the words in a file along with the number of times that each word occurs in the file, from [Section 12.4](#). This program requires [TextReader.java](#). There is no applet version.

Part 2: Graphical Examples from the Text

- [GUIDemo.java](#) and [GUIDemo2.java](#), simple GUI demo applets from [Section 1.6](#). These applets demonstrate AWT and Swing components, respectively. (You won't be able to understand the source code until you read Chapters 6 and 7.)

- [StaticRects.java](#), a rather useless applet from [Section 3.7](#) that just draws a set of nested rectangles.
- [MovingRects.java](#), the sample animation applet from [Section 3.7](#). (This depends on [SimpleAnimationApplet2.java](#).)
- [RandomMosaicWalk.java](#), a standalone program that displays a window full of colored squares with a moving disturbance, from [Section 4.6](#). (This depends on [MosaicCanvas.java](#) and [Mosaic.java](#).) The applet version of the random walk, which is shown on the web page, is [RandomMosaicWalkApplet.java](#). The source code for the applet uses some advanced techniques.
- [RandomMosaicWalk2.java](#) is a version of the previous program, [RandomMosaicWalk.java](#), modified to use a few named constants. From [Section 4.7](#).
- [ShapeDraw.java](#), the applet with draggable shapes, from [Section 5.4](#). This file produces six class files when it is compiled. You won't be able to understand everything in this file until you've read Chapters 6 and 7.
- [HelloWorldApplet.java](#) and [HelloWorldApplet2.java](#), the utterly basic first sample applet, from [Section 6.1](#). The second version has an `init()` method to set its foreground and background colors.
- [HelloSwing.java](#) and [HelloSwing2.java](#), a very basic sample applet using Swing, events, and a dialog box, from [Section 6.1](#). The second version uses an anonymous nested class to respond to clicks on a button.
- [ColorChooserApplet.java](#), an applet for investigating RGB and HSB colors. This is a Java 1.1 applet which uses the AWT rather than Swing. From [Section 6.3](#).
- [RandomStrings.java](#), which draws randomly colored and positioned strings, from [Section 6.3](#).
- [ClickableRandomStrings.java](#), an extension of the previous applet in which the applet is redrawn when the user clicks it with the mouse, from [Section 6.4](#). ([ClickableRandomStrings2.java](#) is an equivalent class that uses an anonymous subclass of `MouseAdapter` to do the event handling.)
- [SimpleStamper.java](#), a basic demo of `MouseEvent`s, from [Section 6.4](#).
- [SimpleTrackMouse.java](#), which displays information about mouse events, from [Section 6.4](#).
- [SimplePaint.java](#), a first attempt at a paint program in which the user can select colors and draw curves, from [Section 6.4](#).
- [KeyboardAndFocusDemo.java](#), which demos keyboard events, from [Section 6.5](#).
- [SubKillerGame.java](#), a simple arcade-style game, from [Section 6.5](#). This applet is based on [KeyboardAnimationApplet2.java](#).
- [HelloWorldJApplet.java](#), a fairly simple example of using layouts and multiple buttons, from [Section 6.6](#).

- [HighLowGUI.java](#), a simple card game, from [Section 6.5](#). This file defines two classes used by the applet. The program also depends on [Card.java](#), [Hand.java](#), and [Deck.java](#)
- [SimplePaint2.java](#), a second attempt at a paint program in which the user can select colors and draw curves, from [Section 6.5](#). This file defines two classes that are used by the applet.
- [HighLowGUI2.java](#), a version of the simple card game, [HighLowGUI.java](#). This version gets pictures of cards from an image file. From [Section 7.1](#).
- [DoubleBufferedDrag.java](#) and [NonDoubleBufferedDrag.java](#), two little applets that demonstrate double buffering. In the second, double buffering is turned off. From [Section 7.1](#).
- [RubberBand.java](#), a little applet that illustrates using an off-screen image and rubber band cursor, from [Section 7.1](#).
- [SimplePaint3.java](#), an improved paint program that uses an off-screen canvas to back up the on-screen image, from [Section 7.1](#).
- [LayoutDemo.java](#), which demos a variety of layout managers, from [Section 7.2](#).
- [BorderDemo.java](#), which shows six different type of Borders, from [Section 7.2](#).
- [RGBColorChooser.java](#), a simplified version of [ColorChooserApplet.java](#) that lets the user select a color with three sliders that control the RGB components, from [Section 7.4](#).
- [SimpleCalculator.java](#), which lets the user do arithmetic operations using JTextFields and JButtons, from [Section 7.4](#).
- [StopWatch.java](#) and [MirrorLabel.java](#), two small custom component classes, and [ComponentTest.java](#), an applet that tests them. From [Section 7.4](#).
- [NullLayoutDemo.java](#), which demonstrates how to do your own component layout instead of using a layout manager, from [Section 7.4](#).
- [ShapeDrawWithMenus.java](#), an improved version of [ShapeDraw.java](#) that uses a menu bar, menus, and a pop-up menu, from [Section 7.5](#).
- [HelloWorldSpectrum.java](#), an applet that displays the message "HelloWorld" in animated color, from [Section 7.6](#). A first example of using a Timer directly to animate an applet.
- [ScrollingHelloWorld.java](#), an applet that scrolls a message, from [Section 7.6](#). Shows how to animate an applet with a Timer created in the applet's start () method.
- [Mandelbrot.java](#), an applet that draws a representation of the famous Mandelbrot set, from [Section 7.6](#). This applet creates a separate thread to do the long computation of the colors for the set.
- [ShapeDrawFrame.java](#), another version of [ShapeDraw](#) as a JFrame instead of an JApplet. From [Section 7.7](#). The ShapeDrawFrame class contains a main ()

routine and can be run as an application. The applet [ShapeDrawLauncher.java](#), merely displays a button. When you click on the button, a ShapeDrawFrame window is opened.

- [HighLowFrame.java](#), another version of [HighLowGUI2](#) as a JFrame instead of an JApplet, and with a main program to run it as an application. The applet [HighLowLauncher.java](#) is a button that can be used to open a HighLowFrame window.
- [SimpleDialogDemo.java](#), a little applet that just demonstrates four of Swing's standard dialog boxes. From [Section 7.7](#).
- [RandomStringsWithArray.java](#), which draws randomly colored and positioned strings and uses an array to remember what it has drawn, from [Section 8.2](#).
- [SimpleDrawRects.java](#), in which the user can place colored rectangles on a canvas and drag them around, from [Section 8.3](#). This simplified shape-drawing program is meant to illustrate the use of vectors. The file also defines a reusable custom component, RainbowPalette.
- [Checkers.java](#), which lets two people play checkers against each other, from [Section 8.5](#). At 702 lines, this is a relatively large program.
- [TrivialEdit.java](#), a standalone application which lets the user edit short text files, from [Section 10.3](#). This program depends on [TextReader.java](#).
- [ShapeDrawWithFiles.java](#), a final version of [ShapeDraw.java](#) that uses files to save and reload the designs created with the program. This version is an independent program, not as an applet. It is described at the end of [Section 10.3](#).
- [ReadURLApplet.java](#), an applet that reads data from a URL, from [Section 10.4](#). This is similar to the command-line program [ReadURL.java](#), from the same section.
- [ChatSimulation.java](#), an that simulates a two-way network connection, using a thread, from [Section 10.5](#).
- [ChatWindow.java](#), a JFrame that supports chatting between two users over the network, from [Section 10.5](#). This class depends on [TextReader.java](#). This class can be run as a standalone application, as either a server or a client.
- [BrokeredChat.java](#), an applet that sets up chat connections that use the previous example, [ChatWindow.java](#). There is a server program, [ConnectionBroker.java](#), which must be running on the computer from which the Web page containing the applet was downloaded. (The server keeps a list of available "chatters" for the applet.) From [Section 10.5](#).
- [Blobs.java](#), an applet that demonstrates recursion, from [Section 11.1](#).
- [DepthBreadth.java](#), an applet that uses stacks and queues, from [Section 11.3](#).

Part 3: End-of-Chapter Applets

This section contains the source code for the applets that are used as decorations at the end of each chapter. In general, you should not expect to be able to understand these applets at the time they occur in the text. Most of these are older applets will work with Java 1.1 or even Java 1.0.

1. [Moire.java](#), an animated design, shown at the end of [Section 1.7](#). (You can use applet parameters to control various aspects of this applet's behavior. Also note that you can click on the applet and drag the pattern around by hand. See the source code for details.)
2. [JavaPops.java](#), and applet that shows multi-colored "Java!"s, from the end of [Section 2.5](#). (This depends on [SimpleAnimationApplet.java](#).)
3. [MovingRects.java](#), the sample animation applet from [Section 3.7](#). (This depends on [SimpleAnimationApplet2.java](#).) This is also listed above, as one of the graphical examples from the text.
4. [RandomBrighten.java](#), showing a grid of colored squares that get more and more red as a wandering disturbance visits them, from the end of [Section 4.7](#). (Depends on [MosaicCanvas.java](#).) (Another applet that shows an animation based on [MosaicCanvas.java](#) is [MosaicStrobeApplet.java](#), the applet version of the solution to one of the [exercises for Chapter 4](#).)
5. [SymmetricBrighten.java](#), a subclass of the previous example that makes a symmetric pattern, from the end of [Section 5.6](#). Depends on [MosaicCanvas.java](#) and [RandomBrighten.java](#).
6. [TrackLines.java](#), an applet with lines that track the mouse, from [Section 6.6](#).
7. [KaleidaAnimate.java](#), an applet that shows symmetric, kaleidoscope-like animations, from [Section 7.7](#). Depends on [SimpleAnimationApplet.java](#).
8. [Maze.java](#), an applet that creates a random maze and solves it, from [Section 8.5](#).
9. [SimpleCA.java](#), a Cellular Automaton applet, from the end of [Section 9.4](#). This applet depends on the file [CACanvas.java](#). For more information on cellular automata see <http://math.hws.edu/xJava/CA/>.
10. [TowersOfHanoi.java](#), an animation of the solution to the Towers of Hanoi problem for a tower of ten disks, from the end of [Section 10.5](#).
11. [LittlePentominosApplet.java](#), the pentominos applet from the end of [Section 11.5](#). This file defines two classes, `LittlePentominosApplet` and `PentominosBoardCanvas`. A pentomino is made up of five connected squares. This applet solves puzzles that involve filling a board with pentominos. If you click on the applet it will start a new puzzle. For more information see <http://math.hws.edu/eck/xJava/PentominosSolver/> where you'll also find the big brother of this little applet.

12. The applet at the end of [Section 12.4](#) is the same [Moire.java](#) that was used at the end of Chapter 1.
-

Part 4: Required Auxiliary Files

This section lists many of the extra source files that are required by various examples in the previous sections, along with a description of each file. The files listed here are those which are general enough to be useful in other programming projects.

- [TextIO.java](#) which defines a class containing some static methods for doing input/output. These methods make it easier to use the standard input and output streams, `System.in` and `System.out`. The `TextIO` class defined in this file will be useless on a system that does not implement standard input. In that case, try using the following file instead.
- [TextIO.java for GUI](#) defines an alternative version of the `TextIO` class. It defines the same set of input and output routines as the original version of `TextIO`. But instead of using standard I/O, it opens its own window, and all the input/output is done in that window. Please read the comments at the beginning of the file. (For people who have downloaded this book: The file is located in a directory named `TextIO-GUI` inside the source directory.)
- [ConsoleApplet.java](#), a class that can be used as a framework for writing applets that do console-style input/output. To write such an applet, you have to define a subclass of `ConsoleApplet`. See the source code for details. Many examples of applets created using `ConsoleApplet` are available above. Any project that uses this class also requires [ConsolePanel.java](#) and [ConsoleCanvas.java](#).
- [ConsolePanel.java](#), a support class that is required by any project that uses `ConsoleApplet`.
- [ConsoleCanvas.java](#), a support class that is required by any project that uses `ConsoleApplet`.
- [SimpleAnimationApplet2.java](#), a class that can be used as a framework for writing animated applets. To use the framework, you have to define a subclass of `SimpleAnimationApplet`. This class uses Swing and requires Java 1.3 or higher. [Section 3.7](#) has an example.
- [SimpleAnimationApplet.java](#), a class that can be used as a framework for writing animated applets. This class has the same functionality as the previous class, but it is a Java 1.0 applet and so can be used even with very old versions of Java. This file is used as the basis for some of my end-of-chapter applets.
- [Mosaic.java](#) which let's you write programs that work with a window full of rows and columns of colored rectangles. `Mosaic.java` depends on [MosaicCanvas.java](#).

There is an example in [Section 4.6](#).

- [MosaicCanvas.java](#), a subclass of the built-in Canvas class that implements a grid of colored rectangles.
- [KeyboardAnimationApplet2.java](#), a class that can be used as a framework for writing animated applets, which the user can interact with by using the keyboard. This framework can be used for simple arcade-style games, such as the SubKiller game in [Section 6.5](#). To use the framework, you have to define a subclass of KeyboardAnimationApplet2. This requires Java 1.2 or higher.
- [KeyboardAnimationApplet.java](#), an older version of the previous class that has essentially the same functionality but that works with Java 1.1. (This version is not used in this textbook.)
- [Expr.java](#), a class for working with mathematical expressions that can include the variable x and mathematical functions such as sin and sqrt. This class was used in [Exercise 9.4](#).
- [TextReader.java](#), a class that can be used to read data from text files and other input streams. From [Section 10.1](#).

[David Eck](#) (eck@hws.edu), July 2002

[Back to FAQS.ORG homepage](#)

Introduction to Programming Using Java

Version 4.0, July 2002

Requires Java 1.3 or higher

Author: [David J. Eck](#) (eck@hws.edu)

WELCOME TO *Introduction to Programming Using Java*, the fourth edition of a free, on-line textbook on introductory programming, which uses Java as the language of instruction. Previous versions have been used as a textbook for an introductory programming class at Hobart and William Smith Colleges. See <http://math.hws.edu/eck/cs124/> for information about this course. This on-line book contains Java applets, many of which require Java 1.3 or higher. To see these applets, you will need a Web browser that uses a recent version of Java. To learn more, please read the [preface](#).

Links for **downloading** copies of this text can be found at the bottom of this page.

Search this Text: Although this book does not have a conventional index, you can search it for terms that interest you. Note that this feature searches the book at its on-line site, so you must be working on-line to use it.

Search *Introduction to Programming Using Java* for pages...

Short Table of Contents:

- [Full Table of Contents](#)
- [Preface](#)
- Chapter 1: [Overview: The Mental Landscape](#)
- Chapter 2: [Programming in the Small I: Names and Things](#)
- Chapter 3: [Programming in the Small II: Control](#)
- Chapter 4: [Programming in the Large I: Subroutines](#)
- Chapter 5: [Programming in the Large II: Objects and Classes](#)

- Chapter 6: [Applets, HTML, and GUI's](#)
- Chapter 7: [Advanced GUI Programming](#)
- Chapter 8: [Arrays](#)
- Chapter 9: [Correctness and Robustness](#)
- Chapter 10: [Advanced Input/Output](#)
- Chapter 11: [Linked Data Structures and Recursion](#)
- Chapter 12: [Generic Programming and Collection Classes](#)
- Appendix 1: [Other Features of Java](#)
- Appendix 2: [Some Notes on Java Programming Environments](#)
- Appendix 3: [Source Code for All Examples in this Book](#)
- [News and Errata](#)

© 2002, David J. Eck. **This is a free textbook.** There are no restrictions on using or redistributing or posting on the web a complete, unmodified copy of this material. There are some restrictions on modified copies. To be precise: Permission is granted to copy, distribute and/or modify this document under the terms of the [GNU Free Documentation License](#), Version 1.1 or any later version published by the Free Software Foundation; with no invariant sections, front cover text, or back cover text.

The most recent version of this book is always available, at no charge, for downloading and for on-line use at the Web address <http://math.hws.edu/javanotes/>. The previous edition, which covered Java 1.1, can be found at <http://math.hws.edu/eck/cs124/javanotes3/>.

Downloading Links

Use one of the following links to download a compressed archive of this textbook:

- **Windows:** <http://math.hws.edu/eck/cs124/downloads/javanotes4.zip> (1.8 Megabytes), with text files in Windows/DOS format. This archive can be extracted with [WinZip](#), or with the free program, [Aladdin](#) Stuffit Expander for Windows, available from <http://www.stuffit.com/expander/>.
- **Linux/UNIX and MacOS X:** <http://math.hws.edu/eck/cs124/downloads/javanotes4.tar.bz2> (1.0 Megabytes), with text files in Linux/UNIX format. If you have the bzip2 program, you should be able to extract this archive with the commands "bunzip2 javanotes4.tar.bz2" followed by "tar xf javanotes4.tar". On Macintosh, this archive can be extracted using [Aladdin](#) Stuffit Expander for

Macintosh, available from <http://www.stuffit.com/expander/>.

- **Linux/UNIX:** <http://math.hws.edu/eck/cs124/downloads/javanotes4.tar.Z> (2.0 Megabytes), with text files in Linux/UNIX format. If you can't use the previous archive, try this one. You can extract this archive on most UNIX systems with the commands "uncompress javanotes4.tar.Z" followed by "tar xf javanotes4.tar".

I know from experience that a lot of people will want to print all or part of the text. The following PDF file is provided to make this a little easier. This is nothing fancy -- just the Web pages captured in a single file. To use this file, you need Adobe Acrobat Reader Version 4 or later. (When you click on this link, the file might open in your Web browser; to download it, right-click the link and choose "Save Link As" or similar command.)

- <http://math.hws.edu/eck/cs124/downloads/javanotes4.pdf> (2.1 Megabytes; 554 pages)

[David Eck \(eck@hws.edu\)](mailto:eck@hws.edu)

Version 4.0, July 2002



Internet FAQ Archives

Online Education

[Internet RFC
Index](#)

[Usenet FAQ
Index](#)

[Other FAQs](#)

[Documents](#)

[Tools](#)

[Cities](#)

Search

► [Search](#)

[FAQs](#)

IFC Home

Quick FAQ Search

This archive contains Usenet Frequently Asked Questions (FAQ) postings in HTML format and in text format.

Select the format that best serves your purposes. *By Author* and *By Archive Name* listings are also available.

- [By Newsgroups](#) index
- [By Category](#) index
- [Multi-Page Digested
FAQs](#) index

Other Information

- Usenet FAQs [tech and
authoring info, stats,](#)

Popular Usenet FAQs

[FAQs A-
D](#) [FAQs J-
P](#)

[FAQs D-
J](#) [FAQs P-
Z](#)

2490 popular FAQs archived

[Top Rated FAQs](#)

Internet RFC/STD/FYI/BCP Archives

The Internet RFC series of documents is also available from here in multiple formats.

- [Most popular RFCs 1-50](#)
- [Most popular RFCs 51-100](#)

Contacting FAQ Maintainers; RFC Authors

The maintainers of this archive are **NOT** the authors or maintainers of

[credits](#)

- [Other FAQs](#)
- [Other documents](#)

the individual RFCs or FAQs appearing on this site. To correct or contribute to these documents, send email to the specific FAQ maintainers or RFC author identified in each of the documents.

© 2003 FAQS.ORG. All rights reserved.
[Contact Us](#) [Terms of Use](#)



Internet RFC/STD/FYI/BCP Archives

[Internet RFC
Index](#)

[Usenet FAQ
Index](#)

[Other FAQs](#)

[Documents](#)

[Tools](#)

[Cities](#)

Search

► [Search
FAQs](#)

► [Search
RFCs](#)

Search the RFC Archives

Or Display the document by number

[RFC Editor Information](#)

[Internet Related Standards Organizations](#)

- [Most popular RFCs 1-50](#)
- [Most popular RFCs 51-100](#)
- [Most popular RFCs 101-150](#)
- [Most popular RFCs 151-200](#)
- [Most popular RFCs 201-250](#)

RFC Index Split by Numbers

**Internet Requests
For Comments**

- [Complete Index](#)
- [Complete Title-
only Index](#)
- [Verbose Index](#)

**Active (non-obsolete)
RFCs**

- [Title-only Index](#)
- [Verbose Index](#)

[Obsolete RFC Index](#)
[Index of Latest RFCs
Only](#)

**Internet Standards
Documents**

[STD
Index](#)

[Verbose](#)

**For Your
Information
Documents**

[RFC 1 - 100](#)[RFC 101 - 200](#)[RFC 201 - 300](#)[RFC 301 - 400](#)[RFC 401 - 500](#)[RFC 501 - 600](#)[RFC 601 - 700](#)[RFC 701 - 800](#)[RFC 801 - 900](#)[RFC 901 - 1000](#)[RFC 1001 - 1100](#)[RFC 1101 - 1200](#)[RFC 1201 - 1300](#)[RFC 1301 - 1400](#)[RFC 1401 - 1500](#)[RFC 1501 - 1600](#)[RFC 1601 - 1700](#)[RFC 1701 - 1800](#)[RFC 1801 - 1900](#)[RFC 1901 - 2000](#)[RFC 2001 - 2100](#)[RFC 2101 - 2200](#)[RFC 2201 - 2300](#)[RFC 2301 - 2400](#)[RFC 2401 - 2500](#)[RFC 2501 - 2600](#)[RFC 2601 - 2700](#)[RFC 2701 - 2800](#)[RFC 2801 - 2900](#)[RFC 2901 - 3000](#)[RFC 3001 - 3100](#)[RFC 3101 - 3200](#)[RFC 3201 - 3300](#)[RFC 3301 - 3400](#)[RFC 3401 - 3500](#)[RFC 3501 - 3542](#)

The FYI documents provide Internet users with a central repository of information about any topics which relate to the Internet.

[FYI](#)[Index](#)[Verbose](#)

Internet Best Current Practices

These documents describe the Best Current Practices for the Internet Community.

[BCP](#)[Index](#)[Verbose](#)

We are experimenting with an additional way of organizing the RFCs.
Please [take a look](#).

© 2003 FAQS.ORG. All rights reserved.

[Contact Us](#)



Other FAQs

[Internet RFC
Index](#)

[Usenet FAQ
Index](#)

[Other FAQs](#)

[Documents](#)

[Tools](#)

Search

► [Search
FAQs](#)

- [Linux FAQ](#) by David Merrill and Robert Kiesling
- [Yet another Linux FAQ](#) by tekmate
- [Linux RAID FAQ](#) by Gregory Leblanc
- [Web Hosting FAQ](#)
- [Digital Cameras FAQ](#)
- [WordPerfect on Linux FAQ](#) by Rick Moen
- [The MailHelp FAQ & HOWTO \(includes sendmail and postfix\)](#) by MoonGroup Consulting, Inc.
- [Stretching FAQ](#) by Brad Appleton

Suggest a FAQ for inclusion in our archive by sending us its web address (use the form below instead if you are the author):

URL	
Anything else about this document we should know:	

Suggest a FAQ that you have created for inclusion in our archive:

Your name	
Your email	
Document title	
URL or	
Text of the document	

Anything else about this document we should know:	
Any data you want published with this document such as your name or your website:	
<p>I acknowledge that I am the author of this document. I authorize FAQS.ORG to publish this document on the WWW without any restrictions. I agree to hold harmless and indemnify FAQS.ORG against any claims, costs, or damages resulting from publishing this document. I agree to release FAQS.ORG from all liability for claims, costs, or damages resulting from publishing this document.</p>	



Other Documents

[Internet](#)
[RFC Index](#)

[Usenet](#)
[FAQ Index](#)

[Other](#)
[FAQs](#)

[Documents](#)

[Tools](#)

[Cities](#)

Search

► [Search](#)

[FAQs](#)

[Contribute new documents](#)

Linux-related documents

- [Linux HOWTOs A-H](#)
- [Linux HOWTOs I-P](#)
- [Linux HOWTOs Q-Z](#)
- [Linux Mini HOWTOs A-L](#)
- [Linux Mini HOWTOs M-Z](#)
- [The Linux Network Administrator's Guide, Second Edition](#) by Olaf Kirch and Terry Dawson
- [The Linux System Administrators' Guide](#) by Lars Wirzenius, Joanna Oja, and Stephen Stafford
- [Linux From Scratch](#) by Gerard Beekmans
- [The Linux Development Platform](#) by Rafeeq Ur Rehman and Christopher Paul
- [Linux Consultants Guide](#) by Joshua Drake
- [Introduction to Linux - A Hands on Guide](#) by Machtelt Garrels

- [EVMS User Guide](#) by Christine Lorenz, IBM, Joy Goodreau, IBM, Kylie Smith, IBM
- [Linux Kernel 2.4 Internals](#) by Tigran Aivazian
- [Linux in Workplace](#) by SSC, Inc, published by No Starch Press
- [Securing and Optimizing Linux](#) by Gerhard Mourani
- [Learning GNU C](#) by Ciaran O'Riordan
- [Advanced Bash-Scripting Guide](#) by Mendel Cooper
- [Apache Compile HOWTO](#) by Luc de Louw
- [The Bugzilla Guide](#) by Matthew P. Barnson
- [Linux Newbie Administrator Guide](#) by Stan, Peter and Marie Klimas
- [Introduction to Backing Up and Restoring Data](#) by Jennifer Vesperman
- [Introduction to Intrusion Protection and Network Security](#) by Jennifer Vesperman
- [Introduction to Physical Security and Security of Services](#) by Jennifer Vesperman
- [Introduction to Securing Data in Transit](#) by Jennifer Vesperman
- [Introduction to Viruses & Virus Hoaxes](#) by Jennifer Vesperman
- [Iptables-tutorial](#) by Oskar Andreasson
- [The Linux Kernel Module Programming Guide](#) by Peter Jay Salzman and Ori Pomerantz
- [Pocket Linux Guide](#) by David Horton
- [Windows+BSD+Linux Installation Guide](#) by Subhasish Ghosh

- [DocBook: The Definitive Guide](#) by Norman Walsh and Leonard Mueller
- [Picking Up Perl](#) by Bradley M. Kuhn
- [Bash Reference Manual](#) by FSF
- [Selected Linux Gazette Articles](#)

Computers-related documents

- [The Zope Book](#) by Michel Pelletier and Amos Latteier *ISBN 0735711372* (Covers Zope 2.5)
- [HTML Code Tutorial](#) by Idocs Inc
- [The Jargon Dictionary](#) - Various authors, primary maintainer Eric Raymond
- [Dive Into Python](#) by Mark Pilgrim, v4.1
- [Thinking in Java, 3rd Edition](#) by Bruce Eckel
- [Introduction to Programming Using Java](#) by David J. Eck
- [How to Think Like a Computer Scientist: Java Version](#) by Allen B. Downey.
- [Practical PostgreSQL](#) by Commandprompt, Inc (John Worsley, Joshua Drake)
- [Introduction to Sound Processing](#) by Davide Rocchesso
- [Ethernet-HOWTO](#) by Paul Gortmaker
- [Perl 5 Internals](#) by NetThink

General documents

- [Newtonian Physics](#) by Benjamin Crowell
- [The Open Source Cookbook](#) by Matthew Balmer
- [Lessons In Electric Circuits](#) by Tony R. Kuphaldt
- [Grains of Mystique: Quantum Physics for the Layman](#) by Thomas Haberkern and N Deepak
- [The World Factbook - country listings](#)
- [World Flags](#)
- [World Reference Maps](#)
- [How to Buy a New Car](#) by US gov.
- [How to Buy a Used Car](#) by US gov.
- [New and Used Car Financing Guide](#) by US gov.
- [Online Auctions Guide](#) by US gov.
- [Buying a Home FAQ](#) by US gov.
- [Buying a House 1/2](#) by US gov.
- [Buying a House 2/2](#) by US gov.
- [House construction and repair terms 1/2](#) by US gov.
- [House construction and repair terms 2/2](#) by US gov.
- [Credit report information](#) by US gov.

- [Safe flying and travel](#) by US gov.
- [Travel for students](#) by US gov.
- [Franchise business buying](#) by US gov.
- [Money saving tips](#) by US gov.
- [CDs - Certificates of Deposit](#) by US gov.
- [Mortgage Deals](#) by US gov.
- [Resumes, applications, and cover letters](#) by Olivia Crosby, US gov., modified
- [U.S. Dietary Guidelines](#) by US gov.
- [Cosmetic Laser Surgery](#) by US gov.
- [Lasik Eye Surgery](#) by US gov.
- [Weight Loss Program Info](#) by US gov.
- [Contact Lenses](#) by Dixie Farley, US gov., modified
- [Fitness and Exercise](#) by US gov.
- [Emergency Supplies](#) by US gov.
- [Cheap and Healthy Recipes](#) by US gov.
- [Online Banking](#) by US gov.
- [Money, Savings, and Credit Basics](#) by US gov.

Suggest an informational resource (guide, tutorial, how-to, documentation, etc.) for inclusion in our archive by sending us its web address (use the form below instead if you are the author):

URL	
Anything else about this document we should know:	

Suggest an informational resource that you have created (guide, tutorial, how-to, documentation, etc.) for inclusion in our archive:

Your name	
Your email	
Document title	
URL or	
Text of the document	

Anything else about this document we should know:	
Any data you want published with this document such as your name or your website:	
<p>I acknowledge that I am the author of this document. I authorize FAQS.ORG to publish this document on the WWW without any restrictions. I agree to hold harmless and indemnify FAQS.ORG against any claims, costs, or damages resulting from publishing this document. I agree to release FAQS.ORG from all liability for claims, costs, or damages resulting from publishing this document.</p>	



Usenet FAQ Archive Search

[Internet](#)
[RFC Index](#)

[Usenet](#)
[FAQ Index](#)

[Other](#)
[FAQs](#)

[Documents](#)

[Tools](#)

[Cities](#)

Search

► [Search](#)
[FAQs](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

A search here covers the entire *.answers FAQ database (over 3900 FAQs).

Enter the search string, select the database to search, and click on the Search button to initiate the search.

Note:

These options **only** pertain to searching the FAQ database (Search FAQs - ...) and **not** to the "Archive-name" or "Article Header" databases. The "Show X references per file" option **only** applies when the "Search FAQs - Show References" search is selected.

Search Options:

Popular Usenet FAQs

[FAQs A-D](#)

[FAQs J-P](#)

[FAQs D-J](#)

[FAQs P-Z](#)

2490 Popular FAQs Archived

[Top Rated FAQs](#)

[[By Archive-name](#) | [By Author](#) | [By Category](#) | [By Newsgroup](#)]
[[Home](#) | [Search Help](#) | [Latest Updates](#) | [Archive Stats](#) | Search | [Help](#)]

© 2003 FAQS.ORG. All rights reserved.



Popular FAQ Index 1

[Internet RFCs](#)

[Usenet FAQs](#)

[Other FAQs](#)

[Documents](#)

[Cities](#)

Search

► [Search](#)

[FAQs](#)

Quick FAQ Search

[FAQ Index 1](#) - ai, acorn, genetic, nets, neural, 3b1, control, afs

[FAQ Index 2](#) - sex, aix, fetish, fashion, spleen, prostitution, recovery, sampler

[FAQ Index 3](#) - amiga, support, depression, introduction, book, sampler, asd, amigauucp

[FAQ Index 4](#) - apple2, antiques, radio, phono, anime, apl, primer, conventions

[FAQ Index 5](#) - apple2, aquaria, reefkeeper, storage, arch, begin, sw, resource

[FAQ Index 6](#) - astronomy, argentina, x86, language, assembly, audiofaq, bit, atari

[FAQ Index 13](#) - cats, breeds, car, audio, calendars, exotics, foreign, burmese

[FAQ Index 14](#) - cats, cdrom, cd, recordable, celebrities, michael, moore, cell

[FAQ Index 15](#) - comics, xbooks, commodore, war, usa, cbm, civil, comedy

[FAQ Index 16](#) - groupware, commodore, compilers, speech, os, plan9, sun, construction

[FAQ Index 17](#) - computer, ada, forth, programming, modula2, java, compression, evaluations

[FAQ Index 18](#) - computer, security, crafts, virus, textiles, books, system, cryonics

[FAQ Index 7](#) - audiofaq, autos, chrysler, australian, gasoline, audio, pro

[FAQ Index 8](#) - autos, backrubs, aviation, vw, barefoot, gasoline, toyota, sport

[FAQ Index 9](#) - boats, bicycles, birds, beer, wild, bigfoot, bisexual, sea

[FAQ Index 10](#) - piercing, tattoo, books, jewelry, experiences, personal, bible, rice

[FAQ Index 11](#) - books, library, bulgaria, asimov, isaac, bosnia, holt, tom

[FAQ Index 12](#) - bulgaria, business, autolisp, cad, learn, calendars, caffeine, driving

[FAQ Index 19](#) - cryptography, cryonics, irish, french, culture, celtic, networking, snake

[FAQ Index 20](#) - irish, zealand, italian, hangul, korea, scottish, cyrillization, russian

[FAQ Index 21](#) - databases, sybase, dance, modern, ballet, tuva, progress, free

[FAQ Index 22](#) - databases, sybase, davis, amiga, funk, chatsystems, chat, antiquariate

[FAQ Index 23](#) - autorenkreis, isdn, startrek, newusers, manual, netiquette, pub, unix

[FAQ Index 24](#) - linux, dcoul, katzen, dec, konsumterror, pdp8, sport, budo

Reader questions and answers:

- [FAQ-Related Q&As](#)
- [General Q&As](#)
- [Answered Questions](#)

[Not finding the answers you need?](#)
[Submit your question for others to see.](#)

[FAQs A-D](#)

[FAQs J-P](#)

[FAQs D-J](#)

[FAQs P-Z](#)

Contacting FAQ Maintainers; RFC Authors

The maintainers of this archive are **NOT** the authors or maintainers of the individual RFCs or FAQs appearing on this site. To correct or contribute to these documents, send email to the specific FAQ maintainers or RFC author identified in each of the documents.

© 2003 FAQS.ORG. All rights reserved.



Popular FAQ Index 1: ai, acorn, genetic, nets, neural, 3b1, control, afs

[Internet RFCs](#)

[Usenet FAQs](#)

[Other FAQs](#)

[Documents](#)

[Cities](#)

Search

► [Search](#)

[FAQs](#)

Quick FAQ Search

- [3b1-faq/part1 - comp.sys.3b1 FAQ part1](#)
- [3b1-faq/part2 - comp.sys.3b1 FAQ part2](#)
- [acorn/faq/part1 - Comp.Sys.Acorn.FAQ part 1 of 4](#)
- [acorn/faq/part2 - Comp.Sys.Acorn.FAQ part 2 of 4](#)
- [acorn/faq/part4 - Comp.Sys.Acorn.FAQ part 4 of 4](#)
- [acorn/faq/part5 - Comp.Sys.Acorn.FAQ part 5 of 5](#)
- [acorn/games - The comp.sys.acorn.games FAQ](#)
- [acorn/networking/faq - comp.sys.acorn.networking Frequently Asked Questions](#)
- [acorn/programmer - The comp.sys.acorn.programmer FAQ](#)
- [active-noise-control-faq - Active Noise Control FAQ v1996-03-](#)

14

- [afs-faq - AFS distributed filesystem FAQ](#)
- [ai-faq/expert/part1 - FAQ: Expert System Shells 1/1 \[Monthly posting\]](#)
- [ai-faq/general/part1 - Artificial Intelligence FAQ: General Questions & Answers 1/6 \[Monthly posting\]](#)
- [ai-faq/general/part3 - Artificial Intelligence FAQ: Associations and Journals 3/6 \[Monthly posting\]](#)
- [ai-faq/general/part4 - Artificial Intelligence FAQ: Bibliography 4/6 \[Monthly posting\]](#)
- [ai-faq/genetic/part1 - FAQ: comp.ai.genetic part 1/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/genetic/part2 - FAQ: comp.ai.genetic part 2/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/genetic/part3 - FAQ: comp.ai.genetic part 3/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/genetic/part4 - FAQ: comp.ai.genetic part 4/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/genetic/part5 - FAQ: comp.ai.genetic part 5/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/genetic/part6 - FAQ: comp.ai.genetic part 6/6 \(A Guide to Frequently Asked Questions\)](#)
- [ai-faq/neural-nets/part1 - comp.ai.neural-nets FAQ, Part 1 of 7: Introduction](#)
- [ai-faq/neural-nets/part2 - comp.ai.neural-nets FAQ, Part 2 of 7: Learning](#)

- [ai-faq/neural-nets/part3 - comp.ai.neural-nets FAQ, Part 3 of 7: Generalization](#)
 - [ai-faq/neural-nets/part4 - comp.ai.neural-nets FAQ, Part 4 of 7: Books, data, etc.](#)
 - [ai-faq/neural-nets/part5 - comp.ai.neural-nets FAQ, Part 5 of 7: Free software](#)
-

[FAQs A-D](#)

[FAQs J-P](#)

[FAQs D-J](#)

[FAQs P-Z](#)

Reader questions and answers:

- [FAQ-Related Q&As](#)
- [General Q&As](#)
- [Answered Questions](#)

[Not finding the answers you need?
Submit your question for others to see.](#)

Contacting FAQ Maintainers; RFC Authors

The maintainers of this archive are **NOT** the authors or maintainers of the individual RFCs or FAQs appearing on this site. To correct or contribute to these documents, send email to the specific FAQ maintainers or RFC author identified in each of the documents.

© 2003 FAQS.ORG. All rights reserved.

comp.sys.3b1 FAQ part1

[Not finding the answers you need?](#)
[Submit your question for others to see.](#)

There are reader questions on this topic!
[Help others by sharing your knowledge](#)

Message-ID: <3b1_faq_part1_1059195810@nyx10.nyx.net>

Newsgroups: [comp.sys.3b1](#)

Subject: comp.sys.3b1 FAQ part1

Reply-To: 3b1-faq@nyx10.nyx.net

Summary: This Posting contains a list of Frequently Asked Questions (and answers) about 3b1 computers. It should be read by all who want to participate in the comp.sys.3b1 newsgroup.

From: jlbunch@nyx1.nyx.net (John B. Bunch)

X-Cache: nntpcache 3.0.1 (see <http://www.nntpcache.org/>)

Date: 25 Jul 2003 23:03:30 -0600

Archive-name: 3b1-faq/part1

Version: \$Id: 3b1-faq-part1,v 2.5 2000/09/05 19:17:48 jlbunch

| Answers to some frequently asked questions about the AT&T UNIX PC, |
| as well as some frequent problems, hints, and solutions. |

| Make a Hard Copy on the FAQ *NOW*, it probably wont be readable if |
| it is on your machine when you *NEED* it. |

[\$Revision: 2.5 \$ \$Date: 00/09/05 19:17:48 \$]

Send updates to 3b1-faq@nyx.cs.du.edu.

Part 1 of 2

Subject: 0.1. Table of Contents for part 1 of the faq.

0.1. Table of Contents for part 1 of the faq.

1.0. General

1.1. What exactly are the AT&T UNIX PC, PC7300, and 3B1?

1.2. What is the operating system? Its origins?

1.3. What are the "OSU Archives"?

1.4. Who supports these machines? Are there any user

groups?

1.5. Where can I get my machine serviced or fixed?

2.0. Software

2.1. How do I get my free Personal Calendar program?

2.2. What is "THE STORE!" and how can I access it?

2.3. Is there any GNU software available?

2.4. Is the X Window system available for the UNIX PC?

2.5. What's MGR?

2.6. How can I get a full 360kB when I format a MS-DOS

floppy

on the UNIX PC?

2.7. Are there any other utilities for fiddling with MS-DOS
floppies?

2.8. What commercial software was available for the UNIX PC?

3.0. Software Development

3.1. Can I use the GNU C compiler in place of the hard-to-

find

development set?

3.2. What do I with old object-file archives?

4.0. Administration

4.1. How do I restore from a backup when one of the

floppies

is bad?

4.2. How can I make a floppy-disk-based UNIX for fsck'ing

the

hard drive?

4.3. How can I get the machine to ask the device and

program to

boot from?

4.4. How do I get multiple login windows?

4.5. What the heck is a +IN suffix on a file?

4.6. What do the HDERR (FDERR, or TPERR) messages in /usr/adm/unix.log mean?

4.7. Why are the header files missing after an install of

the

Development Set?

4.8. Why is the machine is booting over and over?

4.9. Is HoneyDanBer UUCP available to replace the stock

uucp

software?

4.10. Why doesn't the On-Board Modem (OBM) work with some

other

modems?

4.11. How do I get my on-board modem to be a dial-out-only

modem?

4.12. Does the on-board modem support 2400 bps?

4.13. Why aren't the lpadmin, accept, and reject commands

working

right?

4.14. Why are all the jobs on the printer always followed by

a

formfeed?

4.15. Why can't I send bitmapped images to the printer

correctly?

4.16. How do I configure a Hayes compatible external modem

on the

UNIX PC?

4.17. Any tips on building Cnews?

4.18. What are lipc and nipc, and how can I use nipc instead

of

lipc?

5.0. Upgrading

5.1. What third-party hardware is available?

5.2. Can I put a 68881 math coprocessor in my machine?

Subject: 1.0. General

This section contains general questions about the Unix-PC.

Subject: 1.1. What exactly are the AT&T UNIX PC, PC7300, and 3B1?

The name "UNIX PC" is a catch-all name for a set of machines developed by Convergent Technologies (now part of Unisys) and sold by AT&T in the mid to late 80's, all having the same basic configuration:

- o 10MHz 68010 with custom MMU
- o demand paged, virtual memory UNIX (max. process size 2.5M)
- o 10/20/40/67MB disk
- o 512k/1M/2MB RAM
- o monochrome, quasi-Hercules display

As marketing strategies changed and basic features were added, the original offering (the PC7300) became known as the 3B1. The 7300 machines featured 512k RAM on the motherboard with a 10 or 20MB disk. The later 7300's featured 1M on the motherboard and a 20MB half-height Miniscribe drive. The later 3B1 machines had 1M or 2M on the motherboard, and came with a 40 or 67MB disk. Accommodating the larger, full-height drives in the 3B1 required that a hump be added to the sloping, wedge-shaped case top. The 3B1 also has a heftier power supply.

Subject: 1.2. What is the operating system? Its origins?

The operating system is based on UNIX System V Release 2, with extensions from BSD 4.1, BSD 4.2, System V Release 3 and Convergent Technologies. The most recent version is 3.51, with a 3.51m FIXDISK (2.0) available. The FIXDISK was available from AT&T directly, but is now only available on the OSU Archives as FIXDISK2.0+IN.

Subject: 1.3. What are the "OSU Archives"?

OSU-CIS is an Ohio State University computer system which holds a very large selection of UNIX-PC-related programs and files. David Brierley (dave@galaxia.network23.com) is the current maintainer of the archives. Ohio State graciously allows both anonymous FTP and UUCP access to this archive. For FTP from the Internet, access is via the machine `archive.cis.ohio-state.edu` (IP address: 128.146.8.52).

This is the URL for the OSU archives ftp access.

```
<ftp://archive.cis.ohio-state.edu/pub/att7300/>
```

Dave Brierley has also now added www access to the UNIX-PC archives with this URL.

```
<file://archive.cis.ohio-state.edu/pub/att7300/README.html>
```

They recommend the following L.sys (Systems) entries:

```
#
# Direct Trailblazer
# dead, dead, dead...sigh.  for the 3rd time in as many
months.
#
#osu-cis Any ACU 19200 1-614-292-5112 in:--in:--in: Uanon
#
# Direct V.32 (MNP 4)
# dead, dead, dead...sigh.
#
#osu-cis Any ACU 9600 1-614-292-1153 in:--in:--in: Uanon
#
# Micom port selector, at 1200, 2400, or 9600 bps.
# Replace ##'s below with 12, 24, or 96 (both speed and phone
number).
# Can't use MNP with V.32 on -3196
#
osu-cis Any ACU ##00 1-614-292-31## " \r\c Name? osu-cis
nected \c GO \d\r\d\r\d\r\d\r\d\r\d\r in:--in:--in: Uanon
```

The file `~/att7300/README.Z` contains a detailed list of the archive's contents and should be the first thing to get.

Another source of software for Internet-connected sites is the anonymous FTP area on `ftp.cs.caltech.edu`. Andy Fyfe (andy@cs.caltech.edu) maintains new versions of TeX and GNU utilities

in the pub/3b1 directory.

[Ed. Note: As far as I know the archive at ftp.cs.caltech.edu for the 3b1 has been shut down, everything in the caltech archives is mirrored in the OSU archives in ~/pub/att7300/csvax]

Subject: 1.4. Who supports these machines? Are there any user groups?

The primary support for the machine is the Usenet newsgroup comp.sys.3b1. There are a lot of dedicated people who enjoy these machines and post a wealth of information to the network.

If you are in the Silicon Valley area, contact Thad Floryan (thad@btr.com) for information on how to go to the "AT&T UNIX User's Group" meeting on the fourth Wednesday of every month. Although it's a generic AT&T UNIX group, a large number of the members (including Thad) own UNIX PC's.

Subject: 1.5. Where can I get my machine serviced or fixed?

This is difficult, since AT&T no longer supports the machine. The only remaining possibility appears to be ``A Small Computer Repair Company'' (ASCRC). They will diagnose your problem, and repair or replace the part that is broken. They will try their hardest to repair the item first. You need to send the computer (or just the component in question) to them. They will repair/replace it and ship it back. Their turn-around time is usually 48-72 hours. They repair AT&T's 6300, 6300+, 7300, 3B1 and UNIX PC computers. For more information and/or to arrange servicing, contact:

A Small Computer Repair Company
5762 Dichondra Place
Newark, CA 94560
(510) 430-9226 or (510) 793-6980

Subject: 2.0. Software

This section describes some of the software available.

Subject: 2.1. How do I get my free Personal Calendar program?

Enclosed with the documentation of many or all UNIX PC's was a card which you could send in to receive a free copy of the Personal Calendar program. The machine is discontinued, so sending in the card now won't accomplish anything, but that doesn't mean that you're out of luck. Many machines were shipped with the calendar program in /etc/fixes. Install it as follows (the name of the program is "pcal"):

Append this to your /usr/lib/ua/Office file:

```
Name=Calendar
Default = Open
Open=EXEC -d /usr/bin/pcal -c
Help=EXEC -d /usr/bin/uahelp -h /usr/lib/ua/ua.hlp -t
```

Calendar

Append this to your /usr/lib/ua/Preferences file:

```
Name=Calendar
Default = Open
Open=EXEC -d /usr/bin/pcal -p
Help=EXEC -d /usr/bin/uahelp -h /usr/lib/ua/ua.hlp -t
```

Calendar

If you are using the pcal that is located in /etc/fixes:

```
$ su
Password:
# mv /etc/fixes/pcal /usr/bin
# mv /etc/fixes/pcal.hlp /usr/lib/ua
# chown bin /usr/bin/pcal /usr/lib/ua/pcal.hlp
# chgrp bin /usr/bin/pcal /usr/lib/ua/pcal.hlp
```

```
# chmod 755 /usr/bin/pcal
# chmod 644 /usr/lib/ua/pcal.hlp
```

Subject: 2.2. What is "THE STORE!" and how can I access it?

THE STORE! was owned and operated by AT&T, but is no longer available for dialup uucp. All publicly accessible software that was formerly available there has been moved and archived on the OSU archives (see above).

Subject: 2.3. Is there any GNU software available?

There are fairly recent versions of gcc, g++, gas, gdb, and emacs as binary-only cpio archives on OSU as well at CalTech (see above).

Subject: 2.4. Is the X Window system available for the UNIX PC?

No, X has not been ported, and probably won't ever be ported to the UNIX PC. X is quite large, and there have been several discussions about porting it in comp.sys.3b1, but it's probably not worth the effort.

Subject: 2.5. What's MGR?

MGR is an alternative windowing environment developed by Steve Uhler at Bellcore and ported to the UNIX PC by Brad Bosch and Brian Botton. The MGR windowing environment can replace the standard /dev/window environment on the UNIX PC quite nicely (it does prevent some UNIX PC specific programs from being run since the wind.o loadable device driver is not loaded). MGR's user interface is quite

similar to a SunWindows environment, and raster operations are quite fast. MGR is a user program, not a driver (besides the pty driver), so it doesn't take up precious kernel space. It does require a hardware modification called the VIDPAL. The VIDPAL (developed by Brian Botton [...!att!iexist!botton]) is a daughterboard that sits sandwiched between the 68010 CPU and the motherboard and allows direct access to video memory from a user process.

At one time, Brian had provided VIDPAL kits but no longer does so. If you want to try out MGR, but can't get a VIDPAL board, you may want to try out John Milton's VIDPAL emulator -- a software-only solution to video memory access. It is certainly slower than a real VIDPAL, but is interesting none the less. The VIDPAL emulator was posted to comp.sources.3b1 and so should be archived at standard archive sites like uunet.uu.net.

A beta source distribution of MGR is on OSU, and can also be gotten via anonymous ftp from max.physics.sunysb.edu (129.49.21.100).

Subject: 2.6. How can I get a full 360kB when I format a MS-DOS floppy on the UNIX PC?

The md_format program defaults to formatting floppies with 8 tracks per sector (320kB). Use the "-9" option to get 9 tracks per sector (360kB).

A further suggestion is to get windy ("windy.cpio.Z" at OSU) and use it to run the md_format program, since md_format is one of those which tends to turn your full-screen UNIX window into a little, horrible-looking window. Windy fixes this by running the command in its own window.

Subject: 2.7. Are there any other utilities for fiddling with MS-DOS floppies?

The best of the bunch is Emmet P. Gray's Mtools package, which is available on OSU. The utilities in this package allow one to copy

files, delete files, rename files, make directories, format disks, etc. The 2.0 version of Mtools also supports the C:, D:, etc. drive partitions of the DOS-73 emulator.

Subject: 2.8. What commercial software was available for the UNIX PC?

What follows is a list Steve Urich (beyo@beyonet.UUCP) typed in from an old TRC catalog listing UNIX PC commercial software. At the end of this list are a few more products seen by other folks on Usenet.

UNIX PC SOFTWARE

Model	Description
AT&T650002 EGM	GSS Terminal. Access to host graphics; Tektronix 4014
AT&T650005 dedicated	3270+ Emulator. For SNA networks through dial-up or lines
AT&T650007 options for	AT&T Electronic Mail. menu driven with lots of sending notes & files
AT&T650008 TFTP &	TCP/IP Ethernet, includes ICMP, UDP, NVT, PTP, SMTP, remote cmnds
AT&T650101 mail	Voice Mail Software. Send and receive text and vioce
AT&T650S01 e-mail	UNIX PC Network. Starlan messaging, file transfer and
AT&T650S02 networks.	UNIX PC Server. Starlan file server for MS-DOS
AT&T651002	GSS Drivers+ VDI based software for printers
AT&T651003	UNIX System V Release 3.51
AT&T651004 plotting	GSS Toolkit. Graphics programming including metafile, & windows.
AT&T651005 VDM standard	GSS Metafile Interpreter. Library of functions for
AT&T651006	GSS GKS. C tool implements the GKS standard
AT&T651007	GSS Plotting System. Chart building capabilities.

AT&T651008	GSS Window Manager for C language windowing.
AT&T651010	Informix C-ISAM. Tool for ISAM without a full RDBMS.
AT&T651018	Development Tools. Commercial and scientific ISAM
sort/merge	
AT&T651021	UNIX Utilities 3.51.
AT&T651201	MS Basic. Basic with over 120 commands from Microsoft.
AT&T651202	SMC Basic. Business Basic III compatability.
AT&T651203	SMC Run Time. Executable only; non-development
version.	
AT&T651204	RM Cobol. 1974 ANSI standard; certified by GSA.
AT&T651205	RM Cobol Run Time. Executable only; non-development
version.	
AT&T651209	LPI Fortran. Fortran 77 meeting ANSI X3.9-1978
AT&T651210	LPI Pascal. ANSI/IEEE standard supported by LPI Debug.
AT&T651211	LPI C Full implementation with LPI's modular
component	
	architecture.
AT&T651216	LPI Debug. Interactive source level debugger works
with all	
	LPI products.
AT&T651219	RM Fortran. High preformance implementation of F77
and ANSI	
	3.9-78.
AT&T651221	Animator. Integrated with MF Level II Cobol.
AT&T651223	Cobol LVL II. ANSI-74, ISAM tools, source compatible
with	
	compact Cobol II
AT&T651224	Forms II. Visual programming tool for screen based
forms	
	generation.
AT&T651226	Cobol LVL II Run Time. Executable only; non-
development version	
AT&T651227	SVS Fortran. ANSI-77 including Symbolic Debugger.
AT&T651229	SVS Pascal. Combines ISO and UCSD standards
AT&T651232	AT&T BASIC Interpreter. Standard Basic with many
extensions	
AT&T651233	AT&T BASIC Compiler. Full implementation of ANSI
X3.60-78 with	
	extensions.
AT&T651237	UNIFY. Multi-user RDBMS.
AT&T651702	dBASE III. Ashton-Tate and AT&T
AT&T651706	QUICKCODE III. Automate dBASE III programming.
AT&T651707	dUTIL. Toolkit for dBASE III programmers.

AT&T651713 informix files	FILE-IT. Easy to use personal DBMS which builds thru menus.
AT&T651713	INFORMIX. The most flexible true relational multi-user programming language.
AT&T651714	INFORMIX Run Time. Executable versions of Informix programs.
AT&T651715 with the	SMART DBMS. Powerful relational database integrated Smart package.
AT&T651L60 DB2	BASIC ORACLE. Fully compatible with IBM's SQL/DS and DB2
AT&T651L61 precompiler.	TURBO ORACLE. ANSI Standard SQL; C language precompiler.
AT&T652004	Multiplan. Microsoft's spreadsheet solution.
AT&T652009 mainframe quality	GSS CHART. Interactive standalone package for mainframe quality graphics.
AT&T652010 on a wide	GSS Sound Pres. Fully featured interactive graphics on a wide variety of devices.
AT&T652016 spreadsheets.	AT&T SUPERCOMP 20. The multiuser standard of spreadsheets.
AT&T652017	BUSINESS GRAPHICS. Turn your 20/20 data into charts. (Requires Supercomp 20).
AT&T652022 package.	PAINT POWER. Sophisticated but easy to use drawing package.
AT&T652026	SMART SFTWR SYS. Database-Spreadsheet-Wordprocessor.
AT&T652029 sharing all	TEAM POWER. Office work groups for 2 to 5 users sharing all resources.
AT&T652202 UNIX.	MS WORD. Microsoft's professional word processor for UNIX.
AT&T652204	AT&T Word Processor. Easy to use word processor.
AT&T652208 language	Crystalwriter. Powerful word processing with English language commands.
AT&T652209	Wordstar 2000. MicroPro's best selling word processor.
AT&T652210 which works	SMART WORD PROCESSOR. Professional word processor which works with Smart.
AT&T653001	BUSINESS ACCTING. Complete business accounting system.
AT&T653002	OC/INV. Complete package for managing incoming orders

and

product control.

AT&T653003 PAYROLL. Complete payroll and personnel management.

AT&T653004 A/P. Comprehensive control system-can be integrated with G/L.

AT&T653005 A/R. Maintains customer profiles and accounts-can be integrated

with G/L.

AT&T653006 GENERAL LEDGER. Fully automated package for maintaining business records.

AT&T?????? Wordmarc Composer. Word processing package.

AT&T?????? Pegasys. Computer-aided design.

AT&T?????? Image Director

AT&T?????? Samna. Word processor.

AT&T?????? Q-Office. Office integration

AT&T?????? User Agent Design Tool.

Subject: 2.0. Software Development

This section gives a little info on what is necessary for software development

Subject: 3.1. Can I use the GNU C compiler in place of the hard-to-find development set?

In theory, anyway, most of what you need from the Development Set can be obtained elsewhere. There are at least five things that you need to do C programming on the UNIX PC:

- o a C compiler

- Use GCC (binary available in languages/gcc-gas.tar.Z on OSU-CIS)

- o an assembler

- Use GAS (binary available in languages/gcc-gas.tar.Z on OSU-CIS)

- o a linker/loader (/bin/ld)

This is included in the Foundation Set.

- o system header files

Alex Crain (alex@umbc3.umbc.edu) has created a set of ANSI header files which appeared in Volume 1, Issue 49 of comp.sources.3b1, with one patch.

- o libraries

This is the tough one. There are a bunch of libraries that come the Development Set which would be difficult to replace. One of the most important (/lib/libc.a) is on the Encryption Set disks in the Foundation Set. Supposedly FIXDISK2.0 contains one or more updated libraries. The network and OSU remain good sources for strings, POSIX, dirent, etc. libraries. Of course, there are other libraries like /lib/libm.a (math) and /lib/libld.a (COFF access) which might be more difficult to replace.

This writer hasn't actually heard of anyone actually pulling this feat off, but sometimes he has trouble paying attention. ("Eh?")

(Thanks to Glenn Thobe for providing up-to-date information.)

Subject: 3.2. What do I with old object-file archives?

The object-file archive format was changed from release 3.0 to 3.5 of the operating system. There is a utility to convert these archives to the new format.

```
# convert oldarchive.a newarchive.a
```

Or you can run:

```
# arconvert
# file oldarchive.a newarchive.a
oldarchive.a: 5.0 archive
newarchive.a: 5.2 archive
```

That will convert all the archives in /usr/lib and /lib that are in the old 5.0 archive format to the new 5.2 archive format.

Subject: 4.0. Administration

This section contains info on how to administer the 3b1 and some of the available packages for the 3b1

Subject: 4.1. How do I restore from a backup when one of the floppies is bad?

Get the public domain program called "afio". It's available in the OSU archives. It supports reading the floppy disk backup set, and will ignore errors and recover when it finds the next cpio ASCII header if you use the "-k" option. The backup set must be written using cpio and the "-c" option must have been used during the writing of the diskettes.

The syntax for afio to restore is:

```
# cd /
# afio -ivk /dev/rfp021
      ^ use the k option to allow dealing with
        corrupted archives
```

Subject: 4.2. How can I make a floppy-disk-based UNIX for fsck'ing the hard drive?

Make a copy of the "Floppy Filesystem Disk" (Disk 3 of ##) of the Foundation Set as follows. Insert the original floppy filesystem diskette, and have a formatted, 10 sectors/track diskette ready. Type the "fpcp" command and copy it.

Now that you have a copy, place a copy of /etc/fsck on it. While you're at it, save your /etc/inittab in case it gets destroyed in the future and you can't get the machine to boot.

```
# mount /dev/fp021 /mnt
# cp /etc/fsck /mnt/etc/fsck
# cp /etc/inittab /mnt/etc/inittab.save
# sync
# umount /dev/fp021
```

Now you have a disk that will help you do a standalone filesystem check.

To use this, first boot the system using the "Floppy Boot Disk" (Disk 2 of ##). It will stop and ask you to insert the Floppy Filesystem Disk. Insert your copy instead. When it comes to the first question, interrupt the script with to get a "#" prompt.

The disk is already mounted as /mnt, so unmount it:

```
# umount /dev/fp002
warning: /dev/fp002 not in mount table
```

Do your filesystem check:

```
# /etc/fsck -D -S /dev/rfp002
```

Reboot the system:

```
# sync
# sync
# reboot
```

NOTE: the root filesystem is the floppy filesystem, so the "-s" option to fsck salvages the floppy root filesystem, not the root filesystem on the hard drive. This is why "-s" is not used above.

*** THE FOLLOWING IS NOT FOR THE UNINHIBITED OR CASUAL USER ***

For the real UNIX hacker out there (who is fortunate enough to have a tape drive on your machine) you could grab the fp_unix.sh.Z, conf.sh.Z and kern.cpio.Z files from the OSU Archives. This is a set of tools, along with the kernel object files for 3.51m, that will let you link in the tape driver (tp.o) to your floppy UNIX kernel and give you full control of the tape device from the floppy UNIX. This is very handy for doing full backups or restores from the floppy!

Subject: 4.3. How can I get the machine to ask the device and program

to boot from?

By default the UNIX PC is set up with the non-verbose system loader. This can be changed to the "verbose" loader which will ask what program and device to load from.

*** WARNING *** Any time you write to the disk device like the following, be extra careful that you type the correct device name. A backup is always recommended.

Insert a blank diskette in the floppy drive.

```
# fdfmt.vl
# /etc/ldrncpy /dev/rfp020 /dev/rfp000
```

Reboot your machine and you'll be able to load from the floppy or the hard disk whatever program you desire (not that there is too much you can load). It may be useful to copy the several diagnostic utilities to the hard disk (for easy retrieval).

Insert your diagnostic disk ...

```
# mount /dev/fp021 /mnt -r
# mkdir /dgn
# cp /mnt/s4diag /dgn/s4diag
# umount /dev/fp021
```

This can be repeated for diagnostics like, STARLAN, Voice Power, DOS-73, Floppy Tape, etc. Name the diagnostic programs something unique (slndiag, vpdiag, dosdiag, etc.) Now you can load from the hard disk /dgn/s4diag, /dgn/vpdiag, etc.. and have that diagnostic utility handy when needed.

NOTE: After you do this procedure your system will not reboot automatically (after power failures) without some user input.

Subject: 4.4. How do I get multiple login windows?

It is fairly easy to start up several windows with logins on them: all you need to do is add additional getty commands to the /etc/inittab file. Don't be afraid to edit your /etc/inittab, even though there is a big warning at the top of the file -- nothing will

happen if you are careful.

```
vid:2:respawn:/etc/getty window 9600
vd2:2:respawn:/etc/getty window 9600
vd3:2:respawn:/etc/getty window 9600
^ NOTE: in all cases there is a space character there.
```

This will start up 3 windows with logins. Using the <Shift><Suspd> key, you can cycle through all of them.

Another option is to get the Boyd Ostroff's "wlogin" package, posted to comp.sources.3b1 and available from the archives. This program can either replace or work with /etc/getty on the console and lets you have multiple overlapping 24 line x 80 character windows using a smaller font. It will work with or without wmgr, smgr, ph and ua. The number of windows and their position is fully configurable by the user. If desired, it can provide a simple alternative windowing environment to the UA, allowing you to remove ua and all its associated files, thus freeing up over 1 MB of disk space.

Subject: 4.5. What the heck is a +IN suffix on a file?

On the UNIX PC, "+IN" denotes an "Installable File". If you were to use the UA it would show that it's an Installable File. The Installable format is just a normal cpio archive. The file can be installed by hand by doing:

```
# mkdir /tmp/install
# mv FILE+IN /tmp
# cd /tmp/install
# cpio -icduvmb < ../FILE+IN
[...]
# ./Install
```

A list of other Suffixes appears in the file /usr/lib/ua/Suffixes.

Subject: 4.6. What do the HDERR (FDERR, or TPERR) messages in /usr/adm/unix.log mean?

There are several possible causes for these. One of course is a bad disk, or a disk that has gone bad. But one should check the other options before determining the disk is really bad.

Dirty power supply contacts have been known to cause these problems. Open the machine and clean the power supply contacts on the ribbon-type cable that goes from the supply to the motherboard.

A weak or faulty power supply could also be your problem. Test the power supply voltages (with the hard drive and motherboard connected as a load), using some sort of Y-connector off the power cable to the hard drive. Test the +12VDC and +5VDC supplies with a meter, and make sure they are within acceptable tolerances. If they are too low, intermittent HDERRs will occur. There are several adjustment screws on the power supply (marked +5, +12, -12) that can adjust these values. Turning clockwise will increase the value, and counterclockwise will decrease it. Faulty power can make a good hard disk or motherboard appear to be bad.

More commonly you'll find FDERRs in your /usr/adm/unix.log file. Every time you format a new floppy disk, you'll get at least one. Floppy disks are prone to more errors, especially if you get those bargain basement brand types.

TPERRs might appear if you have a bad or defective cartridge tape block. If you start seeing a lot of these during your backup or verify phases, it would be a good idea to re-format the tape and run another surface check (to check for possibly bad streams, or good streams that have gone bad).

Subject: 4.7. Why are the header files missing after an install of the Development Set?

One of the packages' Install scripts (apparently that of "Curses/Terminfo Programmers Package"), copies curses.h to /usr/include anticipating that the directory has already been created by a previous package's Install script. If /usr/include doesn't exist

yet because the packages weren't installed in the right order, the Install script will make a *file* called /usr/include, which is really curses.h.

To prevent this from happening, install the packages in this order:

Curses/Terminfo End User Package
Development Set 3.5x
Curses/Terminfo Programmers Package

Subject: 4.8. Why is the machine is booting over and over?

The stock /etc/rc that called when the machine boots up writes the output of the fsck(1M) to the hard disk (/etc/.lastfsck). This is definitely a problem. Many people prefer having control over what fsck does rather than running fsck with the "-y" option and having it do all the work. A lot of times fsck will delete files or clear them and you have no control over what it's doing.

Check out the fsokay.cpio.Z package on OSU, it contains some enhanced /etc/rc scripts and tools to make the booting phase of the UNIX PC a lot cleaner and more reliable.

Subject: 4.9. Is HoneyDanBer UUCP available to replace the stock uucp software?

HDB binaries and documentation are available on OSU as the following files:

~/att7300/STORE/HDB3.5+IN.Z
~/att7300/STORE/HONEYDOCS+IN.Z

Subject: 4.10. Why doesn't the On-Board Modem (OBM) work with some other modems?

One problem is that the OBM seems to create answerback tones which identifies itself (for some reason) as an MNP reliable modem (!). This confuses some MNP modems and the Telebit Trailblazer (only if set in MNP reliable mode). These cannot be altered in the OBM, but often a system which cannot call the UNIX PC OBM can be called by the UNIX PC OBM.

Another problem is that the OBM has trouble establishing a UUCP connection when calling Telebits configured in locked-speed mode. Chris Lewis (clewis@ferret.ocunix.on.ca) has written a program called phfix which can be invoked from /etc/rc to correct this particular problem using the (undocumented?) PIOCOSPD setting on the OBM. The result is that the OBM can successfully connect with locked-speed Telebits, and they can connect back. The program is not on OSU or in any comp.sources.3b1 archives, so it is presented here:

```
/*      Sample program for bashing the OBM into tone dial and
        setting PIOCOSPD to permit talking to certain modems
        (particularly telebits).
        The documentation mentions 2.3% speed change for PIOCOSPD.
        That's all I know.
```

You are free to do whatever you wish with this code, but please leave this comment in.

Chris Lewis, clewis@ecicrl.uucp, Jan 2 1991.

```
*/
#include <stdio.h>
#include <fcntl.h>
#include <sys/phone.h>

main(argc, argv)
int argc; char **argv; {
    int f;
    struct updata upd;
    f = open("/dev/ph1", O_RDWR | O_NDELAY, 0);
    if (f < 0) {
        perror("/dev/ph1");
        exit(1);
    }
    ioctl(f, PIOCGETP, &upd);    /* retrieve Phone parameters */
```

```

#ifdef  NEVER
    /* if you want to play with these go ahead - for some reason my
       3b1 always comes up in PULSE */
    upd.c_lineparam &= ~PULSE; /* reverse the sense to set to pulse
dial */
    upd.c_lineparam |= DTMF; /* reverse the sense to set to pulse
dial */

    upd.c_feedback |= SPEAKERON;
    upd.c_feedback |= LOUDSPK;
    ioctl(f, PIOCDISC, &upd); /* apply PIOCovSPD for talking to
some modems*/
#endif

    ioctl(f, PIOCovSPD, &upd); /* apply PIOCovSPD for talking to
some modems,
                                eg: Telebits */
    ioctl(f, PIOCSETP, &upd); /* set phone parameters */
}

```

Subject: 4.11. How do I get my on-board modem to be a dial-out-only modem?

The easiest way to do this is to edit (with your favorite editor) the /etc/inittab file. Change the line:

```

        ph0:2:respawn:/etc/getty ph0 1200
to:
        ^
        ph0:2:off:/etc/getty ph0 1200

```

NOTE: There is a space character in front of the first "ph0" in the lines above. ph0 may be ph1 if you are using line 2 for the on-board modem.

Subject: 4.12. Does the on-board modem support 2400 bps?

In what Convergent considered future releases of the UNIX PC

(P6), there was to be a 2400 bps modem. This machine was never fully developed to production levels, and therefore there is no 2400 bps modem. As the existing OBM is a proprietary AT&T chip, the likelihood of there being a drop-in upgrade is remote at best.

Interesting trivia: The P6 machine was to have a color video, 60MB QIC tape, as well as a 68020 CPU paired with a 68881 FPU.

Subject: 4.13. Why aren't the lpadmin, accept, and reject commands working right?

The lpadmin(1M), accept(1M), and reject(1M) commands require the user to be logged in as (or su'd to) user "lp". Being root will not work.

```
# su lp
$ disable lp1
$ /usr/lib/lpadmin -plp1 -mdumb -v/dev/lp
$ enable lp1
```

Subject: 4.14. Why are all the jobs on the printer always followed by a formfeed?

The line printer driver follows each close(2) of /dev/lp with a formfeed. There is no way to disable this, except by avoiding the driver altogether and going straight to the raw printer device.

```
# su lp
$ /usr/lib/lpadmin -plp1 -mdumb -v/dev/rawlp
```

Subject: 4.15. Why can't I send bitmapped images to the printer correctly?

8-bit, bitmapped images need to go to the raw printer device,

/dev/rawlp.

Subject: 4.16. How do I configure a Hayes compatible external modem on the UNIX PC?

Thanks to Jim Adams, included in the OSU Archives is an informational posting (posted to unix-pc.uucp and [comp.sys.att](#)) on how to set up your external modem under HDB uucp. The file is named HDB_Modem.Z.

The file uses the "hayes" modem as the example, although information could probably be extracted for uses with other modems. If you want information on how to set up your Telebit Trailblazer modem, get the file tb-setup.sh.Z on OSU.

This posting was too large to include in its entirety here, so a completely separate posting was made. He goes into how to set up the modem, proper cabling, proper Devices and Dialers entries, and a discussion on HFC (hardware flow control).

Additionally, the "modemon" package by Boyd Ostroff provides a simple way to configure external modems. It consists of a small program executed via inittab which can reset your modem and execute any desired AT commands each time a getty is spawned on the serial port. This allows you to configure the modem differently for incoming and outgoing calls and is especially handy if your modem doesn't have nonvolatile parameter RAM. The package includes complete documentation and examples of how to set up an external modem. It was posted to comp.sources.3b1 and is available in the archives.

Subject: 4.17. Any tips on building Cnews?

A sample build.def from Jan Isley (jan@bagend.uucp) follows with the following interesting characteristics noted:

- news account is uid=20, gid=20
- bin owns the executables
- using Doug Gwyn's dirent library (available on OSU)

- using a mailer that understands @ addressing (like smail 2.5)
- UNIX PC kernel does not support setuid(geteuid())
- other site-specific stuff (machine name and organization)

```
newsuid="news"
newsgid="news"
binuid="bin"
bingid="bin"
binsrc="no"
mess="no"
unmess="no"
newsarts="/usr/spool/news"
newsctl="/usr/lib/news"
newsbin="/usr/lib/newsbin"
newsu mask="002"
newsmaster="usenet"
newsconfig="/usr/lib/news/bin/config"
chown="/bin/chown"
chboth="yes"
chgrp="/bin/chgrp"
unixkind="usg"
addrsiz e="big"
dbmopt=" "
faststdio="no"
storeval="yes"
faststrchr="yes"
sete="no"
ranlib="no"
symdef="yes"
cc="ccc"
copts="-O"
ldopts="-s"
postlibs="-ldirent"
hostname="no"
uname="yes"
uucptype="hdb"
dftype="ustat"
dfdirs="no"
archive="yes"
spacelow="yes"
nfsgroup="no"
server="newsie"
```

```
manpages="/usr/man"
manmess="no"
rbin="/usr/bin"
doui="no"
bin="/usr/bin"
atok="yes"
postdefltdist=""
paranoid="no"
whoami="bagend"
mailname="bagend.uucp"
organization="1 Bagshot Row, the Shire"
postdefltgroup=""
newspath="/bin:/usr/bin:/usr/local/bin"
fake=" fsync.o mkdir.o symlink.o strerror.o"
fakehdrs=" ../include/string.h ../include/sys/timeb.h"
immediate="no"
inputstall="yes"
defsub=""
mustsub=""
```

Subject: 4.18. What are lipc and nipc, and how can I use nipc instead of lipc?

/etc/lddrv/lipc is the loadable device driver that implements System V inter-process communications on the UNIX PC (semget(), etc.). /etc/lddrv/nipc is a newer implementation of this driver which fixes an IPC bug, but was never fully tested. The default driver loaded by /etc/lddrv/drivers is lipc, and in fact, this is the driver which the program ipcs looks for when it reports on IPC usage. No bugs with nipc have been uncovered since it was made available (87?), and many people would rather run the "better" driver than stick with the old lipc.

There are two approaches for replacing lipc with nipc. The most obvious way is to edit /etc/lddrv/drivers to replace lipc with nipc for when the system is next booted, then replacing the in-core lipc with nipc with the following sequence:

```
# cd /etc/lddrv
# ./lddrv -dv lipc
```

```
# ./lddrv -av nipc
```

Unfortunately, ipcs will not find the lipc driver, and so won't give any IPC status. This can be overcome by wielding a binary editor in the general direction of /usr/bin/ipcs, replacing the hard-coded instances of "lipc" with "nipc".

Another method is to remove lipc from core (./lddrv -dv lipc), rename its files to something benign (lipc -> lipc.old, lipc.o -> lipc.o.old, ifile.lipc -> ifile.lipc.old), rename the nipc files to be lipc (nipc -> lipc, nipc.o -> lipc.o, ifile.nipc -> ifile.lipc), and finally reload the new lipc (./lddrv -av lipc).

Subject: 5.0. Upgrading

This section contains info on upgrading your unix-pc.

Subject: 5.1. What third-party hardware is available?

Presently there are no known distributors that have a selection of UNIX PC hardware. The best source for hardware is the network, reading comp.sys.3b1 and [misc.forsale](#). There is always someone selling UNIX PCs and the appropriate hardware expansion.

Subject: 5.2. Can I put a 68881 math coprocessor in my machine?

AT&T had listed a 68881 feature as being available for the UNIX PC, but it was never fully developed.

--

John B Bunch	AT&T	I don't want the world, I just want
your		
9404 N. Church, APT 206	UnixPC	half.... -TMBG
Parma Hgts., OH 44130	IBM PC	jbunch@nyx.net

(440) 887-9310

KB2SIV

jbunch@nyx10.nyx.net

--

John B Bunch

AT&T

I don't want the world, I just want
your

9404 N. Church, APT 206

UnixPC

half.... -TMBG

Parma Hgts., OH 44130

IBM PC

jbunch@nyx.net

(440) 887-9310

KB2SIV

jbunch@nyx10.nyx.net

Part1 - [Part2](#) - [MultiPage](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions somewhat related to this FAQ:

- [how can i find a password](#) by bety (9/9/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
jbunch@nyx1.nyx.net (John B. Bunch)

Last Update October 03 2003 @ 00:11 AM

comp.sys.3b1 FAQ part2

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <3b1_faq_part2_1059195810@nyx10.nyx.net>
Newsgroups: [comp.sys.3b1](#)
Subject: comp.sys.3b1 FAQ part2
Reply-To: 3b1-faq@nyx10.nyx.net
Summary: This Posting contains a list of Frequently Asked Questions
(and
answers) about 3b1 computers. It should be read by all who
want
to participate in the comp.sys.3b1 newsgroup.
From: jlbunch@nyx1.nyx.net (John B. Bunch)
X-Cache: nntpcache 3.0.1 (see <http://www.nntpcache.org/>)
Date: 25 Jul 2003 23:03:31 -0600

Archive-name: 3b1-faq/part2
Version: \$Id: 3b1-faq-part2,v 2.5 2000/09/05 19:17:48 jlbunch

| Answers to some frequently asked questions about the AT&T UNIX PC, |
| as well as some frequent problems, hints, and solutions. |

| Make a Hard Copy on the FAQ *NOW*, it probably wont be readable if |
| it is on your machine when you *NEED* it. |

[\$Revision: 2.5 \$ \$Date: 00/09/05 19:17:48 \$]

Send updates to 3b1-faq@nyx.cs.du.edu.

Part 2 of 2

Subject: 0.2. Table of Contents for part 2 of the faq.

0.2. Table of Contents for part 2 of the faq.

5.0. Upgrading continued.

5.3. Can I really get 4MB of memory, even with a 1.5MB

combo

card, 512K RAM card, and 2MB of RAM on the motherboard?

5.4. What dynamic memory chips can be used to upgrade a 3b1/7300?

5.4. Can I hook up a 3.5" 720K floppy drive to my UNIX PC?

How

about a 1.2MB or 1.44MB floppy drive? Can I run both

the

3.5" drive and the 5.25" drive on my machine somehow?

5.5. Can I put a larger hard disk drive in the UNIX PC?

6.0. Maintenance

6.1. How do I park the hard disk heads before moving the

machine?

6.2. How do I open the case and get to the motherboard?

6.3. Why does my fan sometimes speed up and slow down?

Should I

replace it?

6.4. Why has my clock stopped?

7.0. Failures

7.1. What can I do when I turn on my UNIX PC and all I see

is

a "green screen"?

7.2. What can I do when I turn on my UNIX PC and I have no video?

7.3. What can I do when I get lots of FDERRs when writing/formatting a floppy?

7.4. Why does rn fail with "Can't open /dev/tty" from the built-in modem?

7.5. Can I connect my Starlan board to an Ethernet?

7.6. Can I run SLIP (Serial Line Internet Protocol) on my

UNIX

PC?

- 7.7. What are the consequences of "fsck -s" (salvaging the freelist)?
- 7.8. What does the "-s" option to dismount do?
- 7.9. How do I identify what motherboard revision I have?
- 7.10. How can the monitor fail?
- 8.0. Mysteries
- 8.1. What are the LED's left side of the machine for?
- 8.2. What's /etc/update? What does it do?
- 8.3. Why did the time display at the top of the screen go away?
- 8.4. How do I stop that darn double-ESC mode on console windows?
- 8.5. What do I do when the machine hangs at the boot message?
- 8.6. How can the UNIX PC be made more secure?
- 8.7. How do I access the expert menus in the diagnostics?
- 9.0. Credits

Subject: 5.0. Upgrading continued.

This is a continuation of the upgrading section from part 1 of the faq.

Subject: 5.3. Can I really get 4MB of memory, even with a 1.5MB combo card, 512K RAM card, and 2MB of RAM on the motherboard?

The answer is yes. It does require a simple pin-ectomy. You need to fool the hardware to think the 512K RAM card is in a slot that doesn't physically exist on the UNIX PC. For more information on how to do this, grab John Milton's HwNote06 from the archive sites.

Subject: 5.4. What dynamic memory chips can be used to upgrade a 3b1/7300?

The following is a cross-reference list of 256 by 1-bit dynamic memory chips that are usable for 3b1/7300 memory upgrades:

AM90C256-xx	AMD	Advanced Micro Devices
MB81256-xx	FUJ	Fujitsu
HM50256-xx	HIT	Hitachi
HY53C256-xx	-	Hyundai
P21256-xx	-	Intel
M5M4256P-xx	MIT	Mitsubishi
MCM6256-xx	MOT	Motorola
UPD41256-xx	NEC	NEC Technologies
MSM41256-xx	OKI	Okidata
KM41256-xx	-	Samsung
TMS4256-xx	TI	Texas Instruments
TMM4256C-xx	TOSH	Toshiba

The digits in xx are speed designations--common values are: xx=10 for 100ns; xx=12 for 120ns and xx=15 for 150ns.

Since it is now economically advantageous to obtain chips from third parties (private sales, auctions or hamfests), the manufacture's LOGO and identification stamped on the chip may be the only clues one has for a scavenger hunt. If the experimentalist is not familiar with the Manufacture's LOGOs, a perusal of a computer magazine (PC World, etc.) should help one to become familiar with most of them. Good hunting!

Subject: 5.5. Can I hook up a 3.5" 720K floppy drive to my UNIX PC?
How

about a 1.2MB or 1.44MB floppy drive? Can I run both the 3.5" drive and the 5.25" drive on my machine somehow?

Yes, to the 720K. No, to the 1.2MB and 1.44MB.

Putting a 720K 3.5" floppy drive is rather simple if you are just replacing the existing 360K 5.25" drive completely. In most cases it's a one-to-one swap, providing you can get the jumper setting

set correctly on the 3.5" drive.

You can run both drives, provided you make a mechanical switch (SPDT) to change the drive select between the 5.25" 360K internal drive and the 3.5" 720K (run externally). You need to make a cable to switch the pin 10 (FDRIVE0*) from one drive to the other. Drilling a hole in the case above the left fan grate is a suitable spot.

When you use the 720K drive, all you need to do is create an iv description file that has 80 cylinders instead of 40, and you get the full 800K (80 tracks, 10 sec/trk). Makes backups go faster!

Subject: 5.6. Can I put a larger hard disk drive in the UNIX PC?

Upgrading from a 10MB, 20MB, or 40MB to a 67MB drive requires a 3B1 power supply and a 3B1 case top (the 40MB and 67MB drive is full-height). There are other solutions to this -- you can get half-height drives that have seek times faster than the 80ms of the old 10MB and 20MB drives, and which have more disk space. So long as the drive has a ST506/MFM interface, has less than or equal to 1024 cylinders and less than or equal to 8 heads, the drive will work without *any* hardware modifications.

To upgrade to a disk with more than 8 heads and more than 1024 cylinders there are several approaches one can take. Gaining more cylinders is the easiest of upgrades: all you need to do is replace the WD1010 disk controller (which is socketed on the motherboard at location 21H) with the pin-for-pin compatible disk controller, WD2010. The WD2010 comes in several varieties, and all seem to work for the most part (WD2010A, WD2010B, etc.). The WD2010 is a very difficult part to come by -- Intel makes (or made) a pin-compatible version of the WD2010, the Intel 82064. There has been some discussion on Usenet that people haven't been able to get the WD2010 to work in their older revision motherboard UNIX PC or PC7300. These machines have a daughterboard that handles the disk circuitry, instead of the all-in-one chip that was replaced in the later models.

The operating system, from at least release 3.0, supported an unreleased motherboard revision, P5.1. The P5.1 revision level (like the P3...P5 that you see during the boot phase) includes some extra

features such as an extra disk head select (expanding to 16 read/write disk heads) and extra drive select (allowing expansion to two simultaneous hard disks). With the appropriate hardware modifications (all requiring some expertise in soldering and reading schematics), one could upgrade his motherboard to emulate this undocumented motherboard revision. These upgrades weren't released to the public by either CT or AT&T during the life-cycle of the product, but were later released and made public by several people in several different forms.

- o John Milton <jbm@megalinx.net> has a prebuilt circuit board that offers up to 4 hard disks and 2 floppy drives, but be forewarned that the operating system only supports the two hard disks and one floppy drive. If the operating system patches could be made, John's hardware would support it. He's offering a prebuilt and pretested board that can be wired into the motherboard. The motherboard wiring (jumpers) and soldering will have to be done as well before you can use John's board (this is not a plug in and go situation -- it requires some time to wire). The board and instructions currently cost \$75, but contact John for pricing. [As far as I know this is no longer available from John]

- o SSDL/ICUS Hard Disk Upgrade Version 2.0.
Gil Kloepfer, Jr (gil@limbic.ssdl.com) is currently (10Jan92) offering the second version of the popular ICUS do-it-yourself hard-disk upgrade kit. From the announcement, answering the question "What is it?" --
"It is a single-chip upgrade to the 3B1 that allows a second hard disk to be added and a 4th head select line to allow disks with more than 8 heads to be used. It is a superset of the functionality of the P5.1 PAL (ie. you don't need P5.1 to use the V2.0 PAL), and completely emulates all the functionality of the earlier ICUS V1.0 upgrade.

"This upgrade *DOES NOT* extend the number of cylinders (>1024). You must purchase a WD2010 to replace the WD1010

chip on the motherboard if you wish to do this."

Full information about availability and pricing can be obtained from v2upgrade@limbic.ssd1.com.

[This is also no longer available from Gil *See Below*]

[The following was received from Gil]

Just letting you know that the WWW page with the HD upgrade instructions and the PAL equations is up and operational. My apologies in advance that the formatting is basic and the diagrams are scanned-in and put up as GIF images. I'm sure those who need the info will be grateful anyhow.

The URL is: <http://www.gc2.kloepfer.org/~gil/hdinstr.html>

There is no other pointer anywhere around to this location,

so

if there is some kind of 3B1 web site, it should likely be referenced there.

Enjoy! If you see any glaring mistakes, send an email to "Gil Kloepfer Jr." <gil@gc2.kloepfer.org>.

- o FIELD P5.1 PAL upgrade. The P5.1 instructions were posted to unix-pc.general a long time ago, and are now archived on OSU in the P5.1.Z file. This requires a preprogrammed PAL chip to be made.

The largest disk which can be handled by the UNIX PC/3B1 is:

- o Motherboard revision P3...P5 (WD1010 disk controller)
8 heads x 1024 cyls x 16 sectors/track x 512 bytes/sector = 67.1MB
- o Motherboard revision P3...P5 (WD2010 disk controller)
8 heads x 1400 cyls x 16 sectors/track x 512 bytes/sector = 91.7MB
- o Motherboard revision P5.1 (modified) (WD1010 disk controller)
16 heads x 1024 cyls x 16 sectors/track x 512 bytes/sector = 134.2MB

- o Motherboard revision P5.1 (modified) (WD2010 disk controller)
16 heads x 1400 cyls x 16 sectors/track x 512 bytes/sector =
183.5MB

NOTE: 1400 cylinders is the #define HDMAXCYL in /usr/include/sys/gdisk.h -- although the WD2010 can support up to 2048 cylinders, the operating system cannot. Also, with the multiple hard disk upgrades you can have two disks that can be as large as the above sizes for the P5.1 modified motherboard revision.

FINAL NOTE ON THE WD2010: Some folks have reported troubles with their systems after installing the WD2010, far too many to discount as due to bad chips. Thad Floryan was irritated enough by this to take time away from sheep-herding and solve the problem. This problem occurs only on certain versions of the 3b1 motherboard. Short and sweet, quoting from Thad here:

"So, in overview, the complete and correct "DRUN patch" modification

to a 3B1 motherboard which does function with a WD1010 but does not

function with a WD2010 is:

1. separate and lift [13N] 74123's pins 1 and 2 from the motherboard
2. run a wire from the lifted [13N] pin 1 to [13M] 74F10 pin 7 (ground)
3. run a wire from the lifted [13N] pin 2 to [13K] 26LS32 pin 3
4. replace R63 per:
original: 6.81K, 1%, 1/4W
new value: 4.75K, 1%, 1/4W

Parts list:

1. new 74123 (reason for this is described below)
2. 4.75K, 1%, 1/4 W precision resistor
3. less than one foot of 30ga "wire-wrap" wire for the two patches"

And additionally:

"If your system is one that DOESN'T have the "DRUN Patch" then putting the WD2010 in your system will cause you a LOT of grief. From my observations on MANY systems, it's not always obvious whether the patch exists on one's system;

some factory runs implemented the patch along the lines of what I described in my posting last December [excerpted above], and some runs had the patch integrated into (presumably) new motherboard layouts where the legs of the 74123 chip are NOT sticking up in the air. If the resistor at R63 has the color code bands, then the presence of 4.75K 1% means the patch is already applied (the value of 6.81K 1% means you have the old data separator circuit which will NOT function properly with a WD2010); if the resistor is the RN05 type (no color bands) then you probably won't be able to read the value and you'll either have to remove it (to read the value) or forget the whole thing.

The ABSENCE of a capacitor at C252 is also a good clue one's motherboard has the DRUN patch already applied."

Subject: 6.0. Maintenance

This section answers general maintenance questions.

Subject: 6.1. How do I park the hard disk heads before moving the machine?

The Miniscribe and Hitachi disks used in the 40MB and 67MB machines parks the heads automatically (and loudly) when the power is turned off. (That's that *clunk* sound you hear when you hit the power switch.) Also note that many newer drives have auto-parking mechanisms -- check with your specific manufacturers for more information.

If your drive doesn't auto-park (many Seagates don't), or you want to make extra sure that the heads are in the parked position, then after the machine is shutdown insert the Diagnostics floppy disk and boot from it. Select "Park Disk Heads" from the Diagnostics menu.

Note that the older 7300 machines have 10 or 20MB disks which do not auto-park. If you're buying one used (especially at an auction

or a fair), you may want to bring along a diagnostics diskette to make sure the disk is okay.

Subject: 6.2. How do I open the case and get to the motherboard?

[Courtesy of Norman Yarvin:]

Three sets of screws hold the case together. The first set consists of two screws underneath the keyboard retainer posts, and three screws in the rear panel. (The keyboard retainer posts hold the keyboard to the base -- one is next to the socket for the keyboard plug. Note the seam around the top of the retainer posts. Remove the covers from the posts, and you'll find a screw inside each.)

When this set of screws is removed, the top (plastic) part of the case is attached to the bottom only by some cables, which have enough slack to let you take the top of the case off, tilt it backward, and rest it on its rear behind the machine. However, this is quite a difficult task. This is because it is hard to get the very front of the case up; the plastic is shaped in such a way as to catch on to the metal bottom somewhere. A bit of wrestling with the case is usually necessary here, and some people prefer to take the top part of the top part off (the next paragraph) before taking off the bottom part of the top part.

The second set of screws holds the top part of the case together. It consists of six screws, pointing upwards, which are found under the overhang of the case. The only time they really need to be removed is when replacing the fan. In addition to these screws, two or three plastic hook-and-tab latches in the front of the machine need to be released. The top of the case must be moved outward slightly (usually with a screwdriver or finger pressure) along the joint to the right of the floppy drive in order to release the catches. [The three plastic catches in the front are in the middle, and at about the 7th-to-10th louvers from the left and right of the case.]

Taking off the top of the case exposes only the floppy drive, the hard disk (underneath shielding) and the power supply. To get to the motherboard, you then have to unscrew the third set of screws --

three screws at the very front of the machine. The two latches on either side of the motherboard cover become obvious when one tries to lift up the panel, and are easily released. The motherboard cover pivots at the rear; it can be lifted up. To lift it up more than an inch, the power supply cable and the 10-pin video cable must be unplugged. After that the metal shielding can be lifted and slid along the tracks and then flipped up or removed. This exposes the motherboard. If you need to remove the motherboard shielding completely and the monitor assembly, you need to disconnect the floppy and hard disk cables from the motherboard (note the direction of the connectors, and when replacing them be very sure that the 20-pin and 34-pin connectors are seated correctly on the associated pins). If you have a PC7300 power supply and motherboard, your floppy drive power cable might also be connected to the motherboard. To remove the whole assembly, in that case, you'll need to remove the power connector from the back of the floppy drive as well.

Be careful when putting the top of the Unix PC/3B1 back on; a common cause for the machine not powering up after the cover is replaced is the 120VAC connectors (brown and blue wires crimped on) falling off the power input, or being pulled off by the hard drive as the case is closed. The green ground wire has a tendency to get caught in the fan blades (causing the fan not to start spinning when the machine is turned on) or caught in the case itself. Check that the fan is working after closing the case.

As always, use your head. Be careful when exposing any component of the Unix PC. There are many static sensitive components; ground yourself before poking around inside.

Subject: 6.3. Why does my fan sometimes speed up and slow down?
Should

I replace it?

The fans have been a problem with the UNIX PC in a lot of cases. What happens is the 12VDC fan is connected to a thermal switch that will run the fan motor faster when the machine is hot, and then slow it down when the machine cools. There have been occasions, however, when a fan goes from fast to slow, and then slows all the way to a dead stop. The fan tends to collect a lot of dust and dirt, and

sometimes when switching to the slow speed it goes so slow that it stops and doesn't have enough "umph" to start up again.

Gil Kloepper theorizes the reason for this happening is that the 12VDC fan is constantly running with too little current due to a resistor wired in series with the power supply when the thermal switch is in its normally open position. When the fan is beginning to malfunction, it will run subtly slower, but not enough to keep enough air moving through the machine. The thermal switch kicks-up the power, which causes the fan to move faster and cool the machine down until the switch kicks-out again. This cycling effect keeps going until the fan become excessively weak and clogged with dirt to where it eventually stops working permanently. But he goes on to add that, in any case, "I don't think it's just dirt."

The next stage is the machine overheats, the power supply cuts out, and the machine powers down, then it powers up, and down, and up. If you are lucky, you catch this before major damage occurs or you take preventive measures beforehand. Most of the time the power supply gets so hot, it warps the plastic case above it. This is a sure sign that a UNIX PC has had a "meltdown" before.

What can you do? Well, you can replace the 12VDC fan with a 3" 120VAC fan. The 120VAC fans are more robust, they produce more air current (~34CFM normally) and don't draw on the power supply any. One drawback is that they are noisier. Radio Shack has an appropriate 120VAC fan for \$16.95, cat. no. 273-242.

Some people can go years or forever without ever having a problem, but it just takes that one day that you aren't around and the machine goes into "meltdown" and then you'll be assured some damage somewhere.

Subject: 6.4. Why has my clock stopped?

Your battery is dead. On the UNIX PC motherboard there is a 3.0 VDC lithium battery which keeps the real-time clock operating. Unfortunately, the battery is soldered to the motherboard in most cases. It's either the round cylindrical canister type, or more commonly the flat disc-shaped battery. A suitable replacement can be

purchased at Radio Shack (BR-2325), but you'll need to get the disc battery holder. If you desolder the battery from the motherboard, solder in the holder, future replacement of this battery will be much simpler. If you are nervous about touching a soldering iron to your precious machine, ASCRC will do it for you (see above).

Subject: 7.0. Failures

This section answers question about failures.

Subject: 7.1. What can I do when I turn on my UNIX PC and all I see is a "green screen"?

This symptom crops up in a lot of UNIX PC's. Generally, the machine can be revived with only little fuss. Open the machine down to the motherboard. Carefully reseal all the socketed chips, especially the 68010 CPU. Blow all of the accumulated dust out of the machine (vacuuming is not recommended due to the possibility of static discharge). 7 times out of 10 the machine will boot afterwards. If the machine still doesn't boot, it could be something more serious. Check with the ASCRC on how you can go about getting the machine repaired.

Subject: 7.2. What can I do when I turn on my UNIX PC and I have no video?

The first thing you could do is check the brightness control. After you are sure that it's not that, the problem generally goes away by replacing the power supply. If you don't have a spare one, try asking on Usenet, or deal with ASCRC.

Subject: 7.3. What can I do when I get lots of FDERRs when writing/formatting a floppy?

Jon H. LaBadie, Boyd Ostroff, and Perry Miller have suggested that there could be accumulated dust blocking the write protect apparatus on the floppy drive. The easiest solution for this is to get a can of compressed air, or blow real hard into the floppy aperture several times. This generally will remove the dust or dirt from the area, and hopefully will solve the problem. (With the light being blocked, the floppy drive is considered permanently write protected!)

If the problem persists after you follow the simple solution, you might have to open the machine, remove the floppy drive, and perform a closer examination. If all else fails, a standard TEAC 360K floppy drive is a one-for-one replacement.

Subject: 7.4. Why does rn fail with "Can't open /dev/tty" from the built-in modem?

The problem is a line in the term.c file. The lines that have to be changed for rn to work are:

Before change:

```
[...]
devtty = open("/dev/tty",O_RDONLY);
if (devtty < 0) {
    printf(cantopen,"/dev/tty") FLUSH;
    finalize(1);
}
fcntl(devtty,F_SETFL,O_NDELAY);
[...]
```

After change:

```
[...]
devtty = open("/dev/tty",O_RDWR);      /* changed for
UNIX PC */
if (devtty < 0) {
```

```

        printf(cantopen, "/dev/tty") FLUSH;
        finalize(1);
    }
    /* fcntl(devtty, F_SETFL, O_NDELAY);    /* changed for
UNIX PC */
    [...]

```

This change is required because the /dev/ph* devices require DATA connections to be opened with O_RDWR, so changing the O_RDONLY (or, in some versions of rn, the constant 0) to O_RDWR will solve your problems. Note that these changes are also required for rn-derived programs like trn.

Subject: 7.5. Can I connect my Starlan board to an Ethernet?

No, you cannot connect Starlan to an Ethernet network, at least not directly. Starlan, or in the case of the UNIX PC, Starlan-1 (1BASE5) is a 1Mbps (megabits/sec) network over twisted-pair wire. The URP protocol is used to communicate over Starlan-1 on the UNIX PC. The newer Starlan standard is Starlan-10 (10BASE2) and is 10Mbps which is more *like* Ethernet. The protocol used is the ISO/OSI standard, and therefore its interconnectability is increased. However, this is not compatible with the UNIX PC version. There is an expensive item that AT&T sells, called the Starlan 1:10 Bridge, which connects the two networks together if this is a necessity, but plan to spend around \$4,500 for the convenience. (AT&T PEC Code: STARLAN 1:10 BRIDGE 2611-005.) According to AT&T Stargroup documentation, there is software available to interconnect Starlan-10 hardware to Ethernet using IEEE 802.3, TCP/IP protocol, this of course in conjunction with the Bridge could connect Starlan-1 via the Starlan 1:10 Bridge to Starlan-10, and then to Ethernet, a roundabout way, but presumably possible.

If you want to connect your UNIX PC to a *real* Ethernet, you'll need to hunt down the AT&T UNIX PC Ethernet board. This board runs a version of the TCP/IP drivers developed by Wollogong. The board will require the proper cables, as well as a transceiver. This increases the cost of Ethernet interconnectability. The Wollogong TCP/IP drivers are an older version not supported by Wollogong anymore. It's generally acknowledged that there are many bugs, and

the throughput of the board is nowhere near what Ethernet should be getting. (People report that throughput with the Starlan-1 board was better than the TCP/IP Ethernet board, which shouldn't be the case.)

Thanks to the hard work of Roger Florkowski (cs.utexas.edu!taliesin!roger), UNIX PC Starlan users don't have to be limited with just uucp'ing and cu'ing over the network. He has ported and created a bunch of BSD network utilities (r* commands). His package, (bsdslan.cpio.Z on OSU-CIS) allows one to do remote tape operations, remote copies, and remote shell commands.

Subject: 7.6. Can I run SLIP (Serial Line Internet Protocol) on my UNIX PC?

So far there hasn't been anyone who has ported a SLIP device driver. That would be the optimal solution, but in the interim we do have an answer for those who want to run SLIP.

There is the KA9Q/W9NK TCP/IP Version 890421.1 available for the UNIX PC. Thanks to Phil Karn (the original developer), Gary Sanders, and Rob Stampfli, the package supports SLIP which in theory, over a modem or direct serial line (preferably 9600 baud or higher) one could use to connect to an Internet machine allowing Dialup/Direct SLIP logins. With the pseudo-tty driver (pty) you can have multiple TELNET sessions (even on the UNIX PC side). Built into the "net" package is FTP, TELNET, FINGER, SMTP, and others.

KA9Q is available from OSU-CIS, Gary Sander's BBS or via anonymous uucp login on Rob's UNIX PC:

```
kd8wk Any ACU 2400 16147598597 in:--in: uucp word:
anonymous
```

To obtain the net source, issue the following uucp command:

```
$ uucp kd8wk!~/pub/netsrc.cpio.Z /usr/spool/uucppublic
```

To obtain an executable for the AT&T 7300, enter the following:

```
$ uucp kd8wk!~/pub/netexe.7300.Z /usr/spool/uucppublic
```

System Name: N8EMR
Phone: 614-895-2553 (19.2K Trailblazer, 2400, 1200)
Login: hbbs
Data Settings: 8 Bits, NO Parity, 1 Stop Bit
Times: 24hrs

Subject: 7.7. What are the consequences of "fsck -s" (salvaging the freelist)?

Jim Adams sent some information regarding the uses (and dangers) of salvaging the freelist using the fsck(1M) command.

fsck(1M) provides a method of salvaging and reconstructing the freelist maintained by the UNIX filesystem. It is dangerous to haphazardly do anything with the filesystem, as well as just reconstructing the freelist. If the filesystem isn't in a good state, it's possible that the freelist could be further damaged by just salvaging it. fsck(1M) will salvage the freelist when necessary, or when the question "SALVAGE (Y/N)?" is answered "yes".

Jim has said that the alternative method, fsck -S, should be used if you wish to salvage the freelist. The salvage will only be done if the filesystem is properly constructed, and nothing damaging could occur by its reconstruction. If errors are found during the fsck phases, other than errors like "POSSIBLE FILE SIZE ERROR I=nnn" (which occurs from sparse files, also known as files with holes in them) the salvage will not be done.

fsck(1M) is designed to be run on a mounted root filesystem, so long as the block device is used and the system is in a quiet state. fsck(1M) can be run on the raw/character device when the filesystem isn't mounted, and this is generally much faster. fsck(1M) will automatically reboot the system without sync'ing, if the "mounted" root filesystem was modified, just as you should (since the in-core image of the filesystem would be different). There is no "re-mount" facility on the UNIX PC, otherwise the root filesystem could just be remounted.

Another suggestion made was to run "fsck -D" to check directories for bad blocks. This takes longer, but is considered worth it. (fsck -D is similar to the MSDOS CHKDSK facility.)

Subject: 7.8. What does the "-s" option to dismount do?

It should never be used. It's an historical option (as the manual notes), used to un-mount the "Syquest" external drive. This unfortunately causes the first hard disk to RECAL if you don't have the second disk upgrade. With the second disk upgrade it improperly un-mounts all the filesystems, apparently not handling the /etc/mnttab file correctly for all the partitions on the second disk.

In many people's opinions, it's much safer to use multiple /etc/umount commands to unmount multiple partitions. This works for all cases, and there is no second guessing on what the command is actually doing. If you want to mimic the operation of dismount, you can easily issue the "sync" command before the "umount" command. As far as clearing the "pulled-flag" as the manual indicates, many have never had any problem just using the /etc/umount command (on floppies as well as my other partitions and hard disk)

Subject: 7.9. How do I identify what motherboard revision I have?

[Courtesy of Thad Floryan:]

The board "schematic" number (in copper) near the left rear corner is quite useful when referencing one of the three sets of schematics in the Reference Manual. Often the copper number is obscured by a white sticker bearing a different number. BOTH sets of numbers "almost" uniquely identify your machine. Peel the white sticker off and reapply it flanking the copper number.

The copper board number will (usually) be one of 60-00222-00, 60-00225-00 or 60-00230-00. If yours is 60-00216-00 you have my sympathy (the connector to the floppy drive may be pin-for-pin reversed from that found on all other motherboards, and you probably

have the daughterboard above the motherboard). The white paper sticker will bear a printed number something like "60-00237".

The OTHER "number" to write down for future reference is the "REV.n" value on the white sticker normally found near the volume control sliding pot; this will be something like "REV.C", "REV.F", "REV.J", etc.

The combination of the two sets of reference designators seems to uniquely identify all 3B1 systems I've seen. And note that a "REV.C" on a "225" board is NOT the same as a "REV.C" on a "230" board. And, before you ask, I have NOT been able to determine precisely what each "REV.n" represents and I doubt that information still exists even at CT (now UNISYS/NCG).

Subject: 7.10. How can the monitor fail?

[Courtesy of Rob Stampfli:]

I have witnessed the loss of more than a few Unix-PC monitors to a phenomenon where the right side of the screen becomes increasingly compressed (nonlinear), at an exponentially increasing rate, until the monitor fails completely. Usually, this occurs over a period of months, and it usually is observed after the monitor has been removed from service, stored, then placed back into service.

[Rob notes a particular case which was diagnosed by his colleague, Harry Maddox, BEFORE the monitor failed completely. He writes, "We believe that an actual failed monitor would take out an associated transistor and the flyback transformer, unless the monitor is fused, presenting a much more difficult problem to fix." The particulars:]

A 4.7 uF 25V non-polarizing electrolytic capacitor (C411) is bad. C411 develops a high internal resistance and gets quite hot, which further causes it to deteriorate. It may explode -- use caution. C411 is located between L402 and T401 inside the monitor proper. The value and voltage rating of this capacitor is not critical, "ESR" [equivalent series resistance] is however.

Replace C411 with a mylar capacitor, 4-6 uF @ 25V or more, such as AT&T 535GA (4.22 uF @ 100V) or equivalent. Mount on end with insulation on top lead. Dress away from adjacent parts.

Replace CAP ASAP before further damage is done. Replace fuse if blown. Check TR402 for Collector to Base shorts if set was not working. Also D403 for short.

Procedure:

1. Remove CRT Cover (2 screws in back).
2. Remove Speaker Assembly (2 screws).
3. Remove RF Tape from bottom cover (shield). One tape is hidden at front of bottom shield.
4. Remove bottom shield.
5. A small part (I think a thermal sensor) is found on the bottom of the PC board just under C411. It is covered with black tape. Remove the tape and bend sensor out of the way.
6. Remove C411 and replace with Mylar capacitor, 4-6 uF, 100V.
7. Replace sensor and tape.
8. Reassemble monitor.

Note: the bottom shield is tricky to remove and replace if you don't unmount the monitor from its swivel mount, but it can be done. If monitor has failed completely, then check fuse (if present), TR402 (C-B short), and D403 for a short.

Subject: 8.0. Mysteries

This section describes some mysteries of the 3b1/unixpc.

Subject: 8.1. What are the LED's left side of the machine for?

This is from John Milton's HwNotes series #1.

0 RED: This is the "user LED". It can be turned on and off

with the `syslocal(2)` call. It is not used by any existing applications.

- 1 GREEN: This is the one most people get wrong. This LED toggles every time there is a process context change, and is cleared on the whole second.
- 2 YELLOW: This is the idle LED. When it is on, there are no processes in the ready to run state.
- 3 RED: Heart beat LED. This is toggled on the whole second.

This and other interesting information is available in the HwNote series 1-15 that are archived on OSU.

Subject: 8.2. What's `/etc/update`? What does it do?

`/etc/update` is an antiquated command which is no longer necessary to be used. It is not a shell script, but could easily be one. The executable basically takes one argument, the number of seconds to sleep, or defaults to 30 (I believe). It then sleeps that interval and then issues a `sync(2)` system call. This is a continuous process -- it detaches itself from the current tty with the `setpgrp(2)` call, and closes all file descriptors 0, 1, and 2 (stdin, stdout, and stderr). It was to be run by `/etc/init`, as a boot-time process, and was to remain there for the duration of the machine's uptime.

Subject: 8.3. Why did the time display at the top of the screen go away?

The time at the top of the display is provided by the program `/etc/smgr`, which combines the functionality of `cron`, `/etc/update`, a time display, plus maybe a few other mysterious things. Equally mysterious is its propensity to occasionally die, leaving a stipple pattern in its place.

As `smgr` does its `cron` processing, it logs what it is doing in `/usr/adm/cron.log`. So that this file does not get too large, `smgr` responds to signal 17 (`SIGUSR2`) by truncating the log file. Unfortunately, `smgr` will exit if the log file is missing.

If you want to make sure this does not happen anymore, edit /etc/cleanup.wk (the script that runs weekly and sends smgr the clean up signal) and add

```
touch /usr/adm/cleanup.wk
```

before the script sends the signal with "kill -17 \$PID"

Restarting smgr is thankfully unmysterious; become root and type "/etc/smgr".

Subject: 8.4. How do I stop that darn double-ESC mode on console windows?

Some programs that use the TAM (Terminal Access Method) library can leave the keyboard (really the shell window) in a strange state after leaving. This state is characterized by each press of the ESC key injecting two 0x1b characters into the input stream. This generally doesn't help anybody -- vi beeps too much, emacs is unusable, etc. The fix is to issue the following ioctl from a C program:

```
#include <sys/window.h>
ioctl(0, WIOCSESC, 0); /* to turn off double-esc
mode */
```

If you really want it back again, do the following:

```
ioctl(0, WIOCSESC, 1); /* to turn on double-esc mode
*/
```

Subject: 8.5. What do I do when the machine hangs at the boot message?

```
Version #.##x
Real memory      = #####
Available memory = #####
Main board is ####
```

9 times out of 10 the /etc/inittab file is either deleted, corrupted, or truncated because of some filesystem damage during a system crash.

The machine will hang there at that Main board prompt forever since /etc/init is looking for the inittab file. This is where it is handy to have a floppy filesystem disk with saved copy of /etc/inittab on it. Boot the system using the "Floppy Boot Disk" (Disk 2 of ##), then insert your copy when it asks for the Floppy Filesystem Disk. Interrupt the script with to get a "#" prompt when the first question appears. On your floppy, if you followed the previous advice, is /etc/inittab.save, which can be happily copied to the /mnt/etc/inittab file when the hard disk root filesystem (/dev/fp002) is mounted from the floppy as /mnt.

```
# umount /dev/fp002
# fsck -s /dev/rfp002
# mount /dev/fp002 /mnt
# ls -l /mnt/etc/inittab
```

If the file isn't there, or is corrupted:

```
# cp /etc/inittab.save /mnt/etc/inittab
# sync
# umount /dev/fp002
# sync
# sync
# reboot
```

The other one time (out of 10), the /etc/inittab file is okay but there is a /etc/utmp.lck file on the system. This happens in very rare race conditions involving the pututent(3C) routines. Removing this file and rebooting will generally recover the system.

Subject: 8.6. How can the UNIX PC be made more secure?

The best way to not worry about security is to not allow users on your machine that aren't trusted. Especially users that have shell access.

There are several serious problems with the UNIX PC's software, specifically the User Agent (UA). The UA (the windowing

environment, also known as the Office environment) has some serious security problems. The best solution, of course, would be to remove the entire UA system from your machine. This isn't the easiest procedure (since there are lots of programs scattered all around the disk that are tied into the UA) and probably not the most desirable for some novice users. What's so wrong with it? Well, look in your trusty manuals, in section 4. The manual UA(4) states (talking about UA configuration files):

[...] (page 4)

EXEC and SH have a number of variations, which are used depending

on the intelligence of the process being invoked.

[...]

The variations are specified via option characters as follows:

-n	Run the process without a window
-w	Run the process without waiting
-d	Run the process in a dimensionless window
-p	Run the process with superuser privileges

[...]

The "-p" option being the problem. For a little experiment to show to a security conscious user (who still likes the UA), start out in a non-privileged user account.

First create a file in your home directory called "Office" with the following lines:

```
Name=Super User UNIX
Default = Run
Run=EXEC -pwd $SHELL
```

Then type:

```
$ exec /usr/bin/ua
```

Select the new object that you just created ("Super User UNIX") and then at the "#" prompt type "id" for the effect.

```
# id
uid=0(root) gid=0(root)
```

OK, convinced?

If you really *LOVE* the UA, you can do something about this. Protect the programs /usr/lib/ua/uasetx and /usr/lib/ua/uasig so they are not executable by "other" and only executable by a "trusted" group.

```
-rwsr-x---  1 root      trusted    4268 Jan  1  1970 /usr/lib/ua/
uasetx
-rwsr-x---  1 root      trusted    2068 Jan  1  1970 /usr/lib/ua/
uasig
```

Another problem involves UA mail-handling. Send yourself some electronic mail. Nothing elaborate is necessary.

```
$ mail myself < /dev/null
```

Select the [mailbox] icon when it comes up, and then when you're in /bin/mail, at the "?" prompt type "! /bin/sh". Poof! Root shell.

```
# id
uid=0(root) gid=0(root)
# pwd
/etc/lddrv
```

This last problem can easily be corrected with Lenny Tropiano's "email" program that is archived on OSU as "email.sh.Z". That program sets the correct user id, group id, and home directory.

The other things to look for are covered in lots of books on UNIX security: directories with 777 permissions (world writable), setuid programs that aren't very security conscious, etc.

Subject: 8.7. How do I access the expert menus in the diagnostics?

The diagnostic floppy has a mode in it for the more experienced system tester. This mode allows the user to skip the menus and just specify the test to run. The diagnostic tests can be run repeatedly for testing intermittent hardware. The diagnostic

output can be sent to a parallel printer for review later, and also for unattended testing (since the output can scroll off the screen rather easily).

To enter the expert mode, boot the diagnostic disk and type in "s4test" at the first menu prompt. The result is the following prompt:

```
expert>
```

From there you can type "?" for a "semi-verbose" command syntax, and a list of many of the tests. For more detail on what tests and subtests you can do, grab a nice file by Craig Votava (cmv@ihlpf.att.com) called "s4test.info.Z" from the OSU Archives.

Subject: 9.0. Credits

The following are just a few of the folks who made this list possible.

Apologies to those who may have been missed.

James Warner Adams	< adams@ucunix.san.uc.edu >
Brad Bosch	< brad@i88.isc.com >
Brian Botton	< botton@iexist.att.com >
David Brierley	< dave@galaxia.network23.com >
Brant Cheikes	< brant@manta.pha.pa.us >
Alex S. Crain	< alex@umbc3.umbc.edu >
Mark Dapoz	<...!cs.utoronto.edu!hybrid!mdapoz>
Mike "Ford" Ditto	< ford@omnicron.com >
Roger Florkowski	<...!cs.utexas.edu!taliesin!roger>
Thad Floryan	< thad@btr.com >
Darren Friedlien	< darren@bacchus.bacchus.com >
Mark Galassi	< rosalia@max.physics.sunysb.edu >
Robert Granvin	< rjg@sialis.com >
Emmet P. Gray	<...!uunet!uiucuxc!fthood!egray>
Jan Isley	<...!gatech!bagend!jan>
Karl Kleinpaste	< karl@cis.ohio-state.edu >
Gil Kloepfer, Jr	< gil@limbic.ssd1.com >
Jon H. LaBadie	<...!princeton!jonlab!jon>

John McMillan	< jcm@pegasus.att.com >
Perry Miller	< pbm@cup.portal.com >
John Milton	< jbm@megalinx.net >
Scott H. Mueller	< scott@zorch.SF-Bay.ORG >
Boyd Ostroff	< ostroff@oswego.oswego.edu >
Arnold Robbins	< arnold@skeeve.ATL.GA.US >
Gary W. Sanders	< gws@n8emr.nitetech.com >
Rob Stampfli	< res@colnet.cmhnet.org >
Lenny Tropiano	< lenny@icus.ICUS.COM >
Craig Votava	< cmv@ihlpf.att.com >
Norman Yarvin	< yarvin-norman@cs.yale.edu >
Chris Lewis	< clewis@ferret.ocunix.on.ca >

--

John B Bunch	AT&T	I don't want the world, I just want your
9404 N. Church, APT 206	UnixPC	half.... -TMBG
Parma Hgts., OH 44130	IBM PC	jbunch@nyx.net
(440) 887-9310	KB2SIV	jbunch@nyx10.nyx.net

--

John B Bunch	AT&T	I don't want the world, I just want your
9404 N. Church, APT 206	UnixPC	half.... -TMBG
Parma Hgts., OH 44130	IBM PC	jbunch@nyx.net
(440) 887-9310	KB2SIV	jbunch@nyx10.nyx.net

[Part1](#) - [Part2](#) - [MultiPage](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions somewhat related to this FAQ:

- [how can i find a password](#) by bety (9/9/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
jbunch@nyx1.nyx.net (John B. Bunch)

Last Update October 03 2003 @ 00:11 AM

comp.sys.3b1 FAQ part2

Archive-name: 3b1-faq/part2

Version: \$Id: 3b1-faq-part2,v 2.5 2000/09/05 19:17:48 jbunch

| Answers to some frequently asked questions about the AT&T UNIX PC, |
as well as some frequent problems, hints, and solutions.

| Make a Hard Copy on the FAQ *NOW*, it probably wont be readable if |
it is on your machine when you *NEED* it.

[\$Revision: 2.5 \$ \$Date: 00/09/05 19:17:48 \$]

Send updates to 3b1-faq@nyx.cs.du.edu.

Part 2 of 2

Section Contents

- [News Headers](#)
- [0.2. Table of Contents for part 2 of the faq.](#)
- [5.0. Upgrading continued.](#)
- [5.3. Can I really get 4MB of memory, even with a 1.5MB combo card, 512K RAM card, and 2MB of RAM on the motherboard?](#)
- [5.4. What dynamic memory chips can be used to upgrade a 3b1/7300?](#)
- [5.5. Can I hook up a 3.5" 720K floppy drive to my UNIX PC? How about a 1.2MB or 1.44MB floppy drive? Can I run both the 3.5"](#)
- [5.6. Can I put a larger hard disk drive in the UNIX PC?](#)
- [6.0. Maintenance](#)
- [6.1. How do I park the hard disk heads before moving the machine?](#)
- [6.2. How do I open the case and get to the motherboard?](#)
- [6.3. Why does my fan sometimes speed up and slow down? Should I replace it?](#)
- [6.4. Why has my clock stopped?](#)
- [7.0. Failures](#)
- [7.1. What can I do when I turn on my UNIX PC and all I see is a "green screen"?](#)

- [7.2. What can I do when I turn on my UNIX PC and I have no video?](#)
- [7.3. What can I do when I get lots of FDERRs when writing/formatting a floppy?](#)
- [7.4. Why does rn fail with "Can't open /dev/tty" from the built-in modem?](#)
- [7.5. Can I connect my Starlan board to an Ethernet?](#)
- [7.6. Can I run SLIP \(Serial Line Internet Protocol\) on my UNIX PC?](#)
- [7.7. What are the consequences of "fsck -s" \(salvaging the freelist\)?](#)
- [7.8. What does the "-s" option to dismount do?](#)
- [7.9. How do I identify what motherboard revision I have?](#)
- [7.10. How can the monitor fail?](#)
- [8.0. Mysteries](#)
- [8.1. What are the LED's left side of the machine for?](#)
- [8.2. What's /etc/update? What does it do?](#)
- [8.3. Why did the time display at the top of the screen go away?](#)
- [8.4. How do I stop that darn double-ESC mode on console windows?](#)
- [8.5. What do I do when the machine hangs at the boot message?](#)
- [8.6. How can the UNIX PC be made more secure?](#)
- [8.7. How do I access the expert menus in the diagnostics?](#)
- [9.0. Credits](#)

[Part1](#) - [Part2](#) - [Single Page](#)



[Current Top-Rated FAQs](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
jbunch@nyx1.nyx.net (John B. Bunch)

Last Update October 03 2003 @ 00:11 AM

comp.sys.3b1 FAQ part1

Archive-name: 3b1-faq/part1

Version: \$Id: 3b1-faq-part1,v 2.5 2000/09/05 19:17:48 jlbunch

| Answers to some frequently asked questions about the AT&T UNIX PC, |
as well as some frequent problems, hints, and solutions.

| Make a Hard Copy on the FAQ *NOW*, it probably wont be readable if |
it is on your machine when you *NEED* it.

[\$Revision: 2.5 \$ \$Date: 00/09/05 19:17:48 \$]

Send updates to 3b1-faq@nyx.cs.du.edu.

Part 1 of 2

Section Contents

- [News Headers](#)
- [0.1. Table of Contents for part 1 of the faq.](#)
- [1.0. General](#)
- [1.1. What exactly are the AT&T UNIX PC, PC7300, and 3B1?](#)
- [1.2. What is the operating system? Its origins?](#)
- [1.3. What are the "OSU Archives"?](#)
- [1.4. Who supports these machines? Are there any user groups?](#)
- [1.5. Where can I get my machine serviced or fixed?](#)
- [2.0. Software](#)
- [2.1. How do I get my free Personal Calendar program?](#)
- [2.2. What is "THE STORE!" and how can I access it?](#)
- [2.3. Is there any GNU software available?](#)
- [2.4. Is the X Window system available for the UNIX PC?](#)
- [2.5. What's MGR?](#)
- [2.6. How can I get a full 360kB when I format a MS-DOS floppy on the UNIX PC?](#)
- [2.7. Are there any other utilities for fiddling with MS-DOS floppies?](#)

- [2.8. What commercial software was available for the UNIX PC?](#)
- [2.0. Software Development](#)
- [3.1. Can I use the GNU C compiler in place of the hard-to-find development set?](#)
- [3.2. What do I with old object-file archives?](#)
- [4.0. Administration](#)
- [4.1. How do I restore from a backup when one of the floppies is bad?](#)
- [4.2. How can I make a floppy-disk-based UNIX for fsck'ing the hard drive?](#)
- [4.3. How can I get the machine to ask the device and program to boot from?](#)
- [4.4. How do I get multiple login windows?](#)
- [4.5. What the heck is a +IN suffix on a file?](#)
- [4.6. What do the HDERR \(FDERR, or TPERR\) messages in /usr/adm/unix.log mean?](#)
- [4.7. Why are the header files missing after an install of the Development Set?](#)
- [4.8. Why is the machine is booting over and over?](#)
- [4.9. Is HoneyDanBer UUCP available to replace the stock uucp software?](#)
- [4.10. Why doesn't the On-Board Modem \(OBM\) work with some other modems?](#)
- [4.11. How do I get my on-board modem to be a dial-out-only modem?](#)
- [4.12. Does the on-board modem support 2400 bps?](#)
- [4.13. Why aren't the lpadmin, accept, and reject commands working right?](#)
- [4.14. Why are all the jobs on the printer always followed by a formfeed?](#)
- [4.15. Why can't I send bitmapped images to the printer correctly?](#)
- [4.16. How do I configure a Hayes compatible external modem on the UNIX PC?](#)
- [4.17. Any tips on building Cnews?](#)
- [4.18. What are lipc and nipc, and how can I use nipc instead of lipc?](#)
- [5.0. Upgrading](#)
- [5.1. What third-party hardware is available?](#)
- [5.2. Can I put a 68881 math coprocessor in my machine?](#)

Part1 - [Part2](#) - [Single Page](#)



[Current Top-Rated FAQs](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
jbunch@nyx1.nyx.net (John B. Bunch)

Last Update October 03 2003 @ 00:11 AM

Your question will be published for anyone to respond to and rate. Your question will not be displayed immediately. If you'd like to rate the responses or benefit from positive ratings, please create a new account or login into an existing account below. Your question should be complete enough so that it can stand on its own - don't leave out the subject matter. Do not ask for answers via email. FAQS.ORG reserves the right to edit your question as to improve its clarity.

Your name or nickname:	
If you'd like to create a new account or access your existing account, put in your password here:	
Is your question related to this FAQ?	<input type="radio"/> Yes <input type="radio"/> Somewhat <input type="radio"/> No
Your question:	

[Check spelling](#)



Top Rated FAQ Index

[Internet RFC
Index](#)

[Usenet FAQ
Index](#)

[Other FAQs](#)

[Documents](#)

Search

► [Search
FAQs](#)

Quick FAQ Search

This is a list of FAQs receiving very high ratings from their readers:

- [Audio FAQ](#)
- [Beginner Motorcycle Info](#)
- [FAQ: How do spammers get people's email addresses?](#)
- [Tattoo FAQ](#)
- [Hardgainer Bodybuilding & Weightlifting FAQ](#)
- [Martial Arts FAQ](#)
- [Digital Cameras FAQ](#)
- [Cats FAQ](#)
- [Dog Breed FAQ](#)
- [Running Beginners' FAQ](#)
- [Computer Virus FAQ](#)

- [C++ FAQ](#)
- [Neural Net FAQ](#)
- [Web Hosting FAQ](#)
- [Autos/Gasoline FAQ](#)
- [Electrical Wiring FAQ](#)
- [Client/Server FAQ](#)
- [Chocolate FAQ](#)
- [Computer Graphics Algorithms FAQ](#)
- [Compression FAQ](#)
- [Rosacea FAQ](#)
- [Puerto Rico FAQ](#)
- [Quaker Religion FAQ](#)
- [Bipolar Disorder FAQ](#)
- [TCP/IP FAQ](#)
- [Classical Guitar FAQ](#)
- [Csh Programming Considered Harmful](#)
- [UNIX shell differences and how to change your shell](#)
- [Chemistry FAQ](#)
- [Sudden Infant Death Syndrome \(SIDS\) misc.kids FAQ](#)
- [FAQ: The Annotated "American Pie"](#)
- [Gambling FAQ](#)

Reader questions and answers:

- [FAQ-Related Q&As](#)
- [General Q&As](#)
- [Answered Questions](#)

[Not finding the answers you need?](#)
[Submit your question for others to see.](#)

[FAQs A-D](#)

[FAQs J-P](#)

[FAQs D-J](#)

[FAQs P-Z](#)

© 2003 FAQS.ORG. All rights reserved.



AudioFAQ

- **AudioFAQ/AmbisonicFAQ**

Subject: [Ambisonic Surround Sound FAQ, v2.8](#)

Maintainer: mleese@omg.unb.ca

FAQ Home Page: http://members.tripod.com/martin_leese/Ambisonic/faq_latest.html

Last Posted: **09 Sep 2003 10:50:18 GMT**

Last-modified: **21 January 1998**

Posting-Frequency: **monthly**

Version: **2.8**

- **AudioFAQ/part1**

Subject: [FAQ: rec.audio.* Intro 2/99 \(part 1 of 13\)](#)

Maintainer: neidorff@ti.com

Last Posted: **09 Sep 2003 10:51:08 GMT**

Last-modified: **1999/11/19**

Version: **2.15**

- **AudioFAQ/part10**

Subject: [FAQ: rec.audio.* Mail Order 2/99 \(part 10 of 13\)](#)

Maintainer: neidorff@ti.com

Last Posted: **09 Sep 2003 10:51:12 GMT**

Last-modified: **2002/11/30**

Version: **2.16**

- **AudioFAQ/part11**

Subject: [FAQ: rec.audio.* Networking 2/99 \(part 11 of 13\)](#)

Maintainer: neidorff@ti.com

Last Posted: **09 Sep 2003 10:51:13 GMT**

Last-modified: **2003/08/01**

Version: **2.16**

- **AudioFAQ/part12**

Subject: [FAQ: rec.audio.* The Press 2/99 \(part 12 of 13\)](#)

Maintainer: neidorff@ti.com

Last Posted: **09 Sep 2003 10:51:13 GMT**

Last-modified: **2002/02/17**

Version: **2.15**

- **AudioFAQ/part13**

Subject: [FAQ: rec.audio.* Misc 2/99 \(part 13 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:13 GMT**

Last-modified: **1999/11/19**

Version: **2.15**

- **AudioFAQ/part2**

Subject: [FAQ: rec.audio.* Systems 2/99 \(part 2 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:08 GMT**

Last-modified: **2020/09/04**

Version: **2.16**

- **AudioFAQ/part3**

Subject: [FAQ: rec.audio.* Sources 2/99 \(part 3 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:09 GMT**

Last-modified: **2000/12/14**

Version: **2.15**

- **AudioFAQ/part4**

Subject: [FAQ: rec.audio.* Amplifiers 2/99 \(part 4 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:09 GMT**

Last-modified: **2003/04/07**

Version: **2.16**

- **AudioFAQ/part5**

Subject: [FAQ: rec.audio.* Speakers 2/99 \(part 5 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:10 GMT**

Last-modified: **2000/02/02**

Version: **2.15**

- **AudioFAQ/part6**

Subject: [FAQ: rec.audio.* Rooms 2/99 \(part 6 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:10 GMT**

Last-modified: **2002/08/29**

Version: **2.15**

- **AudioFAQ/part7**

Subject: [FAQ: rec.audio.* Recording 2/99 \(part 7 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:11 GMT**

Last-modified: **2003/1/22**

Version: **2.16**

- **AudioFAQ/part8**

Subject: [FAQ: rec.audio.* Wire 2/99 \(part 8 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:11 GMT**

Last-modified: **2000/4/12**

Version: **2.15**

- **AudioFAQ/part9**

Subject: [FAQ: rec.audio.* Retail 2/99 \(part 9 of 13\)](#)

Maintainer: **neidorff@ti.com**

Last Posted: **09 Sep 2003 10:51:12 GMT**

Last-modified: **1999/11/19**

Version: **2.15**

- **AudioFAQ/pro-audio-faq**

Subject: [rec.audio.pro FAQ \(v 0.9\)](#)

Maintainer: gabe@pgm.com (Gabe M. Wiener)

Last Posted: **22 Dec 1996 10:35:06 -0500**

Last-modified: **1996/06/25**

Version: **0.9**

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#) | [Cities](#)]

PLEASE NOTE:

The official FAQ Home Page is available by selecting the link listed as the 'FAQ Home Page'.

The maintainers of this archive are **NOT** the authors or maintainers of the individual FAQs. To correct or contribute to these documents, send email to the specific FAQ maintainers identified in each of the

FAQs.

Last Update October 03 2003 @ 00:35 AM

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Ambisonic Surround Sound FAQ, v2.8

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/AmbisonicFAQ_1063104376@rtfm.mit.edu>
X-Last-Updated: 2003/08/01
Newsgroups: [rec.audio.tech](#), [rec.audio.pro](#), [rec.audio.misc](#),
[rec.audio.opinion](#)
Subject: Ambisonic Surround Sound FAQ, v2.8
From: mleese@omg.unb.ca
Summary: Frequently Asked Questions by domestic listeners about
Ambisonic Surround Sound. Includes theory, practice, details
of current decoder manufacturers and a discography of UHJ
encoded LPs and CDs.
Keywords: Ambisonics, Ambisonic, surround sound, FAQ, UHJ
Reply-To: mleese@omg.unb.ca
Date: 09 Sep 2003 10:50:18 GMT

Archive-name: AudioFAQ/AmbisonicFAQ
Posting-Frequency: monthly
URL: http://members.tripod.com/martin_leese/Ambisonic/faq_latest.html
Version: 2.8
Last-modified: 21 January 1998

Pointer to
Ambisonic Surround Sound FAQ

Frequently Asked Questions by domestic listeners about Ambisonic Surround Sound. Includes theory, practice, details of current decoder manufacturers and a discography of UHJ encoded LPs and CDs.

Where can I get this FAQ?

=====

A major problem with FAQs is out-of-date versions. Even if you are reading this online it may not be the latest version. The latest version is available on the WWW at the following location:

- o http://members.tripod.com/martin_leese/Ambisonic/

Only this pointer is posted monthly to the Usenet newsgroups rec.audio.tech, rec.audio.pro, rec.audio.misc, rec.audio.opinion, rec.answers and news.answers (*.answers archive-name: AudioFAQ/AmbisonicFAQ). To read the FAQ please visit the Web site listed above.



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [how do I get sound?](#) by scorpiox (9/5/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
mleese@omg.unb.ca

Last Update October 03 2003 @ 00:11 AM

Your question will be published for anyone to respond to and rate. Your question will not be displayed immediately. If you'd like to rate the responses or benefit from positive ratings, please create a new account or login into an existing account below. Your question should be complete enough so that it can stand on its own - don't leave out the subject matter. Do not ask for answers via email. FAQS.ORG reserves the right to edit your question as to improve its clarity.

Your name or nickname:	
If you'd like to create a new account or access your existing account, put in your password here:	
Is your question related to this FAQ?	<input type="radio"/> Yes <input type="radio"/> Somewhat <input type="radio"/> No
Your question:	

[Check spelling](#)

FAQ: rec.audio.* Intro 2/99 (part 1 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part1_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Intro 2/99 (part 1 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:08 GMT

Archive-name: AudioFAQ/part1

Last-modified: 1999/11/19

Version: 2.15

1.0 Contents:

Part 1 Intro

- 1.0 Contents
- 2.0 Organization
- 3.0 Purpose
- 4.0 Omissions
- 5.0 Credits
- 6.0 Errors and Corrections

7.0	Disclaimer
8.0	Copyright Notice
Part 2	Systems
9.0	High Fidelity Systems
Part 3	Sources
10.0	CD Players, CDs, Turntables, and LPs
Part 4	Amplifiers
11.0	Amplifiers
Part 5	Speakers
12.0	Speakers
Part 6	Rooms
13.0	Listening Rooms and Houses
Part 7	Recording
14.0	Recording
Part 8	Wire
15.0	Wire
Part 9	Retail
16.0	Retail
Part 10	Mail Order
17.0	Mail Order
Part 11	Networking
18.0	Net Protocol
Part 12	The Press
19.0	The Press
Part 13	Misc
20.0	Miscellaneous

2.0 Organization:

This FAQ is divided into a preamble and a list of subjects. Each subject is described by a list of questions and answers. Some questions have no answers yet. That's life.

This FAQ is split into 13 individual postings. This FAQ also references a frequent posting of sources for audio via Mail Order. That list is maintained by nau@SSESCO.com (William R. Nau). Contact Mr. Nau directly for information or corrections to that posting. The list is also available via FTP in the /pub/Rec.Audio directory of ssesco.com as file Mailorder.txt

Lines beginning with "|" are new since the last version of the FAQ.

3.0 Purpose:

The purpose of this FAQ is to address frequently-asked questions as a whole, so that [rec.audio.*](#) volume can be reduced. Towards this end, we assembled a list of common questions, and some general answers to these questions. Audio is part science and part art, so some of the answers are objectively correct, while others try to open-mindedly present both sides of a subject.

4.0 Omissions:

Many valuable things have been left out of the FAQ. In part this is because there is just too much to say about audio. In part, this is because the general reader doesn't need that much detail. Also, some things were omitted because they are too controversial or inflammatory.

5.0 Credits:

This FAQ is the work of many people. Allow me to thank everyone who helped now. Some of the contributors to this FAQ are listed below. Others have made great contributions, and are no less appreciated.

andrew@research.att.com (Andrew Hume)

jj@research.att.com (jj)

Ken Kantor of NHT

neidorff@ti.com (Bob Neidorff)

Rick Oakley (no internet access)

DPierce@world.std.com (Richard d Pierce)

P.Smee@bristol.ac.uk (Paul Smee)

gabe@panix.com (Gabe M. Wiener)

6.0 Errors and Corrections:

If you have a correction to the FAQ, additional information, or a new topic for the FAQ, please send e-mail to neidorff@ti.com describing your thoughts in detail. Please include your e-mail address in your submission, so that we can stay in touch. Every submission will be considered for inclusion in the next release of the FAQ. This FAQ will

be reposted every month.

7.0 Disclaimer:

Everyone's human. Nothing is perfect. The people who wrote the information here put varying amounts of research into their work. To the best of my knowledge, no one made any contribution or comment because of a vested interest.

Audio is a very lucrative and competitive industry, filled with honest companies, aggressive marketing people, people who stretch the truth very thin, excellent products, and lousy products. We tried hard to screen the hype from valuable data. If we insulted, omitted, or otherwise disturbed you, your company, your product, or something you feel strongly about, please let me know.

The information here attempts to paraphrase a large portion of the information exchanged in rec.audio newsgroup discussions. At times, people will make recommendations or suggestions to others on some of these newsgroups. Some of these statements are included here because we have been asked to include statements of that sort. These statements, and everything in this document are the opinions of various people. Nothing here is intended as recommendation or suggestion.

Further, no matter how it is worded, nothing here should be taken as fact. The authors take no responsibility for any use of this information.

8.0 Copyright Notice:

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments
50 Phillippe Cote St
Manchester, NH 03101 USA

Internet: neidorff@ti.com
Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed

Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

Part1 - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Systems 2/99 (part 2 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part2_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/09/04

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Systems 2/99 (part 2 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:08 GMT

Archive-name: AudioFAQ/part2

Last-modified: 2020/09/04

Version: 2.16

9.0 High Fidelity Systems

People frequently use the term "Stereo" to refer to a sound reproduction system. To be more accurate, we will use the term

High Fidelity System to refer to a pile of equipment including

at least one source, at least one amplifier, and at least one speaker. Common sources are turntables, CD players, tape players, tuners, and receivers.

9.1 What is a receiver?

A receiver is a tuner, power amplifier, and preamp combined.

A

common receiver has inputs for a turntable, a CD player, a

tape

deck, and perhaps one or two other sources. It probably also has selector switch(s), tone controls, and a volume control.

A

receiver may have outputs for two speakers, or for more.

Some

receivers do | not have phono preamps, a trend that may

become

more common as vinyl loses popularity. Many receivers

contain

surround sound processors.

9.2 What is a tuner?

A tuner is a radio reception device which can not drive speakers. Sometimes, the radio in a tuner is higher quality than the radio in a receiver. A tuner may or may not receive the AM broadcast band, but 99.999% will receive the FM

broadcast

band. Some also receive short wave bands, frequencies used for long-distance rather than for local commercial

broadcasts.

9.3 How should I go about selecting a system?

If you're looking to buy something, the first step is to

figure

out what you can spend. If you're looking for a whole system, this gets tricky, because you have to allocate amounts for

the

different components. The most popular current rule-of-thumb for a single source system (speakers, amp, 1 something-

player)

is to divide the money about equally among the three parts.

If

you want several players, you'll have to decide whether they

are

all equally important, and so deserve the same amount of

money;

or whether some are less important, in which case you can

spend

less on them and put the savings elsewhere.

combination

might

speakers.

if

better

hand,

be

This rule isn't hard-and-fast. It's just meant as a starting point so you don't have to listen to every possible

of equipment. If you are building around a CD player, you

spend a bit less on the player and a bit more on the

If you are buying turntable (or something else which plays by physical contact) on the other hand, it might be good idea to put a bit extra into the player. The reason for this is that

you skimp on the turntable, then when you come to buy a

one you may find that your records have been worn out by the cheap player. If you skimp on the speakers, on the other

then when you can afford better speakers the music will still

there on your records.

Another perspective says that you should spend the most you can on your source, as the sound can never be better than what you get off of the record/CD.

listen

to and what to listen for when evaluating speakers, turntables,

CD players, tape recorders, and systems in general.

9.4 How can I improve the sound of my stereo?

The cheapest improvement you can make, and perhaps the most effective, is to position your speakers carefully and correctly.

See 13.1, below. This will improve the frequency response flatness, making it easier to hear every instrument and voice. Setting speaker position correctly can also improve the three-dimensional recreation of a stereo image.

9.5 Do I want a combo system or separate components?

Combo systems used to be cheap jokes; that's not always true now. Some sound very nice; there are even some made by "audiophile" companies, and they sound even nicer. They've

lots of advantages. They take up less space. The controls

to be well-integrated, especially if they are remote-controlled.

Therefore, they are easy to operate; this can be a major plus

some of the people who'll use it are afraid of, or not very

at, technology. Also easy to set up, and don't leave millions of wires dangling all over everywhere.

If you do go for a combo, get a brand name; either an

company, or a good "consumer electronics" company. Brand-X combos are generally overpriced and unpleasant. If possible, buy it where you can listen to it first, such as a "real" hi-

shop. Mid-range hi-fi shops sell combos, as a way of introducing beginners to quality sound.

In most good combos, the speakers are the weak link. If you do go for a combo, you can almost always improve the sound drastically by buying a set of better speakers. Better

start in the \$100-\$200 price range. Some of the best combos come without speakers, forcing you to do this. A good combo with replacement speakers will give you very pleasant music.

Sounds good, you say, so why do people bother with

Well, you can get better sound with a component system -- but usually at the expense of convenience and size. A good component system will normally require a mixture of boxes

different makers to get the best results, so you've got to

more time listening to things. However, if you listen to your music seriously, then the performance of a component system

the reward for that extra work.

Components are harder to set up and operate. However, as noted, you can get better sound. You also get more flexibility. If, for example, you decide you want a better CD player, you just replace the CD player. With a combo system, you've got to replace the whole system. If your component tape deck breaks, you can remove it from the system and take it in for repair or replacement. With a combo, the whole system has to go in for repair or be replaced.

When you want to add some new recording medium to your system (laserdisc, VCR, DAT, DCC, MD, ...), if you've got components you just go buy the appropriate box. Many combo systems do not have places (or many places) to attach extra bits, so again you could be looking at replacing the whole thing. With a component system, you can add a turntable; most modern combos can't cope with turntables any more. Do you have a record collection?

If you're really not sure, components are the safer bet; if you're going to make a mistake, that's probably the better way to be wrong. But, if you're sure that a combo would be best for your needs, it can be a totally reasonable choice.

Now, some people may be tempted by one-maker 'component sets', particularly the modern, miniature ones. They tend to be equivalent to combos. Most use non-standard connections, rather than the normal twin phono plug, so that it's likely you can't swap or add components anyway. Even where they use standard interconnects, they may rely on non-standard interconnections for control purposes. In a few cases, they also rely on sharing power, with a power supply in only one of the boxes and the rest

taking low-voltage connections from that. And, no one maker makes the best everything. By default, assume that they will have the same disadvantages (and most of the same advantages)

as
combos. If it's important for it to work with "standard" components from other makers, be sure to ask before you buy.

One-maker 'component sets' are also often of lower quality

than
true individual components. Component sets are designed for convenience and appearance, rather than sound quality.

And, if you're in doubt, go for separate components.

9.6 How can I get better FM radio reception?

A. Use a (better) antenna. (See 9.7 and 9.8 below)

B. Use a (more) directional antenna. (See 9.7 and 9.8 below)

C. Aim your directional antenna. Rhombics are ungainly to

move,

but Yagis and dipoles are small enough to point right

at

the station. With the dipole, to tune in a station to the East, run the antenna North-South. With a Yagi, point the individual elements North-South with the smallest element on the East end.

9.7 How good are these compact FM antennas?

For receiving, small is ugly. The bigger the antenna (all

else

equal) the better. Of course, all else is never equal, but these fancy, expensive mini antennas tend to be awful. Some compensate for their small receiving structure with a small antenna signal amplifier. However, the quality of that amplifier is often no better than the quality of the

amplifier

in your tuner or receiver, so the antenna just gives you a stronger signal, complete with stronger noise.

All of that said, some compact FM antennas can work better

than

a simple dipole in some situations. Some have an internal amplifier, which helps with weak signals if the input stage in your receiver is poor. Some are directional. Some aren't. If

possible, be sure that whatever you buy can be returned for a refund if it doesn't work out well for you.

9.8 What makes the best FM radio antenna?

Although there is no "best" antenna for everyone, one of the most directional is the "rhombic". Being very directional,

this

antenna can select one weak station out of many strong ones,

or

one group of stations originating from a general direction. In addition, very directional antennas are good at reducing multipath interference, a problem which is more severe in cities with tall buildings.

This antenna is very long, and made up of four pieces of wire with feedline at one end for antenna connections and a

resistor

at the other for termination. Rhombics for FM broadcast band use are at least 15 feet (4.5 meters) long, but can be made fairly narrow, less than 3 feet (1 meter) wide. A more narrow antenna will be more directional. A longer antenna will give

a

stronger signal.

Another very directional antenna is the "yagi", which looks

just

like a common TV antenna. You can even use a common TV

antenna

as a very good FM antenna. The FM and TV bands are very close together. It has the advantages of being cheap, directional, and easy to rotate.

One of the simplest and easiest to make antennas is the

folded

dipole, made from 300 ohm twin lead. It is approx. 58" long. This antenna is surprisingly good for receiving signals in a moderately strong signal area. Folded dipoles come with many tuners and receivers as a standard accessory. They are also available for approximately \$2 at audio and department stores.

Whatever antenna you have, you can often get it to work

better

for specific stations by moving it. In the case of the folded

dipole, sometimes it works better vertically, and other times it works best horizontally. Sometimes, you can get that one elusive station to come in perfectly if you bend the two ends of it at funny angles. Don't be afraid to experiment. One warning. As atmospheric conditions change, the best antenna placement may also change.

An excellent reference book on antennas is printed by the American Radio Relay League (ARRL). It is called The ARRL Antenna Book. Currently in its 17th edition, it is a 736 page large, illustrated paperback which includes a disk of MS-DOS software. It costs \$30 plus s/h. It has fairly complete antenna theory, practical information such as charts, drawings, comparisons, and tips on construction and adjustment. ISBN 0-87259-473-4. The ARRL is founded and chartered as a non-profit organization to better amateur radio, and antennas are a vital part of amateur radio.

American Radio Relay League
225 Main Street
Newington CT 06111 USA
203-666-1541

Also useful:

Practical Antenna Handbook by Joseph J. Carr
Tab Books #3270/McGraw Hill - ISBN 0-8306-3270-3

9.9 What about power line conditioners?

Each home and each outlet has slightly different power line impedance and power line noise. Each amplifier is affected by power line impedance and power line noise differently. Power line conditioners try to reduce this line noise. Some also change the power line impedance in a way which is supposed to be

better. We will leave it to your ears to decide if these devices help the sound of your system enough to justify their expense.

9.10 How can I reduce vibration sensitivity?

Some complain that heavy foot falls will cause skipping or more subtle sonic problems with CD players or turntables. If you

you have these problems, there are a few different things which
can try to reduce the problem. One is to add weight to the
rack which holds the equipment. Heavier things move slower. If you
tracking can get the motion slow enough, it won't cause sonic or
problems.

Another solution is to add rubber or elastomer (Sorbothane)
cushions under the CD player or turntable. This might make it
better, but might also make it worse. Experiment.

A third solution is to increase the coupling between the rack
and the floor using spikes, which concentrate the weight on
between a very small area. Another way to increase the coupling
the rack and the floor is to use a plastic adhesive like
HoldIt,
sold under the UHU trade name in office supply stores.

9.11 What equipment can I buy that is 100% made in the USA?

There are many lines of equipment that are carefully hand
crafted in the USA. Unfortunately, these systems are usually
the high-end ones. Some US companies also make gear in the
far east. When in doubt, ask. Some US audio manufacturers are:

Adcom (some made in Japan) <http://www.adcom.com>

Audio by Van Alstine

Audio Research <http://www.audioresearch.com>

B & K <http://www.bkcomp.com>

California Audio Labs (CAL) <http://www.calaudio.com/>

Carver (some made in Japan)

Jeff Rowland <http://www.jeffrowland.com>

Krell <http://www.pcnet.com/~krell>

Mark Levinson <http://www.madrigal.com/MLHP5.htm>

McCormack

McIntosh <http://www.mcintoshlabs.com>

Proceed <http://http://www.madrigal.com/PROHP2.htm>

PS Audio <http://www.psaudio.com>

Spectral <http://www.spectralinc.com>

Sumo (Power amps, preamps, CD transports, D/As)

Wadia <http://www.wadia.com/index.html>

9.11.1 Any information on equipment made in other countries?

Thanks to Stephane Tsacas, we know:

Australia:

Krix Loudspeakers <http://www.krix.com.au>
Metaxas <http://www.metaxas.com>

Canada:

Bryston <http://www.bryston.ca>
Coincident <http://www.coincidentspeaker.com>
Energy Speakers <http://www.energy-speakers.com>
Newform <http://www.barint.on.ca/newform>
Paradigm <http://www.paradigm.ca>
Psb Speakers <http://www.psbspeakers.com>
Sonic Frontiers <http://www.sonicfrontiers.com>
Waveform <http://www.waveform.ca>

Czech Republic:

KR Enterprise <http://www.kr-enterprise.com>

Denmark:

Bang & Olufsen <http://www.bang-olufsen.com>
Bow Technologies <http://www.bowtechnologies.com>
Bruel & Kjaer <http://www.bkhome.com>
SEK Acoustics <http://www.adpointer.net/sekacoustics>

France:

Audax <http://www.audax.com>
Audio Aero <http://www.audioaero.com>
Audioreference <http://www.audioreference.com>
Cabasse <http://www.cabasse.com>
Confluence <http://www.a-t.fr/confluence>
J-M Reynaud <http://www.charente-fr.com/jm-reynaud>
Kora <http://www.kora.net/index.html>
JM Lab <http://www.focal.tm.fr>
Triangle <http://www.triangle-fr.com>
Verdier
YBA <http://www.phlox-electronique.fr>

Germany:

Lehmann audio <http://www.lehmannaudio.de>
Steinmusic <http://www.steinmusic.de>

Italy:

Audio Analog [http://www.hi-fi-forum.com/
audio_analogue.htm](http://www.hi-fi-forum.com/audio_analogue.htm)
Pathos <http://www.hi-fi-forum.com/pathos.htm>

Korea:

Pulsus <http://www.pulsustech.com>

Netherlands:

Final <http://www.hi-fi-forum.com/final.htm>
Philips <http://www.philips.com>

New Zealand:

Perreaux <http://www.perreaux.com>
Plinius <http://www.pliniusaudio.com>

Norvegia/Norway:

Electrocompaniet <http://www.electrocompaniet.no>
Tandberg <http://home.sol.no/~johandor>

Switzerland:

Nagra <http://www.nagra.com>
Goldmund <http://www.goldmund.com>
Revox <http://www.revox.ch>
Lenco
AMT

UK:

Audio Note <http://www.audionote.co.uk>
Cambridge Audio <http://www.cambridgeaudio.com>
Newtonia <http://www.newtonia1.freeseve.co.uk>
Quad <http://www.quad-hifi.co.uk>

9.12 Should I buy "xxx"? Which is better: "yyy" or "zzz"?

We can provide facts and opinions (and you get to decide which

is which :-), but we can't recommend if, or which way, you should jump, because we don't know what your priorities are. (That won't stop us from trying, though!) For example, if you

are considering a used item at a low price vs. a new one at a higher price, one of us might say "go for the new one because of the warranty", when another would say that you can fix it yourself if it breaks. They're both right.

This also applies to speakers. One may have very good, flat bass, but only go so low, where the other may go lower, but have less flat frequency response. Which is better? Depends on the buyer. Good speakers are carefully designed to achieve a balance of performance that matches the priorities of the designer. Some designers put much of their budget into appearance. Some designers put their budget into very high efficiency. Others strive for the smallest box which can deliver an acceptable low frequency performance. Do you

really want people on the network making that decision for you?

9.13 What is Surround Sound? Pro Logic?

In an effort to make movie soundtracks more dramatic and engaging, Dolby Labs created a signal encoding which encodes more than just two channels of audio onto the stereo signal. Many popular receivers and home-theater systems include the required circuitry to decode these signals. These components are referred to as Pro Logic, Dolby Pro Logic, or Surround Sound components. Very few audio recordings contain this encoding, but it is very common with movie soundtracks and some network TV programs.

Best Surround Sound reproduction requires five separate speaker systems, but some improvement is claimed from a surround sound receiver and three speakers over two speakers. In its best implementation, surround sound will give a fuller sense of being in the middle of the action. The quality of the image is a function of the recording, the broadcast quality, and the choice of reproduction components.

9.14 What do they mean when they say "It sounds warm?"

There are many subjective terms used to describe slight differences in frequency response, distortion, noise, etc. Thanks to Bruce Bartlett and Pro Audio Review, we present this Sound Quality Glossary. This glossary puts a meaning behind many different, common terms. There is no guaranty that people

mean the same thing when they use these terms. However, these definitions give insight into why a system sounds the way it does and may also help bridge the communications gap.

Airy: Spacious. Open. Instruments sound like they are surrounded by a large reflective space full of air. Good reproduction of high-frequency reflections. High-frequency response extends to 15 or 20 kHz.

Bassy: Emphasized low frequencies below about 200 Hz.

Blanketed: Weak highs, as if a blanket were put over the speakers.

Bloated: Excessive mid-bass around 250 Hz. Poorly damped low frequencies, low-frequency resonances. See tubby.

Blurred: Poor transient response. Vague stereo imaging, not focused.

Boomy: Excessive bass around 125 Hz. Poorly damped low frequencies or low-frequency resonances.

Boxy: Having resonances as if the music were enclosed in a box. Sometimes an emphasis around 250 to 500 Hz.

Breathy: Audible breath sounds in woodwinds and reeds such as flute or sax. Good response in the upper-mids or highs.

Bright: High-frequency emphasis. Harmonics are strong relative to fundamentals.

Chesty: The vocalist sounds like their chest is too big. A bump in the low-frequency response around 125 to 250 Hz.

Clear: See Transparent.

Colored: Having timbres that are not true to life. Non-flat response, peaks or dips.

Crisp: Extended high-frequency response, especially with cymbals.

Dark: Opposite of bright. Weak high frequencies.

Delicate: High frequencies extending to 15 or 20 kHz without peaks.

Depth: A sense of distance (near to far) of different instruments.

Detailed: Easy to hear tiny details in the music; articulate. Adequate high-frequency response, sharp transient response.

Dull: See dark.

Edgy: Too much high frequencies. Trebly. Harmonics are too strong relative to the fundamentals. Distorted, having

unwanted

harmonics that add an edge or raspiness.

Fat: See Full and Warm. Or, spatially diffuse - a sound is panned to one channel, delayed, and then the delayed sound is panned to the other channel. Or, slightly distorted with

analog

tape distortion or tube distortion.

Full: Strong fundamentals relative to harmonics. Good low-frequency response, not necessarily extended, but with adequate level around 100 to 300 Hz. Male voices are full around 125 Hz; female voices and violins are full around 250 Hz; sax is full around 250 to 400 Hz. Opposite of thin.

Gentle: Opposite of edgy. The harmonics - highs and upper mids - are not exaggerated, or may even be weak.

Grainy: The music sounds like it is segmented into little grains, rather than flowing in one continuous piece. Not

liquid

or fluid. Suffering from harmonic or I.M. distortion. Some early A/D converters sounded grainy, as do current ones of inferior design. Powdery is finer than grainy.

Grungy: Lots of harmonic or I.M. distortion.

Hard: Too much upper midrange, usually around 3 kHz. Or, good transient response, as if the sound is hitting you hard.

Harsh: Too much upper midrange. Peaks in the frequency response between 2 and 6 kHz. Or, excessive phase shift in a digital recorder's lowpass filter.

Honky: Like cupping your hands around your mouth. A bump in the response around 500 to 700 Hz.

Mellow: Reduced high frequencies, not edgy.

Muddy: Not clear. Weak harmonics, smeared time response, I.M. distortion.

Muffled: Sounds like it is covered with a blanket. Weak highs or weak upper mids.

Nasal: Honky, a bump in the response around 600 Hz.

Piercing: Strident, hard on the ears, screechy. Having sharp, narrow peaks in the response around 3 to 10 kHz.

Presence: A sense that the instrument is present in the listening room. Synonyms are edge, punch, detail, closeness and clarity. Adequate or emphasized response around 5 kHz for most instruments, or around 2 to 5 kHz for kick drum and bass.

Puffy: A bump in the response around 500 Hz.

Punchy: Good reproduction of dynamics. Good transient response, with strong impact. Sometimes a bump around 5 kHz or 200 Hz.

Rich: See Full. Also, having euphonic distortion made of even-order harmonics.

Round: High-frequency rolloff or dip. Not edgy.

Sibilant. "Essy" Exaggerated "s" and "sh" sounds in singing,

caused by a rise in the response around 6 to 10 kHz.

Sizzly: See Sibilant. Also, too much highs on cymbals.

Smeared: Lacking detail. Poor transient response, too much leakage between microphones. Poorly focused images.

Smooth: Easy on the ears, not harsh. Flat frequency response, especially in the midrange. Lack of peaks and dips in the response.

Spacious: Conveying a sense of space, ambiance, or room around the instruments. Stereo reverb. Early reflections.

Steely: Emphasized upper mids around 3 to 6 kHz. Peaky,

nonflat

high-frequency response. See Harsh, Edgy.

Strident: See Harsh, Edgy.

Sweet: Not strident or piercing. Delicate. Flat high-frequency response, low distortion. Lack of peaks in the response. Highs are extended to 15 or 20 kHz, but they are not bumped up.

Often

used when referring to cymbals, percussion, strings, and sibilant sounds.

Thin: Fundamentals are weak relative to harmonics.

Tight: Good low-frequency transient response and detail.

Tinny, Telephone-like: Narrowband, weak lows, peaky mids. The music sounds like it is coming through a telephone or tin can.

Transparent: Easy to hear into the music, detailed, clear, not muddy. Wide flat frequency response, sharp time response, very low distortion and noise.

Tubby: Having low-frequency resonances as if you're singing in a bathtub. See bloated.

Veiled: Like a silk veil is over the speakers. Slight noise or distortion or slightly weak high frequencies. Not transparent.

Warm: Good bass, adequate low frequencies, adequate fundamentals relative to harmonics. Not thin. Also excessive bass or midbass. Also, pleasantly spacious, with adequate reverberation at low frequencies. Also see Rich, Round. Warm highs means sweet highs.

Weighty: Good low-frequency response below about 50 Hz. Suggesting an object of great weight or power, like a diesel locomotive.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments		Internet: neidorff@ti.com
50 Phillippe Cote St		Voice : (US) 603-222-8541
Manchester, NH 03101 USA		

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Sources 2/99 (part 3 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part3_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Sources 2/99 (part 3 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:09 GMT

Archive-name: AudioFAQ/part3

Last-modified: 2000/12/14

Version: 2.15

10.0 CD Players, CDs, Turntables, and LPs

10.1 What should I listen for when evaluating a turntable or CD player?

For tape decks and turntables, beware first of speed
variations

(wow and flutter). A good check for this is Richard Strauss'
"Also Sprach Zarathustra" (aka: The Theme From 2001), which
has

a long, low, sustained organ note that comes in well before the main theme starts, and is held through the first movement. Concentrate on that. Make sure it doesn't wobble or warble. There's also a good bit at the beginning of Pink Floyd's "The Wall", but it doesn't go on as long, so you've got less time to think about it. Tape decks are prone to losing high-frequency notes, so pick something you like which has lots of treble, and make sure it is clear.

The sound of a turntable is largely bound up in the kind of cartridge mounted on it. Make sure to listen to a table with a cartridge similar to what you're buying, and not one in a different price bracket. If possible, audition the turntable with the same arm and cartridge, so that you will experience potential cartridge/arm interactions, too. Most cartridges work better with one arm than another. Treat the tonearm/cartridge pair as a system, rather than independent parts.

For CD players, try some piano music. See if the high notes sound tinny. Also, try something which has some soft parts, not the same as turning the volume down. Distortion for CD players (as for other devices) is measured at a high output, but in fact in CD players (unlike others) it's likely to be worse in soft passages of music. Most classical recordings contain a suitable soft passage. Most rock music won't.

Distortion in CD players, if you want to call it that, is a function of the granulation noise, or time-delay pre-echo

that can come out of the filtering. To listen for this, use material

that is rich in high-order harmonics, such as brass music. Unfortunately, you can't reliably predict how a CD player will sound by looking at specifications, features, or the technology it uses. If you want to know how a player will sound, you MUST listen to it.

10.2 Are some discs better than others?

Some recordings are better than others. Some artists are better

than others. Some recording engineers are better than others. Some microphones are better than others. Some music is better than others.

Ignoring that, there is some difference between discs. Some of the very earliest discs were badly made and deteriorated with time. The technical problems that caused those problems have been solved.

Some "gold" discs are available which are advertised to have better life and quality than common "aluminum" discs. These sell for an extra US \$15 or more per disc over the cost of

the same music on a common disc. Studies have shown that there is an advantage to glass-encased, gold platters for archiving computer data that is not error tolerant and will need to be stored for many tens of years. I have yet to see a similar comparison which justified any extra effort for storing audio recordings for 50 years. Part of the reason for this is that audio recordings contain error correction codes, allowing a CD player to perfectly reconstruct minor flaws. Another reason is that CD players can effectively reconstruct badly damaged audio data, even if some data is completely missing.

Some discs seem to have pinholes in the aluminum, which are visible when the disc is held up to a strong light. However, these discs play fine and last very well, so the effect of

these pinholes is probably nil. Some have performed studies

counting errors on various discs with various players. They found

that, in general, the error count was consistent from one player to another. Also, in general, most discs have a low, consistent error rate which is perfectly correctable using the redundant data stored on the disc. This study did find that one group

of discs had a higher error rate than all of the rest. This

group was the promotional discs, also called "music samplers" given away by music companies to introduce you to their family of artists and performers. Despite these higher error counts, these discs still played fine.

If there is no abusive handling involved, I have rarely heard of a disc that degraded with time. Of the few that have existed, they tended to be from one of the bad batches mentioned earlier.

There is no doubt that some discs are mastered better than others. Some are badly mixed. Some are so badly recorded that there is noticeable clipping. Some are made from damaged master recordings. CD technology is no guarantee of good music or of a good recording.

10.3 Are CDs better than LPs?

Some excellent recordings are mastered digitally, and sound great on LPs. This suggests that there is nothing inherently bad about digital.

Some find that LPs sound better than CDs. Advocates of LPs claim that the digital to analog (D/A) converter in home CD players isn't up to the quality of the information on the disc.

They also claim that the analog electronics in a home CD player can be poor.

Some believe that CDs do not sound like LPs because the CD does not have the frequency response errors, the distortion, or the stereo separation problems of LPs.

In general, though, there are good and bad CD players, just as there are good and bad turntables, cartridges, and tone arms. Any ultimate comparison would require ultimate equipment, which is unaffordable. In moderately priced systems, there will be some signal damage from the turntable system and some signal damage from the CD player.

LP lovers often learn the nuances of cartridge selection, record care, and even turntable and tonearm adjustment. They have found that the turntable will sound different if the arm height is adjusted, if the cartridge angles are changed, and if the tonearm wire is moved. CDs do not offer as many avenues for the home experimenter.

However, Audio Amateur Magazine has published modification projects for CD players; particularly for Magnavox 560 and similar European players. Audio Magazine has also published such articles.

10.4 What turntable should I buy?

Despite improvements in motor technology, most great turntables use belt drive. Rubber roller (idler) drive sounds the worst.

Select a turntable with a very heavy platter for the least wow and flutter. Give the platter a rap with your knuckle. It should not "ring" like a cymbal. It should feel and sound dead.

Also look for a turntable that has good isolation from base to stylus. With the amp on and the turntable selected, but with the turntable motor off, put an old record on the turntable, lower the stylus onto the record, and then tap the edge of the base. Not too hard, you don't want to send the arm flying. At worst, you will hear a quick 'thump' followed by silence through the speakers; if you're lucky, you'll hear nothing at all. If the sound continues beyond a quick 'thump', the mechanical isolation is not great, and you should look at some other make. When you perform this test, be sure to unplug the turntable power cord.

If the turntable has a tonearm, try to evaluate the arm, too. A good arm should be adjustable in height. A good arm should allow cartridge adjustments. A good arm will be very rigid and have no bearing play. A good arm should accommodate a wide range of cartridges. Despite this, some arms work

better with high compliance cartridges, while others are at their best with low compliance. Ask.

Turntables by Denon, Dual, Linn, Michell, Oracle, Pro-Ject, Rega, Sota, Thorens, and VPI are recommended. If you want a turntable on a budget, consider the NAD 5120 at approx. \$160.

10.5 What phono cartridge should I buy for my older turntable?

The \$30 Grado ZTE+1 is a great value for any home user but a purist. For the purist, there are still many choices, both moving coil and moving magnet. Each sounds slightly

different,

and has its individual strengths. Moving Magnet (MM) cartridges tend to have higher output than Moving Coil (MC) cartridges, with exception. Low Output Moving Coil cartridges require unusual preamplification. Check with a dealer before buying one. Some candidates:

Sumiko Blue Point \$125

Denon DL-160 \$125

Shure VST-V \$150 (MM, Std Mount)

Audio Technica AT-95E (MM, Std Mount)

Denon DL-100 \$85 (MC High Output, Std Mount)

Ortofon MC-10 Super MkI \$110 (MC Low Output, Std

Mount)

10.6 Will phono cartridges still be around ten years from now?

Most likely, there will still be cartridges available, but

not

in the variety available ten years ago. They will become "Special Order" in some stores and unheard of in others.

"Pro" or "DJ" cartridges will stay available in good supply, "Audiophile" cartridges will stay available and very

expensive,

"Mid-line" cartridges will become very scarce, and a few

"Budget" cartridges will remain available in copious supply.

At the same time, some makers will drop their cartridge lines completely.

10.7 Will LPs still be around ten years from now?

There is a strong movement of collectors and purists who will keep their collections and buy good used discs. Count on

these

people to keep the used disc market hot for 25 years longer.

As for new music, less is being pressed today than 20 years ago. Many popular artists are being released on LP in parts of Europe, but availability is dependent on country. One person said that many new LPs are available in Spain.

LP sales have increased recently in Japan and in the UK.

Polydor

is now re-releasing older recordings on vinyl, and will continue

to press them as long as it is profitable. Likewise, there are several re-releasing projects in Japan. Some are for Jazz collectors and others are for pure analog as well as classical music lovers. They are selling the LPs by subscription, with shipments every 2 or 3 months. Each release includes about 20 titles. Japan has released over 100 LPs this way last year.

10.8 What about CD green pens?

In a nutshell, save your money.

A CD player "reads" information on the disc with a laser light

beam. Some believe that if you put a green stripe on the very perimeter of the disc, then the light beam will not reflect around inside the disc and will more clearly pick up the data.

Scientific studies of the data coming off of the disc have failed to show any difference between a virgin disc and a green

painted disc. I have not heard of double blind listening comparisons that have proved that there are people who can

hear the difference, although many have performed uncontrolled tests with positive results.

10.9 What about CD stabilizer rings?

In a nutshell, save your money.

The data coming off of the disc is a serial string of ones and

zeros. If this bit stream has jitter, then it may reach the D/

A

converter out of sync. If this happens, then the actual analog signal recreated will have jitter, and won't be perfectly true. The vendors of stabilizer rings say that using these rings will reduce jitter and make a more perfect signal. Vendors also claim that the rings can increase the mass of a disc, making it spin more smoothly, and reducing transient load on the power supply from the motor.

on

Some players will not play discs that have stabilizer rings on them. The clamp can't handle the thickness. Other players play ringed discs, but do not play them well, because the disc motor was not built for the added load.

With those exceptions, scientific studies of the data coming off of the disc have failed to show any improvement going from a virgin to a ringed disc. I have not heard of double blind comparisons that prove that people hear the difference, either.

10.10 What about CD spray treatments (ArmorAll et al)?

In a nutshell, save your money.

Current wisdom is to avoid any disc coating or spray. Some will definitely damage the disc.

There are many theories on what ArmorAll can do to a disc. One is that it reduces static which will attract the delicate head of the laser detector to the disc. Another theory is that the cleaner will fill voids in the disc with silicone, thereby making it easier to read by reducing diffraction effects.

Scientific studies of the data coming off of the disc have

failed to show any difference between a virgin disc and a treated disc. I have not heard of double blind listening comparisons that have proved that there are people who can hear the difference.

One of the strongest proponents of ArmorAll issued a "recall" on his advice. He now warns that ArmorAll can damage the disc. He also advises that you can clean ArmorAll off treated discs with Dawn dish detergent.

10.11 Are 1-bit CD players better than multi-bit players?
In a nutshell, they are virtually the same.

There are some excellent sounding 1-bit players and some excellent sounding multi-bit players. Some feel that the 1-bit technology has more future because it can be improved with the rapidly improving digital technology, while the multi-bit players improve with slowly improving analog technology. Multi-bit also has its advocates.

All of the various D/A converters try to do the same thing, and try to achieve the exact same ideal performance. How well they succeed is more a function of their skill and the quality of the parts that they buy than the technique that they use. In other words, the architecture of a D/A converter is less important than the quality of its implementation.

10.12 Are three lasers better than one in CD players?

Some players have one beam, some three. All use one laser diode to generate the beam. Three-beam is just a different method for doing track alignment. Neither is better than the other.

There are good 1-beam players and good 3-beam players. Manufacturers want advertising claims and "More Beams Is Better" sounded good to some marketing people. Trust your ears.

10.13 Is the BMG 11-for-1 deal good?

Yes. You have to put up with their frequent mailings. You can elect the "POSITIVE OPTION" and not have to answer each mailing to avoid an order. You should expect to pay approximately \$2.00 per disc for shipping and handling in the US and more elsewhere, but even at that price and assuming that you will buy one of their discs for \$16.00, you still do well. Assuming, of course, that you want at least 11 of the discs that they are offering for sale. Some states requires sales tax on BMG sales, and some states tax "free" discs, but the tax still is small compared to the discount from retail.

The BMG collection contains over 2500 discs. This includes classical, pop, jazz, and other. All BMG discs come from the larger labels. Some rumored that BMG discs are inferior to the discs sold in normal retail chains. This has not been substantiated. In fact, BMG distributes their discs through retail chains, as well as through the mail, so you may get a BMG disc either way.

BMG has a web site. There is also a great CD Club FAQ on the web. Try these sites:

<http://www.bmgmusicservice.com>

ftp://ftp.netcom.com/pub/ra/ramseys/cd/CD_Club.FAQ

10.14 What should I do if there is a problem dealing with BMG?

The number to reach BMG is 317-692-9200. Their people have been

very cooperative with me and others. It is always good policy to confirm any phone call with a letter, restating the

problem

and the resolution you were promised over the phone. It is

good

practice to write down the name of the person you speak with. You can also contact BMG by FAX at 317-542-6090.

If BMG sends you something that you didn't order, DON'T OPEN

THE

PACKAGE. Write REFUSED on the package and put it back in the mailbox. They will accept the return and credit your account for any charges.

BMG has hired a marketing firm to send out information on the classical club. Call 800-264-9555, but don't expect customer service from this number.

10.15 How do I get out of the BMG racket?

If you have taken any discs from BMG, you must either return what you have ordered or fulfill the terms of your original agreement. This often means buying one disc at full price and paying for the shipping on all discs you ordered and received.

Once you have done this, you can quit the club at any time. Take your next order form and mark it with a bold marker in large letters "CANCEL MEMBERSHIP" and mail it to: BMG COMPACT DISC CLUB, PO BOX 91413, INDIANAPOLIS, IN 46291 USA. It may take a month to fully take effect, but they will honor your request. While waiting for the cancel order to take effect,

be

sure to return all future order forms marked the same way. Otherwise, you may wind up with unwanted discs.

10.16 How do I get the most out of BMG?

Only buy one disc at full price, fulfilling your obligation. Request the "POSITIVE OPTION" so that you save on postage.

Only

buy from special fliers. Every month, except November and December, they send out a "Two for half price then one free" flier. They have almost all of the stuff in the regular

fliers.

They even offer "Buy one get two free" sometimes. Wait for those special deals. You can even order discs from an October catalog using the order form that came in the February

catalog.

You can get even more out of BMG by signing up, getting 8 discs

for the price of one, quitting, signing up again, etc. People have done this successfully. BMG reserves the right to deny membership to anyone, so you run a very slight risk of being denied membership the 20th time. However, I have never heard of anyone ever being denied membership for any reason.

The file CDClubFAQ.txt explains more than you ever wanted to know about the BMG and Columbia music clubs. It is available by FTP from: ftp.netcom.com in /pub/ra/ramseys/cd or by gopher at: biogopher.wustl.edu An HTML

version

can be found at: <http://www.blooberry.com/cdfaq/>

Online BMG and CH Popular Catalogs are available at:

<gopher://biographer.wustl.edu> or

<http://biogopher.wustl.edu:70/1/audio/bmg>

Online BMG Classical Catalog is available by FTP from:

ftp.gmd.de in /music/cd-catalogs

Get file bmg-classical-collection_2ed.gz

10.17 What are the differences between multibit and Bitstream/MASH Analogue to Digital converters (16-bit vs 1-bit CD players)?

Audio data is stored on CD as 16-bit words. It is the job of the digital to analogue converter (DAC) to convert these

numbers

to a varying voltage. Many DAC chips do this by storing

electric

charge in capacitors (like water in buckets) and selectively emptying these buckets to the analogue output, thereby adding their contents. Others sum the outputs of current or voltage sources, but the operating principles are otherwise similar.

A multi-bit converter has sixteen buckets corresponding to

the

sixteen bits of the input word, and sized 1, 2, 4, 8 ...

32768

charge units. Each word (ie sample) decoded from the disc is passed directly to the DAC, and those buckets corresponding

to

1's in the input word are emptied to the output.

To perform well the bucket sizes have to be accurate to within

+/- half a charge unit; for the larger buckets this represents

a tolerance tighter than 0.01%, which is difficult.

Furthermore

the image spectrum from 24kHz to 64kHz must be filtered out, requiring a complicated, expensive filter.

Alternatively, by using some digital signal processing, the stream of 16-bit words at 44.1kHz can be transformed to a stream of shorter words at a higher rate. The two data streams

represent the same signal in the audio band, but the new data stream has a lot of extra noise in it resulting from the word length reduction. This extra noise is made to appear mostly above 20kHz through the use of noise-shaping, and the oversampling ensures that the first image spectrum occurs at

a

much higher frequency than in the multi-bit case.

This new data stream is now converted to an analogue voltage by a DAC of short word length; subsequently, most of the noise

above 20kHz can be filtered out by a simple analogue filter without affecting the audio signal.

Typical configurations use 1-bit words at 11.3MHz (256 times over-sampled), and 4-bit words at 2.8MHz (64 times oversampled).

The former requires one bucket of arbitrary size (very simple);

it is the basis of the Philips Bitstream range of converters. The latter requires four buckets of sizes 1, 2, 4 and 8

charge

units, but the tolerance on these is relaxed to about 5%.

MASH and other PWM systems are similar to Bitstream, but they vary the pulse width at the output of the digital signal processor. This can be likened to using a single bucket but with

the provision to part fill it. For example, MASH allows the bucket to be filled to eleven different depths (this is where they get 3.5 bits from, as $2^{(3.5)}$ is approximately eleven).

Lastly it is important to note that these are all simply different ways of performing the same function. It is easy to make a lousy CD player based around any of these technologies;

it is rather more difficult to make an excellent one, regardless of the DAC technology employed. Each of the conversion methods has its advantages and disadvantages, and as ever it is the job of the engineer to balance a multitude of parameters to design a product that represents value for money to the consumer.

All sampling techniques (so also D/A techniques) require an analog reconstruction filter following the converter. This filter inherently adds phase shift, frequency response ripple and high frequency roll-off, depending on the characteristic of the reconstruction filter (which depends on the position of its poles and zeros).

An oversampling data converter generates a higher output sampling rate than a simpler converter, so you can use a more simple reconstruction filter, which is cheaper and more stable in time and temperature and produces less noise. Also, modern oversampling systems include digital filters which compensate the response of the analog filter in the passband, so you can achieve systems with an overall performance of 20 Hz...18 kHz ± 0.05 dB. Also deemphasis is mostly done in the digital domain.

So the "sound" of a CD player is more than just the number of bits. It's the quality of the converter, the filter requirements imposed by that converter, the quality of the filter, and of

course, the quality of the following analog components. Power supply quality and clock jitter also influence the sound.

10.18 What is the best under-\$200 CD player?

In this price range, most manufacturers give you more features than construction quality or sound quality. If you want a particular feature, then use that to guide your purchase. If you are after the best possible sound quality, let your ear be your guide. Sound quality still varies among models. Don't trust reviews or advice alone.

10.20 What is the best under-\$500 CD player?

Some recommend Rotel. Others recommend Marantz, NAD, or Yamaha.

The industry has made major gains in terms of sound consistancy

in the past years. However, models change every year and there are models with design flaws. Let your ear be your guide.

Also,

don't forget to check quality of construction. In this price range, you should get more than a flimsy box and more durable mechanisms than in the <\$200 price range.

10.21 (removed)

10.22 (removed)

10.23 How can I clean a dirty CD?

Use a drop of dish detergent and lots of clean water. Do not rub. Never rub or wipe in a circle. If you must stroke the disc

do it with a soft cotton cloth in a straight line from the center outwards (radially). Rinse the disc in running clear water, shake off most remaining drops, and lightly pat dry with a soft, clean cloth.

10.24 Can you repair a damaged CD?

If the disc is lightly scratched on the bottom, then you can polish out the scratch and probably repair the disc perfectly.

If there are lots of scratches or deep scratches, or there is damage on the top, you may be facing a lost cause. The music information is immediately under the label. If you scratched

the reflective layer, the disc is normally unrecoverable.

Before trying any repair, try washing the disc with clear

water

and a bit of liquid dish detergent. Do not scrub or rub hard. Rinse the disc with clear water and shake off as much water

as

you can. Finally, wipe the last few drops off with a soft, clean cloth, in a radial direction.

SMALL scratches can be removed with a scruffy T-shirt and toothpaste, such as Tom's Toothpaste.

You may wish to try a thin coating of Johnson's Klear floor

wax

on the bottom of the CD. Often it will cover the scratches enough to allow playing. The refractive index is pretty close to polycarbonate, so filled scratches will be nearly

invisible.

You can buy professional plastic polishing compounds at many hobby shops. The ones used for polishing acrylics, plexiglas, etc. work. Ordinary lapidary jeweler's polishes also work. You'll need a rough polish to remove the scratches, then tin oxide to polish to a mirror finish. Telescope lens kits also work. Novus plastic polish and cleaner has been recommended. T-Cut, a car paintwork polish, works well for big scratches. Reviewers at Audio Magazine recommend the "Memorex CD Repair And Maintenance Kit" as the best tool for badly damaged CDs. Another recommended polish is Meguiers' Plastic Polish #17.

Sometimes, a gentle polishing will make a disc playable even though the scratch is not fully removed. This may be even better than complete scratch removal because it leaves more protective plastic behind.

10.25 Can I add digital output to a non-digital-out CD player?

Some Magnavox CD players using the Philips chip set can be modified. Look for a SAA7220 IC. If it has one, then it can

be

modified. If you have experience modifying electronic equipment, follow this procedure:

Take pin 14 of the SAA7220 IC and remove whatever terminating resistor is on it. Connect it through a 560 ohm resistor to

the input of a wide band pulse transformer. Tie the other end of the primary of the transformer to ground. Pulse Engineering PE65612, Schott Corp 6712540, and Scientific Conversions SC916-01 all will work. Bypass the primary through a 620 ohm resistor. Connect the output of the transformer to an RCA

jack. Do not ground either side of the RCA jack. This output is now S/PDIF compatible. (Thanks for the tip to Positive Feedback)

10.26 What can I get in the way of a CD test disc?

Each test disc offers something different. Some discs contain useless filler which advertises a product or shows a unique capability, but really doesn't help you test or improve your system.

Many use the Hi-Fi News & Record Review test discs. So far, these have received only positive comments.

Chesky produces 2 test discs. The first, "Chesky Jazz Sampler Volume I" contains some excellent imaging test signals

(called LEDR), some well-recorded acoustic jazz, and other test

signals. The second, "Chesky Jazz Sampler Volume II" has similar music

& different tests.

Stereophile produces three test discs.

Denon also produces two test discs. The first, "Digital Audio Check" is more useful for home use. The second, "Audio Technical" is more for repair shops and test-disc addicts.

If you are looking for test CDs, one source of supply that stocks lots of different test CDs is:

DB Systems
Main Street
Box 460
Rindge Center NH 03461 USA
603-899-5121

10.27 How do the letters ADD on my CD relate to sound quality?

The simple answer to this question is that there is no relation

between the three letter code and sound quality. Those three letters refer to the recording and mastering tools used in making the CD.

The first letter refers to the recording process. For example, a disc labeled ADD was ANALOG recorded, where a disc labeled DDD was DIGITALLY recorded. Analog recording means that some form of conventional analog tape recorder was used, whether it be a two-track home-quality recorder or a very expensive wide-tape, high-speed, multi-track recorder. Digital

recording

could be as simple as a two-track DAT recorder, or can be a much fancier multi-track digital recorder.

The second letter refers to the recorder used in the mixing and

editing process. Mixing and editing is the process of combining

a multi-track master recording, setting levels, editing out defects, adjusting equalization, and creating a two-track

final

tape. There are good machines available for this which are analog and good machines which are digital.

The third letter refers to the final master, which for a CD is always digital. I have seen discs that are labelled as AAD, ADD, DAD, and DDD.

Future releases may not have this three letter code on them because they don't tell you anything that is significant.

Also,

some codes have been used incorrectly on some discs, which makes the information that much more meaningless.

10.28 How can I clean LPs?

There are expensive machines for this purpose which work very well. One popular model goes by the name Nitty Gritty. These machines spray cleaner onto the record, work it into the grooves, and then vacuum the cleaner and dirt out. If you are

serious about records and have lots of them, it may be a good investment for you.

If you have a more reasonable collection, you might be happy with a good hand washing every now and then. To give your records a good hand washing, start by preparing this wash:

1 gallon distilled water

1 gram Alconox (a laboratory detergent)

Also, get a natural bristle brush and trim it to the correct stiffness/bristle length so that the bristles can get into the grooves but aren't stiff enough to scratch the record.

Some record-cleaning recipes recommend alcohol. However, alcohol will leach plasticizer from vinyl, and eventually degrade LPs. Alcohol will also dissolve the shellac of 78s, so should never touch a 78.

Lay the LP flat and pour a thin coat of the above fluid on it. Brush the wash into the grooves with the bristle brush. Brush in the direction of the grooves, going through all grooves. Flush the wash and dirt off with cool, running tap water. Rinse the record with distilled water and pat it dry with a soft, clean cotton cloth.

Also consider using a carbon fiber brush every time you play the LP. It picks up some surface dirt and removes static.

10.29 How do you set the stylus pressure correctly?

Stylus tracking force is typically adjusted at the back of the tonearm with a knob that is calibrated in grams at the stylus tip. With the control set to zero, the stylus should sort-of float above the record surface. The control is then increased to the number recommended by the cartridge manufacturer.

Do not, under any circumstances, use a lower than recommended force, as the cartridge may lose the ability to maintain contact with the groove wall on passages of large amplitude. This WILL result in RECORD DAMAGE.

If you want the best possible tracking and sound quality, you will want to fine-tune the tracking force. Use a test record and listen very carefully, or get the help of a good dealer with a battery of instruments.

10.30 How do you set the anti-skating on a tonearm?

If you have a recommendation or suggestion from the tonearm manufacturer, follow their advice first. They will give you the best starting point.

Some tonearms come with calibrated anti-skate. The manufacturer

of these tonearms has tried to calibrate the anti-skate control

so that if you match the setting of the anti-skate to the setting of the stylus pressure, you will have nearly perfect anti-skate. Read the manufacturer's recommendations to see if this applies to your tonearm.

You can see gross errors in anti-skate by looking at the stylus. If you shine a light on the front of the tonearm while playing a record, you will be able to see whether the stylus is centered in the stylus holder. If the stylus is biased to one side or another while playing a record, then the anti-skate is way off.

More subtle adjustments can be made by listening for mistracking. If you can, obtain a record with equal left right modulation at high frequency with ascending modulation magnitude (volume), such as the Shure ERA-III, IV, or V test record. They have five bands of "greensleeves" played on flute, and you fiddle until the audible breakup is equal in both channels, and adjust tracking weight until it occurs in the highest band. This is, like other cartridge and tonearm adjustments, easier for the experienced hand than the beginner.

Some high-end dealers have electronic instruments which allow them to accurately adjust anti-skate and other cartridge and tonearm parameters. If you can get this service, consider yourself fortunate.

10.31 How else do you adjust a tonearm/cartridge/stylus?

There are a few other critical adjustments. Again, a good high-end dealer may be your best resource. Your ear may also be your best test instrument.

You need a level turntable. Use a quality carpenter's

level. Some people like the Shure stylus force gage for setting stylus pressure accurately. Other tools which are well recommended are the Geo-disk, a good protractor, and above all, the Cart-Align, which uses a very precise etched plastic mirror for cantilever alignment.

You'll also want to set the tracking angle. It CAN be done by eyeball, but is best done with test instrumentation and a record. There is also the cartridge angle, tonearm height, etc. Read the instructions which came with your tonearm for the best specific advice for that tonearm.

Tonearm cable is more critical than any cable anywhere else in the signal chain. Cable capacitance directly sets the high frequency characteristics of the cartridge. In addition, the correct grounding of the shield is essential to minimize hum. It may be necessary to change preamp input capacitors so that the cable/preamp combination loads the cartridge with the right overall capacitance. Replacing tonearm cable will have a similar effect, but may be harder to change tonearm cable than to change preamp input capacitors. Consult the cartridge, tonearm, and preamp manuals for specific advice. Also refer to 16.6 for more information on tonearm cable.

An excellent article on setting up a turntable is:
Stereophile, July 1990, Pages 62-85.

10.32 Do CDs deteriorate with time? What is their life span?

A CD consists of a polycarbonate top layer, an aluminum (or gold) metal reflective layer, a polycarbonate bottom layer, and some miscellaneous printing ink. Of these materials, polycarbonate seems to be extremely stable with time provided that it is well cared for. Do not use any liquids on a CD that contain silicones or solvents. Do not leave CDs in sunlight or other bright light. Do not stick labels on CDs. Do not write on CDs. Do not expose CDs to temperatures higher than normal room temperatures. Don't leave a CD under water. Even the top side of a CD is critical and subject to damage.

Some pressings from the early 1980s used ink which damaged the polycarbonate top layer and eventually got into the aluminum. These inks are not in use today. Some earlier discs were made with imperfect sealing around the perimeter of the disc. This

was evident because the aluminum in the disc extended all of the way to the disc edge. These discs were known to fail due to moisture getting to the aluminum and causing it to oxidize. Modern CD factories have solved this problem as well.

With those cautions, modern CDs will last for more than 30 years without deterioration. Most of the CDs which were made in 1983 are still around today and still sound good.

10.33 How much music can you possibly cram into a CD?

The longest seen so far (reported by Stuart Kahler) is a MiC bootleg of Depeche Mode "Evolution", at 81:09. Next are

'No

Quarter' by Jimmy Page and Robert Plant at 79:38, the

collected

singles CD release by The Sisters Of Mercy at 79:30, an MCA reissue of Steely Dan: Greatest Hits at 79:17 and a Musical Heritage recording of Bach: Goldberg Variations at 79:02. Modern CDs are pressed using tighter track spacing than the first CDs, because modern equipment is capable of holding tighter tolerance than the original machines.

10.34 What are input and output levels and impedances for signal sources, preamps, amps, etc?

We have been unable to find any formal standard on this topic. However, there is an EIA Bulletin: EIA Consumer Products Engineering Bulletin No 6-A (CPEB6-A) 1974, titled "Preferred Voltage and Impedance Values for the Interconnection of Audio Products". The key word in the title is 'Preferred'.

EIA CPEB6-A recommends 3mV at 47k ohms for magnetic phono cartridges, 250mV at less than 10k ohms for tape and preamp outputs, and 100k ohm minimum for tape, tuner, and amp aux inputs. The bulletin also has information on microphones, and headphones. You can order a copy through a technical library or directly from the EIA.

10.35 Why are turntable speeds 78 RPM, 45 RPM, etc?

The speeds were chosen because that is the speed that resulted when you used standard parts. Electric motors rotate at 1800 rpm, most shafts are 1/4". Those combinations with the proper gears and idlers came out to 78 rpm. In reality it's 78.26 rpm. Tape recorder speeds evolved the same way.

The 78.26 was standardized after electric recording/playback occurred. Prior to that, speeds were "in the neighborhood of" 78 rpm. Some lower and some higher. 80 rpm was used in many recordings. (Courtesy of Bill Vermillion)

10.36 Why is CD digital data written in 44.1 kHz samples?

The rate of 44.1 kHz was picked to be compatible with existing 50 Hz and 60 Hz video-based digital audio storage, where an integral number of frame buffers could fit in a single horizontal scan. Quote from Watkinson and Rumsey, "Digital Interface Handbook" 2.7.6 Choice of Sampling Rate:

"In 60 Hz [525 line, 60 Hz vertical refresh) video there are

blanked lines, leaving 490 lines per frame, or 245 lines per field for samples. If three samples were stored per line,

sampling rate becomes $60 \times 245 \times 3 = 44.1$ kHz. In 50 Hz video [625 line, 50 Hz vertical refresh), there are 37 lines of

leaving 588 active lines per frame, or 294 per field, so the sampling rate becomes $50 \times 294 \times 3 = 44.1$ kHz. The sampling rate

44.1 kHz came to be that of the Compact Disk. Even though CD has no video circuitry, the equipment used to make CD masters is video based and determined the sampling rate."

The length of 74 minutes is determined by the physical nature of the reading system. It's based on the encoding method, the wavelength of the laser used (different wavelengths are incompatible with current CDs) and the necessary support information. During the development of the CD, von Karajan was allegedly asked how long a CD must be, to which he responded it must be long enough to hold HIS performance of Beethoven's 9th symphony, but the parameters had pretty much already been nailed down at that point.

10.37 What's the latest on DVD and DAD?

Check out the articles in The Absolute Sound on the subject, from issue 112, which is also on the web:

<http://www.theabsolutesound.com/dadforum-1.htm>

<http://www.theabsolutesound.com/dadforum-2.htm>

<http://www.theabsolutesound.com/dvdhope.htm>

10.38 What's the latest on the MiniDisc(tm)?

Check out the MiniDisc(tm) organization web site for a minidisc

FAQ and other MiniDisc(tm) information.

<http://www.minidisc.org>

10.39 How can I record an LP or tape onto a CD?

That's a complex question, but basically, get a sound card for your computer, get some cheap software for your computer, and follow some of the advice at:

<http://homepages.nildram.co.uk/~abcomp/lp-cdr.htm>

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments
50 Phillippe Cote St
Manchester, NH 03101 USA

Internet: neidorff@ti.com
Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Amplifiers 2/99 (part 4 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part4_1063104376@rtfm.mit.edu>

X-Last-Updated: 2003/04/07

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Amplifiers 2/99 (part 4 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:09 GMT

Archive-name: AudioFAQ/part4

Last-modified: 2003/04/07

Version: 2.16

11.0 Amplifiers

Note: A receiver contains an amplifier, so the following questions apply to both receivers and amplifiers. In the following text, "amp" and "amplifier" are used synonymously.

11.1 What is Biamping? Biwiring?

Most speakers are connected to an amplifier by one pair of terminals on each speaker. Within these speakers, a crossover distributes the signal (modified appropriately)

to each of the drivers in the speaker.

Some speakers are set up to be either biwired or biamped. A much smaller number allows triwiring and triamping. The same principles apply but use three sets of wires or three

amplifiers

instead of two. Most speakers that support biamping/biwiring have two pairs of terminals and some mechanism for shorting the two pairs together when used in the normal way. This mechanism is most likely a switch or a bus bar. To help the descriptions below, I will refer to these two pairs as LO and HI (because normally one pair connects to the woofer and the other pair connects to the tweeter/midrange).

Biwiring means that a speaker is driven by two pairs of wires from the same amplifier output. One cable pair connects HI to the amp, and the other cable pair connects LO to the same amp output that you connected the HI cable to. Biwiring is controversial; some folks hear a difference, some do not. One plausible explanation for this involves magnetic induction of noise in the relatively low current HI cable from the high current signal in the LO cable. Accordingly, Vandersteen recommends the two cable pairs for a channel be separated by

at

least a few inches. In any case, the effect appears to be

small.

Biamping means that the two pairs of terminals on a speaker

are

connected to distinct amplifier outputs. Assuming you have

two

stereo amplifiers, you have two choices: either an amp per channel, or an amp per driver. For the amp per channel, you connect each terminal pair to a different channel on the amp (for example, the left output connects to HI and the right

side

to LO). In the other configuration, one amp connects to the

LO

terminals, and the other amp is connected to the HI terminals.

The point of biamping is that most of the power required to drive the speakers is used for low frequencies. Biamping

allows

you to use amps specialized for each of these uses, such as a big solid-state amplifier for the L0 drivers and higher quality (but lower power) amp for the higher frequencies. When you have two identical stereo amps, some folks recommend distributing the low-frequency load by using an amp per channel. In any case, whenever you use two different amplifiers, be careful to match levels between them.

Biamping also allows you to use high-quality electronic crossovers and drive the speaker's drivers (the voice coils) directly, without the series resistance and non-linear inductance of a passive crossover. Biamping which uses the speaker's crossover is therefore much less desirable.

Replacing

a good speaker's crossover with an electronic crossover has advantages, but involves some very critical tradeoffs and

tuning

which is best left to those well-equipped or experienced.

See also section 16.0 below, on wire and connectors in general.

11.2 Can amplifier X drive 2 ohm or 4 ohm speakers? How do I raise the impedance of a speaker from (say) 4 ohms to 8 ohms?

Almost any amplifier can drive almost any load if you don't turn

the volume up too high. Tube amplifiers are one exception. Some amps clip if you play them too loud. This is bad and damages speakers. Other amplifiers shutdown if they are asked to play too loud. Many will overheat, with bad consequences. However, in almost all cases, it takes seriously loud sound

or

low speaker resistance (less than 4 ohms) to do damage.

Running

two sets of 8 ohm speakers at once with common amplifiers represents a 4 ohm load. Four sets of 8 ohm speakers makes a

2

ohm load. Two sets of 4 ohm speakers also makes a 2 ohm load. If you stay sober and don't turn it up past the point where

it

distorts, you are PROBABLY safe with most amplifiers and most loads. See 11.3 for more information.

You can raise the impedance of a speaker by a few different methods. However, each has drawbacks. If your amplifier won't drive your speakers, AND you are sure that the problem is that the speakers are too low impedance, you might try one of these techniques.

- A) Add a 4 ohm resistor in series with the speaker. This requires a high power resistor, because the resistor will dissipate as much power as the speaker. Doing this will almost always hurt sound quality, too. This is caused, in part, by the fact that speakers do not have constant resistance with frequency. See 11.3 for more information on this.
- B) Use a matching transformer. There are speaker matching transformers which can change from 4 ohm to 8 ohm, but a high quality transformer like this can cost as much as a common receiver. Also, even the best transformer will add some slight frequency response and dynamic range errors.
- C) Use two identical speakers in series. If you have two 4 ohm speakers which are the same make and model, you can wire them in series and make an equivalent speaker with 8 ohm impedance. The sound from that "new speaker" will not be as precisely localized as it would from one speaker, so your stereo image may be hurt. Also, it requires that you buy twice as many speakers as you might have bought otherwise. However, this technique has one side benefit. Two speakers can handle twice the power of one.

11.3 How do I drive more than two speakers with one stereo amplifier?

One amp can drive many speakers. However, there are two limits to this practice. The first is that you can overheat or damage

an amplifier if you drive too low of an impedance to loud listening levels. Avoid loading any amplifier with a lower impedance than recommended. Adding two speakers to one amp

output loads that output with half the impedance of one speaker.

(See also 11.2 above)

The second is that with tube amplifiers, which are uncommon in today's common system, it is important that the speaker impedance and the amplifier output impedance be well matched.

When driving two or more speakers from one amp output, always wire them in parallel, rather than series. Series connection, while safe in terms of impedance levels, can hurt sound quality

by raising the impedance that the speakers themselves see. Also, when different speakers are wired in series, amplifier voltage will divide between the speakers unevenly, because different speakers have different impedance-versus-frequency characteristics.

Many amplifiers have connectors for two pairs of speakers. In general, these amplifiers also have a speaker selector switch. Most amplifiers connect speakers in parallel when both are selected, although some less expensive ones will wire the speakers in series. It is common for these amplifiers to require

8 ohm speakers only, because the amplifier is built to drive either 4 or 8 ohms, and two sets of 8 ohm speakers in parallel loads the amplifier like one set of 4 ohm speakers. It is almost always safe to connect one set of 4 ohm speakers to an amplifier with two sets of outputs, provided that you NEVER use the second terminals for any other speakers.

11.4 How big an amplifier do I need?

Unfortunately, amplifier power ratings and speaker power ratings are almost always misleading. Sometimes, they are factually wrong. Speaker ratings are almost useless in evaluating needs.

To start with, sound pressure, measured in dB, often stated as dB SPL, is a function of the log of the acoustic "sound" power.

Further, human hearing is less sensitive to differences in power than the log transfer function would imply. This means that

the
watt
perceived difference between a 50 watt amplifier and a 100
amplifier, all else equal, is very small! One columnist said
that a 250 watt amplifier puts out twice the perceived
loudness of a 25 watt amplifier, but quantitative statements
about perception should always be treated with caution.
That statement came from Electronics Now Magazine, Jan 1994,
Page 87, Larry Klein's "Audio Update" Column, which is also
good reading on the subject of required amplifier power.

"sensitivity"
of the various speakers available. I have seen good speakers
with under 80 dB per watt efficiency and have also seen good
speakers with over 96 dB per watt efficiency, measured one
meter
factor
of 40 difference in power requirement!

So the first step in determining amplifier requirements is to
estimate relative speaker efficiency. Other factors include
how
loud you will want to listen, how large your room is, and how
many speakers you will drive with one amplifier. This
information will give you a rough starting point. For an
example, a typical home speaker will produce 88 dB at 1 watt.
In an average room, a person with average tastes will be
happy
with this speaker and a good 20 watt per channel amplifier.
Someone who listens to loud music or wants very clean
reproduction of the dynamics of music will want more power.
Someone with less efficient speakers or a large room will
also
want more power.

Past that point, you will have to use your ears. As with all
other decisions, your best bet is to get some candidates,
borrow
them from a friendly dealer, take them home, and listen to
them
at your normal and loudest listening level. See if they play

cleanly when cranked up as loud as you will ever go, into

your

speakers in your room. Of course, it is also important to be sure that the amp sounds clean at lower listening levels.

11.5 Do all amplifiers with the same specifications sound alike?

Some say that they do. Some say that they don't. Some demonstrated that many amplifier differences can be traced to very slight frequency response difference. Let your own ears guide you. If you want to compare amplifiers, you can do it best in a controlled environment, such as your home, with your music and your speakers. Also be very careful to match levels precisely. All you need to match levels of amplifiers is a

high

input-impedance digital voltmeter set to AC volts and a test recording or signal generator. For best accuracy, set levels with the speakers wired to the amplifier.

11.6 Is this amplifier too big for that set of speakers?

There is no such thing as an amplifier that is too big. Small amplifiers are more likely to damage speakers than large

ones,

because small amplifiers are more likely to clip than larger ones, at the same listening level. I have never heard of speakers being damaged by an overly large amplifier. I have heard of 100 watt speakers being damaged by a 20 watt amplifier, however, in really abusive hands. This will happen because when an amplifier clips, it will generate much more energy at high frequencies than normal music would contain. This high energy at high frequencies may be less than the continuous power rating of the speaker, but higher than the actual energy rating of the tweeter. Tweeters tend to be very fragile components

11.7 Where can I get a cheap low-power amplifier?

There are very few available. One source is to buy a cheap boom

box and only use the amplifier. Another source is Radio Shack.

A third alternative is to buy a car stereo booster and get a 12V power supply for it. Finally, you can build an amp pretty easily if you are handy, but it probably won't be that cheap. Sound Values has a 60 watt amp kit complete for about \$200,

and

Old Colony sells some amp kits for a bit more. These kits have been built by satisfied [rec.audio.*](#) posters. (See 11.15, 11.16, 11.17)

11.8 Is the stuff sold by Carver really awesome?

There is a lot of repeated rumor and prejudice for and against Carver equipment based on anecdotes of older Carver equipment.

Sometime in 1994, Bob Carver left the Carver Company, so it is reasonable to expect significant changes in the company and their product line. One of Carver's claims to fame is lots of watts per pound of weight. As with almost everything else,

the

best policy is to listen for yourself and see what you think.

11.9 What is a preamplifier?

A preamplifier is an amplifying electronic circuit which can

be

connected to a low output level device such as a phono

cartridge

or a microphone, and produce a larger electrical voltage at a lower impedance, with the correct frequency response. Phono cartridges need both amplification and frequency response equalization. Microphones only need amplification.

In most audio applications, the term 'preamplifier' is

actually

a misnomer and refers to a device more properly called a 'control amplifier'. Its purpose is to provide features such as input selection, level control, tape loops, and sometimes, a minimal amount of line-stage gain. These units are not preamplifiers in the most technical sense of the word, yet everyone calls them that.

11.10 What is a passive preamplifier?

A passive preamplifier is a control unit without any amplification at all. It is a classic oxymoron, because it has no capability to increase the gain of the signal. It is only used with line level sources that need no gain beyond unity.

11.11 Do I need a preamp? Why?

The tasks of a preamp are to:

- Switch between various input signals,
- Amplify any phono inputs to line level,
- Adjust the volume,
- Adjust the treble and bass if necessary,
- Present the right load impedance for the inputs, and
- Present a low source impedance for the outputs.

If you have a turntable, you NEED a preamp with a phono input. This is because the turntable has an output which is too small for driving amplifiers and because the output of the turntable requires frequency response equalization. You can't connect any other source to a phono input other than a turntable (phono cartridge). Also, you can't connect a phono cartridge or turntable to any input other than a phono input.

Microphones also require special preamplifiers. Some microphones

also require "phantom power". Phantom power is operating power for the microphone which comes from the preamp. Microphone preamps are often built into tape decks and microphone mixers.

If you only have high level inputs, such as the output of a CD player and the output of a tape deck, the main value of a preamp

is selecting between inputs and providing a master volume control. If you only listen to CDs, it is plausible to skip the preamp entirely by getting a CD player with variable level outputs and connecting them directly to a power amplifier.

Some caveats apply. One, the variable outputs on a CD player are often lower sound quality than fixed outputs. Two, some sources have high or nonlinear output impedances which are not ideal for driving an amplifier directly. Likewise, some amplifiers have an unusually low or nonlinear input impedance such that common sources can't drive the input cleanly. A good preamplifier allows use of such devices without sacrificing sound quality.

Unfortunately, the only way to be sure that a preamplifier is of value with your sources and your amplifier is to try one.

11.12 Should I leave equipment on all of the time or turn it on and off?

Some gear draws significant electricity, so you will waste money and fossil fuel if you leave it on all of the time. As an example, a common amplifier consumes 40 watts at idle. High-end gear uses far more electricity, but ignoring that, 40 watts x 168 hours x 52 weeks x US \$0.0001 per watt hour (rough estimate) is \$35/year. Now add a CD player, a preamp, and a tuner, and it really adds up.

High-end enthusiasts claim that equipment needs to warm up to sound its best. If you care about the best sound, give your equipment at least 20 minutes to warm up before serious listening. Warm up will allow the inside temperature to stabilize, minimizing offsets, bring bias currents up to their proper values, and bringing gain up to operating level.

Either way, good gear will last a very long time. Tubes are known to have a finite life, but good tube designs run tubes very conservatively, giving them life exceeding 10 years of continuous service. Some amplifiers run tubes harder to get more power out, and thereby may be more economical to turn off between use.

Filter capacitors will fail after enough time at temperature with voltage applied. They will last longer if turned off between use. However, like tubes, filter caps can last tens of years of continuous use, as can power transformers, semiconductors, and the like.

Filter capacitors have a funny problem that justified a simple break-in or reforming when they are restarted after many years of rest. It involves bringing up the power line voltage slowly

with a variable transformer. For tips on reforming capacitors, consult "The Radio Amateur's Handbook", by the ARRL.

Semiconductors seem to fail more often because of bad surges and abuse than age. Leaving gear off may be best for semiconductors and other surge-sensitive gear if you expect power line surges, as come from an electrical storm or operation of large motors. Fuses seem to age with temperature and get noisy, but they are so inexpensive that it should not bias your decision. However, some are inconvenient to change, and may require opening the case and even voiding the warranty.

11.13 Do tube amps sound better than transistor amps? FETs? Lets first list some commonly used active electronic components and their good and bad attributes.

TUBE: (Valve, Vacuum Tube, Triode, Pentode, etc.) Tubes operate by thermionic emission of electrons from a hot filament or cathode, gating from a grid, and collection on a plate. Some tubes have more than one grid. Some tubes contain two separate amplifying elements in one glass envelope. These dual tubes tend to match poorly.

The characteristics of tubes varies widely depending on the model selected. In general, tubes are large, fragile, pretty, run hot, and take many seconds to warm up before they operate at all. Tubes have relatively low gain, high input resistance, low input capacitance, and the ability to withstand momentary abuse. Tubes overload (clip) gently and recover from overload quickly and gracefully.

Circuits that DO NOT use tubes are called solid state, because they do not use devices containing gas (or liquid).

Tubes tend to change in characteristic with use (age).

Tubes are more susceptible to vibration (called "microphonics") than solid state devices. Tubes also suffer from hum when used with AC filaments.

Tubes are capable of higher voltage operation than any other device, but high-current tubes are rare and expensive. This means that most tube amp use an output transformer. Although not specifically a tube characteristic, output transformers add second harmonic distortion and give gradual high-

frequency

roll-off hard to duplicate with solid state circuits.

TRANSISTOR: (BJT, Bipolar Transistor, PNP, NPN, Darlington, etc.)

Transistors operate by minority carriers injected from emitter

to the base that are swept across the base into the collector,

under control of base current. Transistors are available as PNP

and NPN devices, allowing one to "push" and the other to "pull".

Transistors are also available packaged as matched pairs, emitter follower pairs, multiple transistor arrays, and even as complex "integrated circuits", where they are combined

with

resistors and capacitors to achieve complex circuit functions.

Like tubes, many kinds of BJTs are available. Some have high current gain, while others have lower gain. Some are fast, while others are slow. Some handle high current while others have lower input capacitances. Some have lower noise than others. In general, transistors are stable, last nearly indefinitely, have high gain, require some input current,

have

low input resistance, have higher input capacitance, clip sharply, and are slow to recover from overdrive (saturation). Transistors also have wide swing before saturation.

Transistors are subject to a failure mode called second breakdown, which occurs when the device is operated at both high voltage and high current. Second breakdown can be

avoided

by conservative design, but gave early transistor amps a bad reputation for reliability. Transistors are also uniquely susceptible to thermal runaway when used incorrectly.

However,

careful design avoids second breakdown and thermal runaway.

MOSFET: (VMOS, TMOS, DMOS, NMOS, PMOS, IGFET, etc.)

Metal-Oxide Semiconductor Field Effect Transistors use an insulated gate to modulate the flow of majority carrier

current

from drain to source with the electric field created by a gate.

N

Like bipolar transistors, MOSFETs are available in both P and

N

devices. Also like transistors, MOSFETs are available as

pairs

and integrated circuits. MOSFET matched pairs do not match as well as bipolar transistor pairs, but match better than tubes.

MOSFETs are also available in many types. However, all have very low input current and fairly low input capacitance.

MOSFETs

have lower gain, clip moderately, and are fast to recover

from

clipping. Although power MOSFETs have no DC gate current,

finite

input capacitance means that power MOSFETs have finite AC

gate

current. MOSFETs are stable and rugged. They are not

susceptible

to thermal runaway or second breakdown. However, MOSFETs

can't

withstand abuse as well as tubes.

JFET:

Junction Field Effect Transistors operate exactly the same way that MOSFETs do, but have a non-insulated gate. JFETs share most of the characteristics of MOSFETs, including available pairs, P and N types, and integrated circuits.

JFETs are not commonly available as power devices. They make excellent low-noise preamps. The gate junction gives JFETs higher input capacitance than MOSFETs and also prevents them

from being used in enhancement mode. JFETs are only available as depletion devices. JFETs are also available as matched pairs and match almost as well as bipolar transistors.

IGBT: (or IGT)

Insulated-Gate Bipolar Transistors are a combination of a

MOSFET

and a bipolar transistor. The MOSFET part of the device

serves

as the input device and the bipolar as the output. IGBTs are only available today as N-type devices, but P-type devices

are

theoretically possible. IGBTs are slower than other devices

but

offer the low cost, high current capacity of bipolar

transistors

with the low input current and low input capacitance of

MOSFETs.

IGBTs suffer from saturation as much as, if not more than bipolar transistors, and also suffer from second breakdown. IGBTs are rarely used in high-end audio, but are sometimes used for extremely high power amps.

Now to the real question. You might assume that if these various devices are so different from each other, one must be best. In practice, each has strengths and weaknesses. Also, because each type of device is available in so many different forms, most types can be successfully used in most places.

Tubes are prohibitively expensive for very high power amps. Most tube amps deliver less than 50 watts per channel.

JFETs are sometimes an ideal input device because they have low noise, low input capacitance, and good matching. However, bipolar transistors have even better matching and higher

gain,

so for low-impedance sources, bipolar devices are even

better.

Yet tubes and MOSFETs have even lower input capacitance, so for very high source resistance, they can be better.

Bipolar transistors have the lowest output resistance, so they make great output devices. However, second breakdown

and high stored charge weigh against them when compared to MOSFETs. A good BJT design needs to take the weaknesses of BJTs into account while a good MOSFET design needs to address the weaknesses of MOSFETs.

Bipolar output transistors require protection from second breakdown and thermal runaway and this protection requires additional circuitry and design effort. In some amps, the sound quality is hurt by the protection.

All said, there is much more difference between individual designs, whether tube or transistor, than there is between

and transistor designs generically. You can make a fine amp from either, and you can also make a lousy amp from either.

Although tubes and transistors clip differently, clipping will be rare to nonexistent with a good amp, so this difference should be moot.

Some people claim that tubes require less or no feedback while transistor amps require significant feedback. In practice, all amps require some feedback, be it overall, local, or just "degeneration". Feedback is essential in amps because it makes the amp stable with temperature variations and manufacturable despite component variations.

Feedback has a bad reputation because a badly designed feedback system can dramatically overshoot or oscillate. Some older designs used excessive feedback to compensate for the nonlinearities of lousy circuits. Well designed feedback amps are stable and have minimal overshoot.

When transistor amps were first produced, they were inferior

the better tube amps of the day. Designers made lots of

with the new technologies as they learned. Today, designers are far more sophisticated and experienced than those of 1960.

Because of low internal capacitances, tube amps have very linear input characteristics. This makes tube amps easy to drive and tolerant of higher output-impedance sources, such

as other tube circuits and high-impedance volume controls. Transistor amps may have higher coupling from input to output and may have lower input impedance. However, some circuit techniques reduce these effects. Also, some transistor amps avoid these problems completely by using good JFET input circuits.

There is lots of hype out on the subject as well as folklore and misconceptions. In fact, a good FET designer can make a great FET amp. A good tube designer can make a great tube

amp, and a good transistor designer can make a great transistor

amp. Many designers mix components to use them as they are best.

As with any other engineering discipline, good amp design requires a deep understanding of the characteristics of components, the pitfalls of amp design, the characteristics of the signal source, the characteristics of the loads, and the characteristics of the signal itself.

As a side issue, we lack a perfect set of measurements to grade the quality of an amp. Frequency response, distortion, and signal-to-noise ratio give hints, but by themselves are insufficient to rate sound.

Many swear that tubes sound more "tube like" and transistors sound more "transistor like". Some people add a tube circuit to their transistor circuits to give some "tube" sound.

Some claim that they have measured a distinct difference

between the distortion characteristics of tube amps and transistor

amps. This may be caused by the output transformer, the transfer function of the tubes, or the choice of amp topology. Tube

amps rarely have frequency response as flat as the flattest transistor amps, due to the output transformer. However, the frequency response of good tube amps is amazingly good.

For more information on tubes, get one of the following old reference books, or check out audioXpress Magazine (see the

magazine section of the FAQ for more info on audioXpress).

The Receiving Tube Manual (annual up to 1970)

The Radiotron Designers Handbook

Fundamentals of Vacuum Tubes" by Eastman 1937, McGraw-Hill

11.14 What about swapping op-amps?

Many components use ICs called op amps as audio amplifiers. Earlier op amps had poor sound quality, especially if misused.

Some engineers with a strong background in ICs and op amps learned that they could improve sound if they replaced slow, noisy, low slew-rate, or otherwise bad op amps with better ones.

Some less informed people tried doing the same thing and made the sound worse.

One pitfall with op amp swapping is that some op amps are more prone to unwanted oscillation than others. The faster the op amp, the more likely it will cause an unwanted oscillation, which will really damage the sound. For that reason, Joe may succeed in replacing 741 op amps with 5534 op amps in his gear, and you may fail. It is dependent on design, layout, etc.

As technology and design expertise improves, audio op amps get better and swapping is getting less and less useful. Newer op amps are displacing yesterday's best, and sound surprisingly similar to straight wire.

Still, there are different op amps for different purposes. Bipolar op amps are ideal for preamplifiers where noise is critical. The OP-27, OP-37, LT1028, and LT1115 are very well received for phono preamps, head amplifiers, and microphone preamplifiers. Bipolar op amps are also more practical for signals with low source impedance.

FET devices like the OPA604 and OPA2604 have higher slew rate, higher bandwidth, and lower input current. These op amps are better for line-level inputs and high source-resistance signals.

Some amplifiers, like the OP-37 and LT1115 achieve higher

bandwidth by using less internal compensation. These amplifiers are not unity gain stable, and should not be used in circuits with low closed loop gain or large feedback capacitors.

Some of the better op amps for audio as of today include (* means highly recommended):

Single	Dual
AD845*	AD842
AD847	AD827
AD797*	NE5535
NE5534	NE5532
OP-27	AD712
LT1115*	LM833
AD811	OPA2604*
AD841	OP249*
HA5112*	
LT1057	
LT1028	
AD744	
SSM2016	

With op amp part numbers, there is a lot of room for confusion.

Here is a guide to the numbers that is often accurate:

Op amp part numbers start with a manufacturer's prefix:

- Analog Devices uses AD
- Burr Brown uses OPA
- Harris/Intersil uses HA
- Linear Technology uses LT
- Motorola uses MC
- National uses LF and LM
- PMI uses OP
- Signetics uses NE and SE
- TI uses TL

This can be confused because if TI copies a Signetics op amp, they may assume the Signetics prefix, or they may use their own.

Fortunately, if the part numbers are the same, circuitry is almost exactly the same, as is the performance. (Note: almost)

The next thing in the part number is two, three, four or five

digits. This is invariably the key to the part. If the numbers are the same, the parts are almost surely the same. For example, an LM357N and an LM357J are electrically identical and sound the same.

Next is a letter or two indicating the op amp package and possibly how it has been tested and what tests it passed. Unfortunately, manufacturers haven't standardized these letters. Fortunately, you almost never care. If it is a dual-inline (DIP) package and you are replacing a DIP, you shouldn't have to worry whether or not it is ceramic or molded. Likewise, you rarely care if it has 100uV offset or 4mV offset for audio. Finally, you don't care if it wasn't tested at elevated temperatures because you will use it in your house, inside well ventilated gear.

So in general, an NE5532J is a TL5532N, and an AD827JN will sound the same as an AD827LD. If you aren't sure about some detail, call or write the IC maker and ask for a data sheet on the parts in question. They will always send data sheets for free, and these data sheets contain details on the various part numbers, internal circuitry, and electrical characteristics.

11.15 Where can I buy electronic parts to make an amplifier?

There are many commercial parts distributors that sell only to Corporations. Their prices are often list, their supply is often good, and their service varies. Common ones are Arrow Electronics, Gerber Electronics, Hamilton Avnet, and Schweber Electronics. See your local phone book.

These There are also distributors that cater to smaller buyers. typically have only one office. Some have lousy selections but great prices. In the following list, (+) means that the dealer

has a good reputation, (?) means that the dealer has
insufficient reputation, and (X) means that some have
reported
problems with this dealer. (C) means they have a catalog.

All Electronics Corporation (Surplus, Tools, Parts) (?) (C)
PO Box 567

Van Nuys CA 90408 USA

800-826-5432

818-904-0524

Allied Electronics (Full Line of Parts) (+) (C)

800-433-5700

Antique Electronics Supply (Tubes, capacitors, etc) (?)

688 First St

Tempe AZ 85281 USA

602-894-9503

Billington Export Ltd. (Valves and CRTs)

I E Gillmans Trading Estate

Billinghurst, RH14 9E3 United Kingdom

Tel (0403) 784961

Chelmer Valves (Valves)

130 New London Rd

Chelmsford, CM2 0RG United Kingdom

DigiKey Corporation (Full Line of Parts) (+) (C)

701 Brooks Avenue South

PO Box 677

Thief River Falls MN 56701-0677 USA

800-344-4539

Electromail (Wide range of parts, similar to Radio Shack)

PO Box 33, Corby, Northants NN17 9EL United Kingdom

Tel 0536 204555

Langrex Supplies Ltd. (Obsolete Valves)

1 Mayo Rd.

Croyden, Surrey, CR0 2QP United Kingdom

Maplin (General parts supplier)

PO Box 3

Rayleigh, Essex, SS6 2BR United Kingdom

Tel 01702 556751.

Marchand Electronics (?) (Crossover kits)

1334 Robin Hood Lane

Webster NY 14580 USA

716-872-5578

MCM Electronics (Speakers, A/V Repair Parts, Etc) (+) (C)

650 Congress Park Dr
Centerville Ohio 45459-4072 USA
513-434-0031 or 800-543-4330
MesaBoogie (Tubes, instrument speakers) (?)
707-778-8823
Michael Percy (Connectors, MIT, Wonder Caps, Buf-03) (+)
PO Box 526
Inverness CA 94936 USA
415-669-7181 Voice
415-669-7558 FAX
Mouser Electronics (Full Line of Parts) (+) (C)
PO Box 699
Mansfield TX 76063-0699 USA
800-346-6873
817-483-4422
Newark Electronics (Full Line of Parts) (+) (C)
Old Colony Sound (Audio parts and audio kits) (+) (C)
PO Box 243
Peterborough NH 03458-0243 USA
603-924-9464
Parts Express (Speakers, Cables, Connectors) (+) (C)
340 East First Street
Dayton OH 45402-1257 USA
937-222-0173
PM Components (High end audio parts and valves)
Springhead road
Gravesend
Kent, DA11 3HD United Kingdom
Tel (0474) 560521
PV Tubes (Valves and Transformers)
104 Abbey St.
Accrington, Lancs, BB5 1EE United Kingdom
Tel (0254) 236521
Radio Shack (Parts, Low-End Audio) (+) (C)
RATA Ltd (Audio parts and cables: Kimber, Ansar, Vishay)
Edge Bank House
Skelsmergh
Kendal, Cumbria, LA8 9AS United Kingdom
Tel (0539) 823247
SJS Acoustics (High-end parts, valves, transformers)
Ben-Dor
Lumb Carr Rd.
Holcombe, Bury, BL8 4NN United Kingdom

Sowter Transformers (Mains and output transformers)

EA Sowter Ltd. PO box 36

Ipswich, IP1 2EL United Kingdom

Tel (0473) 219390

Tanner Electronics (Surplus Parts) (+)

214-242-8702

Toroid Corp of Maryland (Toroidal power transformers) (+)

(also sells without secondary, ready to finish)

Toroid Corporation of Maryland

2020 Northwood Drive

Salisbury, MD 21801 USA

410-860-0300

Fax 410-860-0302

USA Toll Free 888-286-7643

sales@toroid.com

<http://www.toroid.com>

Triode Electronics (Tubes, transformers, boxes) (?)

2010 Roscoe St

Chicago IL 60618 USA

312-871-7459

Welborne Labs (Connectors, Linear Tech ICs, Wima Caps) (?)

P.O. Box 260198

971 E. Garden Drive

Littleton, CO 80126 USA

303-470-6585 Voice

303-791-5783 FAX

Wilson Valves (Valves)

28 Banks Ave.

Golcar, Huddersfield, HD7 4LZ United Kingdom

11.16 Where can I buy audio amplifier kits?

Alas, Heath is no longer making Heathkits. Alternatives:

AP Electronics (High grade components and kits)

20 Derwent centre

Clarke St.

Derby DE1 2BU United Kingdom

Audio Kits, div. Classified Audio Video Inc. (kits from

Erno Borbely designs)

support@audiokits.com

<http://www.audiokits.com>

Audio Note (Audio parts, kits, and high quality amps)

Unit 1

Block C, Hove Business Centre

Fonthil Rd.

Hove, East Sussex, BN3 6HA United Kingdom

Tel (0273) 220511

Audio Synthesis (Many kits from Ben Duncan designs) (?)

99 Lapwind Lane

Manchester M20 0UT, UK

061-434-0126 Voice

060-225-8431 FAX

BORBELY AUDIO, Erno Borbely (JFET & tube preamp kits, MOSFET & tube power amplifier kits. Also audiophile components)

Angerstr. 9

86836 Obermeitingen, Germany

Tel: +49/8232/903616

Fax: +49/8232/903618

E-mail: BorbelyAudio@t-online.de or EBorbely@aol.com

<http://www.borbelyaudio.com>

Crimson (UK) (?)

Hafler (+) (may be out of the kit business)

Hart Electronic Kits (Audiophile kits and components)

Penylan Mill

Oswestry

Shropshire, SY10 9AF United Kingdom

Tel (0691)652894

Old Colony Sound (+) (See 11.15)

PAiA Electronics (?) (Musician-related kits)

3200 Teakwood Lane

Edmond OK 73013 USA

405-340-6378

Sound Values (+) (See 11.7)

185 N Yale Avenue

Columbus OH 43222-1146 USA

614-279-2383

11.17 Where can I read more about building amplifiers, preamps, etc.?

Audio Amateur Magazine

Audio Amateur Publications

PO Box 494

Peterborough NH 03458 USA

603-924-9464

Analog Devices Audio/Video Reference Manual

Electronic Music Circuits, by Barry Klein

Available only from author direct at

barry.l.klein@wdc.com or barryklein@coxnet.net

Howard D Sams & Co ISBN 0-672-21833-X
Electronics Australia (Magazine with audio projects)
AUD47 per year 12 issues, often discounted
PO Box 199
Alexandria, Australia
+612 353 9944 or +612 353 6666
Elektor Electronics (How it works and you-build articles)
(no longer published in US. Still available in Europe)
PO Box 1414
Dorchester DT2 8YH, UK
Enhanced Sound: 22 Electronic Projects for the Audiophile
(Some basic projects and some "how it works")
by Richard Kaufman
Tab Books #3071/McGraw Hill
ISBN 0-8306-9317-3
audioXpress Magazine
Audio Amateur Publications
PO Box 494
Peterborough NH 03458 USA
603-924-9464
IC Op-Amp Cookbook, Third Edition by Walter G. Jung
ISBN 0672-23453-4, Howard W. Sams, Inc.
Journal of the Audio Engineering Society (Theory & Experiment)
Audio Engineering Society
60 East 42nd Street
New York City NY 10165-0075 USA
212-661-2355
Popular Electronics
Radio-Electronics
Radiotron Designer's Handbook, Fourth Edition (old, tube info)
The Technique of Electronic Music, by Thomas H Wells
Schirmer Books ISBN 0-02-872830-0
Vacuum Tube Amplifiers, MIT Radiation Lab series
Wireless World
Some of the above titles, as well as a catalog of technical
books, are available from:
OpAmp Technical Books, Inc.
1033 N Sycamore Avenue
Los Angeles CA 90038 USA
800-468-4322 or 213-464-4322

11.18 What is Amplifier Class A? What is Class B? What is Class AB?
What is Class C? What is Class D?

All of these terms refer to the operating characteristics of the output stages of amplifiers.

Briefly, Class A amps sound the best, cost the most, and are the least practical. They waste power and return very clean signals.

Class AB amps dominate the market and rival the best Class A amps in sound quality. They use less power than Class A, and can be cheaper, smaller, cooler, and lighter. Class D

amps are only used for special applications like bass-guitar amps

and subwoofer amps. They are even smaller than Class AB amps and more efficient, yet are often limited to under 10kHz (less

than full-range audio). Class B & Class C amps aren't used in

audio. In the following discussion, we will assume transistor output stages, with one transistor per function. In some amplifiers, the output devices are tubes. Most amps use more than one transistor or tube per function in the output stage to

increase the power.

Class A refers to an output stage with bias current greater

than the maximum output current, so that all output transistors

are always conducting current. The biggest advantage of Class A is that it is most linear, ie: has the lowest distortion.

The biggest disadvantage of Class A is that it is

inefficient, ie: it takes a very large Class A amplifier to deliver 50

watts, and that amplifier uses lots of electricity and gets very

hot. Some high-end amplifiers are Class A, but true Class A only accounts for perhaps 10% of the small high-end market and

none

of the middle or lower-end market.

Class B amps have output stages which have zero idle bias current. Typically, a Class B audio amplifier has zero bias current in a very small part of the power cycle, to avoid nonlinearities. Class B amplifiers have a significant

advantage

over Class A in efficiency because they use almost no electricity with small signals.

Class B amplifiers have a major disadvantage: very audible distortion with small signals. This distortion can be so bad that it is objectionable even with large signals. This distortion is called crossover distortion, because it occurs

at

the point when the output stage crosses between sourcing and sinking current. There are almost no Class B amplifiers on

the

market today.

Class C amplifiers are similar to Class B in that the output stage has zero idle bias current. However, Class C amplifiers have a region of zero idle current which is more than 50% of the total supply voltage. The disadvantages of Class B amplifiers are even more evident in Class C amplifiers, so Class C is likewise not practical for audio amps.

Class A amplifiers often consist of a driven transistor connected from output to positive power supply and a constant current transistor connected from output to negative power supply. The signal to the driven transistor modulates the output voltage and the output current. With no input signal, the constant bias current flows directly from the positive supply to the negative supply, resulting in no output

current,

yet lots of power consumed. More sophisticated Class A amps have both transistors driven (in a push-pull fashion).

Class B amplifiers consist of a driven transistor connected from output to positive power supply and another driven transistor connected from output to negative power supply. The signal drives one transistor on while the other is off,

so in a Class B amp, no power is wasted going from the positive supply straight to the negative supply.

Class AB amplifiers are almost the same as Class B amplifiers in that they have two driven transistors. However, Class AB amplifiers differ from Class B amplifiers in that they have a small idle current flowing from positive supply to negative supply even when there is no input signal. This idle current slightly increases power consumption, but does not increase it anywhere near as much as Class A. This idle

current

also corrects almost all of the nonlinearity associated with crossover distortion. These amplifiers are called Class AB rather than Class A because with large signals, they behave

like

Class B amplifiers, but with small signals, they behave like Class A amplifiers. Most amplifiers on the market are Class

AB.

Some good amplifiers today use variations on the above

themes.

For example, some "Class A" amplifiers have both transistors driven, yet also have both transistors always on. A specific example of this kind of amplifier is the "Stasis" (TM)

amplifier

topology promoted by Threshold, and used in a few different high-end amplifiers. Stasis (TM) amplifiers are indeed Class A, but are not the same as a classic Class A amplifier.

Class D amplifiers use pulse modulation techniques to achieve even higher efficiency than Class B amplifiers. As Class B amplifiers used linear regulating transistors to modulate

output

current and voltage, they could never be more efficient than 71%. Class D amplifiers use transistors that are either on or off, and almost never in-between, so they waste the least

amount

of power.

Obviously, then, Class D amplifiers are more efficient than Class A, Class AB, or Class B. Some Class D amplifiers have >80% efficiency at full power. Class D amplifiers can also

have

low distortion, although not as good as Class AB or Class A.

Class D amplifiers are great for efficiency. However they are awful for other reasons. It is essential that any Class D amp be followed by a passive low-pass filter to remove switching noise. This filter adds phase shift and distortion. It also limits the high frequency performance of the amplifier, such that Class D amplifiers rarely have good treble. The best application today for Class D amplifiers is subwoofers.

To make a very good full range Class D amplifier, the

switching frequency must be well above 40kHz. Also, the amplifier must

be followed by a very good low-pass filter that will remove all

of the switching noise without causing power loss, phase-shift,

or distortion. Unfortunately, high switching frequency also

means significant switching power dissipation. It also means that

the chances of radiated noise (which might get into a tuner or

phono cartridge) is much higher.

Some people refer to Class E, G, and H. These are not as well standardized as class A and B. However, Class E refers to an amplifier with pulsed inputs and a tuned circuit output. This is commonly used in radio transmitters where the output is at a single or narrow band of frequencies. Class E is not used for audio.

Class G refers to "rail switched" amplifiers which have two different power supply voltages. The supply to the amplifier is connected to the lower voltage for soft signals and the higher voltage for loud signals. This gives more efficiency without requiring switching output stages, so can sound better than Class D amplifiers.

Class H refers to using a Class D or switching power supply to drive the rails of a class AB or class A amplifier, so that the amplifier has excellent efficiency yet has the sound of a

good class AB amplifier. Class H is very common in professional audio power amplifiers.

11.19 Why do I hear noise when I turn the volume control? Is it bad? Almost all volume controls are variable resistors. This goes for rotary controls and slide controls. Variable resistors consist of a resistive material like carbon in a strip and a conductive metal spring wiper which moves across the strip as the control is adjusted. The position of the wiper determines the amount of signal coming out of the volume control.

Volume controls are quiet from the factory, but will get noisier as they get older. This is in part due to wear and in part due to dirt or fragments of resistive material on the resistive strip. Volume control noise comes as a scratch when the control is turned. This scratch is rarely serious, and most often just an annoyance. However, as the problem gets worse, the sound of your system will degrade. Also, as the problem gets worse, the scratching noise will get louder. The scratching noise has a large high-frequency component, so in the extreme, this noise could potentially damage tweeters, although I have never seen a documented case of tweeter damage due to control noise.

Some controls are sealed at the factory, so there is no practical way to get inside and clean out the dirt. Others have access through slots or holes in the case. These open controls are more subject to dirt, but also are cleanable. You can clean an open volume control with a VERY QUICK squirt of lubricating contact cleaner, such as Radio Shack 64-2315. Even better is a non-lubricating cleaner, such as Radio Shack 64-2322. With any cleaner, less is better. Too much will wash the lubricant out of the bearings and gunk up the resistive element.

You can also clean some controls by twisting them back and forth vigorously ten times. This technique pushes the dirt out of the way, but is often just a short term fix. This technique is

also

likely to cause more wear if it is done too often. Try to do it with the power applied, but the speaker disconnected, so that there is some signal on the control.

Sealed and worn controls should be replaced rather than cleaned.

Critical listeners claim that some controls, such as those made by "Alps" and by "Penny and Giles" sound better than common controls. Regardless of the brand, however, it is essential that whatever control you buy have the same characteristics as the one you are replacing. For most volume controls, this means that they must have AUDIO TAPER, meaning that they are designed as an audio volume control, and will change the level by a constant number of dB for each degree of rotation.

Badly designed circuits will wear out volume controls very quickly. Specifically, no volume control is able to work for a long time if there is significant DC current (or bias current)

in the wiper. If the output of the control goes to the input of an amplifier, the amplifier should be AC coupled through a capacitor. If there is a capacitor there, it might be leaky, causing undesirable DC current through the volume control.

If you have a circuit with no blocking capacitor or a bad blocking capacitor, you can add/replace the capacitor when you replace the control. However, get some expert advise before modifying. If you add a capacitor to a device which doesn't have one, you will have to make other modifications to insure that the amplifier has a source for its bias current.

11.20 What is amplifier "bridging" or "monoblocking"? How do I do it?

When you're told a stereo power amplifier can be bridged, that means that it has a provision (by some internal or external switch or jumper) to use its two channels together to make one mono amplifier with 3 to 4 times the power of each channel. This is also called "Monoblocking" and "Mono Bridging".

Tube amps with multiple-tap output transformers are simple to bridge. Just connect the secondaries in series and you get more power. The ability to select transformer taps means

that you can always show the amplifier the impedance it expects,

so tube amp bridging has no unusual stability concerns.

The following discussion covers output transformer-less amps. Bridging these amps is not so simple. It involves connecting one side of the speaker to the output of one channel and the other side of the speaker to the output of the other

channel. The channels are then configured to deliver the same output signal, but with one output the inverse of the other. The beauty of bridging is that it can apply twice the voltage to the speaker. Since power is equal to voltage squared divided by speaker impedance, combining two amplifiers into one can give four (not two) times the power.

In practice, you don't always get 4 times as much power. This is because driving bridging makes one 8 ohm speaker appear

like two 4 ohm speakers, one per channel. In other words, when you bridge, you get twice the voltage on the speaker, so the speakers draw twice the current from the amp.

The quick and dirty way to know how much power a stereo amp

can deliver bridged to mono, is to take the amp's 4 ohm (not 8

ohm) power rating per channel and double it. That number is the amount of watts into 8 ohms (not 4 ohms) you can expect in

mono. If the manufacturer doesn't rate their stereo amp into 4

ohms, it may not be safe to bridge that amp and play at loud

levels, because bridging might ask the amp to exceed its safe maximum output current.

Another interesting consequence of bridging is that the

amplifier

damping factor is cut in half when you bridge. Generally, if you use an 8 ohm speaker, and the amplifier is a good amp for driving 4 ohm speakers, it will behave well bridging.

Also consider amplifier output protection. Amps with simple power supply rail fusing are best for bridging. Amps that rely

on output current limiting circuits to limit output current are likely to activate prematurely in bridge mode, and virtually every current limit circuit adds significant distortion when it kicks in. Remember bridging makes an 8 ohm load look like 4 ohms, a 4 ohm load look like 2 ohms, etc. Also, real speakers do not look like ideal resistors to amps. They have peaks and dips in impedance with frequency, and the dips can drop below 1/2 the nominal impedance. They also have wildly varying phase with frequency.

Finally, some amplifiers give better sound when bridged than others. Better bridging amps have two identical differential channels with matched gain and phase through each input, left and right, inverting and non-inverting. Simpler bridging amplifiers have one or two inverting channels, and run the output of one into the input of the second. This causes the two outputs to be slightly out of phase, which adds distortion.

There are also other topologies. One uses an additional stage to invert the signal for one channel but drives the other channel directly. Another topology uses one extra stage to buffer the signal and a second extra stage to invert the signal. These are better than the simple master/slave arrangement, and if well done, can be as good as the full differential power amp.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments	Internet: neidorff@ti.com
50 Phillippe Cote St.	Voice : (US) 603-222-8541
Manchester, NH 03101 USA	

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)

- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Speakers 2/99 (part 5 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part5_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Speakers 2/99 (part 5 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:10 GMT

Archive-name: AudioFAQ/part5

Last-modified: 2000/02/02

Version: 2.15

12.0 Speakers:

12.1 What should I listen to when evaluating speakers?

The most important thing is to listen to recordings that you **know**. Any good salesman will play you recordings that highlight that particular speaker. Do not be embarrassed about bringing a stack of CDs with you to the hi-fi shop.

Do not spend your valuable listening time switching between a

dozen pairs every 3 seconds. If you are shopping at a quality store, the dealer will, from the description of your room, your size requirements, your musical tastes, and your budget, be able to show you a couple of pairs that will be close to what you want. Spend several minutes listening to each. When you think you're close, don't be embarrassed about spending half an hour or more listening to the speakers. You're going to have them in your home for a lot longer, and many speakers will cause "listening fatigue" after a short time. Make sure you really like them before you hand over money.

One thing to try is well recorded "Spoken Word" records; most people have a very good ability to tell when a speaking voice sounds unnatural, even if they've never heard the person speaking live. If you play an acoustic instrument, find something that features that instrument solo, or in a small group; make sure it really sounds like it should. Almost everyone has heard a live piano. Piano can be very revealing.

Blues, jazz, folk, or 'easy listening' music with simple instruments and a female vocalist is also revealing. Well

female singing voices provide a very good test of a system's response. Try something simple and soft, which will let you hear any noises coming from the system; and something

with lots of instruments all happening at once, to make sure the system doesn't go muddy when things get complicated. And, of course, try a few of your favorites, and see if you like what happens with them.

If a sales person suggests some music to listen to, the odds are that it isn't the most revealing. Sales people tend to suggest things which sound great. Anything you own and like is good, because you know it and are happy to listen to it carefully.

matter how good the recording, if you don't like Opera, you won't listen to it as carefully as your favorite, scratchy, 1940's rhythm and blues.

Most important is to listen to something you are familiar with.

Even if a recording is flawed (and what ones aren't?), how is it different from your normal setup? Some of the most important differences are "Gee, I never heard that instrument before!"

12.2 What should I listen for when evaluating speakers?

When comparing two speakers side-by-side, doing an AB comparison, be extremely careful to match the levels before evaluating. A slight level difference can make one speaker sound better, even though the difference may not be perceived as a level difference. Some claim that you will be influenced by a difference of less than 1/2 dB!

First and foremost, the sound should be natural. If you listen to vocals, close your eyes and try to picture someone singing in the same room with you. Does it sound realistic? Likewise with instruments. You selected recordings of instruments that you like and have heard live. Do they sound like what you remember them sounding like live?

Your very first impression should be something like "what nice sound". If your initial gut reaction is "gosh, what a lot of detail", the system is likely to be heavy in the treble (often interpreted by beginners as "more detailed") and you'll probably find that annoying after a while. If your first reaction is "hey, what powerful bass", then the system is probably bass-heavy, rather than ideal. The most common mistake for beginners is to buy a system with REALLY powerful bass, because it sounds "impressive" at first. After a while, though,

you'll

get tired of being thumped on the head by your music.

your

Not to say that good bass and treble aren't important. But

first realization should be that the music is all there, and that it comes together as good music, without one particular part trying to dominate it. Sit back and listen to it for a bit. You should be able to pick out the individual

instruments

if you want. They shouldn't force themselves on you, and you should also be able to hear the music as a single piece, the

sum

of its parts, without feeling like each of the instruments is trying to grab your attention away from the others.

You should check how things sound with the amp turned up, and also with it turned down to a fairly low volume level. Some speakers which sound very nice at low levels begin to sound confused, like they can't cope, when turned up. On the other hand, some sound nice loud, but sound thin and bodiless when

you

turn them down a bit. With the spoken word or female

vocalist,

listen for "sibilance", a pronounced 'hiss' at the end of 's' and 'z' sounds. It shouldn't be there. Most planar speakers just can't play very loud. Whatever you hear, do some auditioning at the maximum volume you anticipate ever wanting.

to

It is acceptable and sometimes desirable to switch the stereo mono to evaluate naturalness. Mono is a good test of both the room and the speakers. The image should be rock-solid dead center, and not move with signal or level. If it isn't

perfect

mono, it will be nearly impossible to create a good stereo.

frequencies

A speaker in a large box is capable of producing low

at higher volumes with more efficiency than a small box, but that doesn't mean that a small box can't have great bass, it just won't be as efficient and can't play as loud.

Good speakers can "recreate a natural stereo sound stage", placing some instruments to the left of the left speaker, some sounds in the middle, and some to the right of the right speaker. Poorer speakers make it harder to localize voices.

12.3 Why use a subwoofer? Will it help? One or two?

One reason to get a subwoofer is to add bass to a feeble system.

A second reason is to move the lowest frequencies to a separate driver, and thereby reduce a particular kind of distortion caused by the nonlinear mixing of different sounds, called "intermodulation distortion". A third is to increase the power handling ability of the system and the overall reliability. All are valid reasons, but it isn't so simple.

To improve the sound of a good speaker system, a subwoofer must "integrate smoothly" into the system, extending the bass without causing peaks or dips. Many subwoofers have a crossover that goes between your amp and your main speaker which sends the lows to the subwoofer and sends the higher frequency signals to the main speakers. This may damage the perfect sound of a good system, it may sound similar, or it may sound better.

Most good small speaker systems have a bass peak at resonance, which attempts to compensate for the absence of lower bass. Like it or not, this is the only way to make a small system sound realistic. If the small system is done well, the improvement you will get from a subwoofer will be small, but still real and, to many, significant.

Correctly done, a good subwoofer will enhance the sound of a good small-box system. Done wrong or haphazardly, anything is possible. Even a fine large speaker system might benefit from careful addition of a subwoofer. However, the better the

original system, the more likely it will be that a modest subwoofer will do more harm than good.

Low frequencies travel less directionally than high frequencies,
so many people say that only one subwoofer is required for good sound. This is true to some extent, but not completely true.

There are a few reasons for getting two subwoofers. Some feel that you need two subwoofers to accurately reproduce the stereo image, no matter how little low-frequency stereo information there is. Others feel that two subwoofers are much easier to set up in a room, less likely to excite standing waves in the room, and give smoother sound.

A third reason is that two subwoofers can produce twice the sound of one. Finally, even though subwoofers produce very low frequency sound and very low frequency sound is non-directional, subwoofers also have output at 100 Hz, and sound at 100 Hz is directional, so two subwoofers will give a slightly better stereo image than one. Assuming, of course, that the two are separated by at least two feet.

Finally, even though original source signals rarely contain any music with stereo components below 50Hz, there may be some noise component with low-frequency out-of-phase noise. This unusual noise might add a sense of space to a recording if it is reproduced by a system in which the woofers are very far apart.

It is still true that a single good subwoofer, correctly added to a system will help the sound but two will probably help more.

12.4 How do you connect a subwoofer to a stereo?

Many subwoofers contain their own amplifier and crossover.

For these, take the preamp output and feed it into the subwoofer amp input and also into the main amplifier.

For other subwoofers, just run them in parallel with your main speakers, or combine them into your system with your own bass amplifier and crossover.

Some A/V receivers contain a splitter specifically for use with subwoofers. If you have one of these, you will either want a separate amplifier for your subwoofer or an amplified subwoofer.

Consult the manual which comes with the subwoofer.

12.5 What do I need for surround sound?

"Surround Sound" has referred to a number of different products over the years. Many mass-fi receivers have "Surround Sound" buttons that do little more than muck up the imaging.

In recent years the term "Surround Sound" has become synonymous with the surround systems produced by Dolby Laboratories.

Dolby Surround comes in several flavors, such as passive surround (which simply decodes the phase information and sends it to the rear speakers) and the more advanced system called Pro Logic. Pro Logic system uses computer circuitry to route directional information to the appropriate speakers.

Generally, one needs at least two more speakers beyond the main stereo pair. Advanced Pro Logic systems such as the Lexicon

and Fosgate can accommodate several more speakers beyond the two additional ones (usually placed in the rear). Often one can find Pro Logic systems with two front, two rear, two side, as well as a center channel speaker for dialogue.

12.6 I was just approached (accosted?) by a couple of kids driving a

van that said they had some GREAT speakers to sell. They are overstocks, used by major recording studios and DJs or even hot, and they normally sell for \$1000/pr, but they'll let me have them for just \$399. Am I getting ripped off?

Yes, you most certainly are. The speakers these people sell are none of what they describe. They are never used in studios. There might be one or two DJs out there that use them because they can't afford anything else. They are not overstocks, and in all likelihood, they are NOT HOT!.

Are they good speakers? No, they're, at best, no better than the big boom boxes you find in \$400 rack systems in

department

stores. They are worth no more than what the kids paid for them (\$100/pr).

The speakers go under names like "Acoustic Monitor DB IV", "Acoustic Linear," "Pro-Poly," "Audio Reference 4350", "Omni Audio", and so on. They all "feature" things like "liquid cooled 3" tweeter", poly-cone 12" woofer, fantastic (but impossible) frequency response, 98 db/watt sensitivity, and so on. The brand names are remarkably similar to reputable firms, but different enough to delay law suits.

These speaker are made by a couple of manufacturers with the intent of being sold exactly this way. They cost the kids in the van about US \$100 a pair, and the kids are given minimal training about what kinds of stories to use, what parking

lots

are the most likely to generate sales (department store

parking

lots near colleges in September is a great time for these guys).

Anything over the US \$100 the kids paid is pure profit.

Stay away, you're getting ripped off. For more information on these speakers, see:

<http://bigsun.wbs.net/homepages/o/m/n/omniaudioscam/>

<http://www.frii.com/~rjn/audio/whitevan.htm>

12.7 What speakers should I consider in the \$XXX/pair price range?

This is probably the most commonly asked question on [rec.](#)

[audio](#),

and also the most impossible to answer. The market keeps changing, everyone has different tastes, and no one has the time

to listen to even 10% of the products available in any country.

Also, many good products are only available in specific regions or countries.

If you really want recommendations and are willing to listen to

the opinions of others, check the past few issues of Stereophile

Magazine. Although they are strongly biased towards very expensive gear and have their own particular other biases, they

do steer you to some very good equipment in their frequently-updated list of "RECOMMENDED COMPONENTS".

12.8 Can you build better speakers than you can buy?

Some people can build better than you can buy. These people are

either experts, golden ears, extremely well equipped, inspired, or a combination of the above.

Some companies have plans available to entice you into buying their drivers: Audio Concepts, Audax, Dynaudio, Focal, KEF,

and Scanspeak. Your success rate with these plans will probably be

very good IF your cabinetry skills are very good and IF you follow the plans precisely. If you deviate (as everyone

does), anything is possible.

Stereophile has published three different plans designed by

Dick Olsher which are similar two-way ported systems. A recent one

of these was in Stereophile Nov '90, pages 94-127. Audio Magazine

published a plan called "The Pitts" by Ken Kantor, in Audio,
Nov '88 pages 65-71 continued in Dec '88 pages 73-77. This plan
is a two-way sealed box.

I have built one published design and one manufacturer's
design.

I believe that both met my expectations. They took me a long
time to build, taught me a lot, were fun projects, and
sounded good when finished.

I also believe that a commercial system which cost what my
parts cost will never sound anywhere near as good as the one I
build.

If you consider \$2/hour for my time, however, building is
financial suicide.

Designing your own system is even more a can-of-worms, and
should be left to those with either a strong stomach, a very
forgiving ear, infinite resources, or excellent guidance.

12.9 Where can I read more about speaker building?

Europe's Greatest Speaker Designs

Solen Electronique

4470 Avenue Thibault

St.-Hubert, QC J3Y 7T9 Canada

Voice 514-656-2759

FAX 514 443-4949

High Performance Loudspeakers by Martin Colloms

Speaker Builder Magazine

Audio Amateur Publications

PO Box 494

Peterborough NH 03458 USA

603-924-9464

Synergetic Audio Concepts Classes and Newsletters

Syn-Aud-Con teaches classes on Audio and Acoustics

12370 W. Co. Rd. 100 N.

Norman IN 47264 USA

812-995-8212

The Loudspeaker Design Cookbook, Fifth Edition

by Vance Dickason (C) 1995
ISBN 1-882580-10-9
\$34.95 + \$4.45 S&H from:
Old Colony Sound Lab
PO Box 243
Peterborough NH 03458-0243 USA
603-924-9464
\$30.00 + approx. \$3 Shipping from:
Madisound
8608 University Green; Box 4283
Madison WI 53711 USA
608-831-3433
\$30.00 + ??? S&H from:
Parts Express
340 E. First St
Dayton OH 45402 USA
800-338-0531

12.10 Where can I buy speaker drivers?

Audio Concepts (Their own kits plus drivers)
901 South 4th Street
LaCrosse WI 54602 USA
Voice 608-784-4570
<http://www.audioc.com>

Phil Baker (Surplus cabinets only)
546 Boston Avenue
Medford MA 02155 USA

Bandor Design & Development Studios (Aluminium coned speakers)
11 Penfold Cottages
Penfold Lane
Holmer Green
Bucks, HP15 6XR United Kingdom
Tel. (01494) 714085

DBS Audio (Speaker kits and crossovers)
PO Box 91, Bury St.
Edmunds, Suffolk, IP30 0NF United Kingdom
Tel (0284) 828926

Drexler Audio Systems (Bandor Speaker Distributor)
14 Rose Lane
Rosemont PA 19010 USA

Falcon Electronics (Drivers and cross overs)
Tabor House
Mulbarton

Norfolk, NR14 8JT United Kingdom

Tel. (0508) 78272

Faraday Sound (Concrete loudspeaker cabinets)

248 Hall Road

Norwich, NR1 2PW United Kingdom

Tel. (0603) 762967

Gold Sound (Broad line including pro speakers)

PO Box 141

Englewood CO 80151 USA

303-789-5310

Madisound (Broad line)

8608 University Green

Box 4283

Madison WI 53711 USA

608-831-3433

<http://www.itis.com/madisound/>

Meniscus (Broad line)

2442 28th Street SW Ste D

Wyoming MI 49509 USA

616-534-9121

Parts Express (Broad line)

340 East First Street

Dayton OH 45402-1257 USA

513-222-0173

Solen Electronique (Airborne, Audax, Ceratech, Dynaudio,

Eton,

Lpg, Morel, Peerless, Scan-Speak, Seas, Solen, Vifa)

4470 Avenue Thibault

St.-Hubert, QC J3Y 7T9 Canada

Voice 514-656-2759

FAX 514 443-4949

The Speaker Co (Large range of drive units plus speaker kits)

Unit 9, Waterside Mill

Waterside, Macclesfield, SK11 7HG. United Kingdom

Tel. (0625) 500507

Speakers Etc.

2728 West Thomas Road

Phoenix AZ 85017 USA

602-272-6696

SRS Enterprises (Pyle, Pioneer, Eminence, Ultimate, Fane, MG)

1839 N Circle Dr

Colorado Springs CO 80909 USA

Voice 719-475-2545

FAX 719-475-0359

Wilmslow Audio (Kits and drive units. KEF, Dynaudio, Audax,
SEAS,

Peerless, Scanspeak, Morel)

Wellington Close

Parkgate Trading Estate

Knutsford, Cheshire, WA16 8DX United Kingdom

Tel (0565) 650605

Zalytron (Broad line including kits)

469 Jericho Turnpike

Mineola NY 11501 USA

516-747-3515

12.11 Where can I buy loudspeaker kits?

Audiocab (Speaker kits and cabinets)

9 Skewbridge Close

Wooten Bassett, Swindon, SN4 7DW United Kingdom

Tel (0793) 848437

Audio Concepts, Inc. (Wide range of kits. Catalog available)

(see 12.10, above)

Fried Products (Parts kits starting \$550. Catalog available)

(Emphasizes high-end transmission line speakers)

(Parts kits have plan, crossover, and driver)

1323 Conshocken Road

Norristown, PA 19401 USA

610-277-1014 or 800-255-1014

IPL Acoustics (Kits using SEAS, Morel, Audax, and Visaton)

2 Laverton Road

Westbury, Wiltshire, BA13 BRS United Kingdom

Tel (0373) 823333

Mahogany Sound (Parts kits and Woodstyle kits)

(Parts kits have plan, crossover, and driver)

(Woodstyle kits also have 3/4" MDF veneered boxes)

(Prices \$150/pair to \$500/pair. Catalog available)

(Two way, three way & subwoofer kits)

2610 Schillingers Rd #488

Mobile AL 36695 USA

205-633-2054

Tabula Rasa (Wide range of speaker kits)

1 Silkin Dalton Close

Broadfield, Crawley

W. Sussex, RH11 9JD United Kingdom

Tel. (0293) 531190

Visaton UK Ltd (Drivers, crossovers, kits, designs, software)
2 Bentfield Road
Stansted Mountfitchet
Essex
CM24 8HN
UK
Tel. +44 (0)1279 817604 Fax: +44 (0)1279 817601
E-Mail visaton@visaton-amc.demon.co.uk

Also see above, under suppliers for speaker drivers.

12.12 How can I improve the sound of my speakers?

The best way to change the sound of your speakers is to change where you put them. Ideally, the speakers should be located at ear level, in front of you, squared off between you. It's then a matter of fiddling with a) the angles, b) the distance apart, c) the distance from you, and d) the distance from the wall. Just moving the speakers around in the room or putting them onto stands can make a major difference. For more on speaker placement, see 13.1 below.

Other than that, speaker modifications can be a can of worms, or can produce very subtle changes, which you might prefer. For example, you might improve a speaker by adding some cross braces of 1"x1" wood from left to right and from front to back. This will stiffen the cabinet and reduce speaker cabinet wall vibrations, which probably hurt sound quality. Alas, this will be most effective with lower-cost and poorly built speakers.

Along similar lines, some claim success putting lead wire or epoxy putty on thin parts of the speaker to damp out resonances.

You can try doing this to the thinner parts of the speaker "basket" or frame, or to the front "baffle" or supporting panel.

Still another "tweak" is to add sound deadening felt pads to the inside walls of the speaker. Instead of felt pads some advocate sand-filled latex coatings on the inside walls of speakers. Others advocate ceramic tiles held in place with "thinset". Still others rave about commercial products like AC Glop, Acoustic Magic, and Bostik Sheet. However, the people who rave about these products tend to be the same people who sell them.

Any change along the lines of adding felt, cross-bracing, or putty will have subtle effects on the sound.

For the brave at heart, you can replace old or cheap drivers with better ones, but the results of this one change can be very dissatisfying if you happen to get the wrong type of driver for that application, and may never sound right, even if you use a similar driver. Speaker system design is still somewhat of a science and somewhat of an art. Throwing paint on a canvas often makes a mess.

Whatever change you try, don't "burn your bridge" home. Be sure that you can undo whatever change you did, just in case. Many tweaks to good speakers, no matter how well thought through, will correct for one flaw, but create others, or correct a flaw that the designer had cleverly used to his advantage.

12.13 How can I replace/re-cone my old speakers?

The best chance of success is to buy an identical replacement speaker driver from the manufacturer of the system.

Second choice is to buy the exact same driver from a distributor. This is sometimes difficult because it is hard to learn exactly what driver the manufacturer used. In addition, EVEN IF the manufacturer used stock speakers, they might have

used matched pairs or selected speakers by hand for an exact set of specific characteristics.

There are companies that rebuild drivers, but they charge quite a bit. I have heard \$75 per driver. This is rarely done for anything but very expensive commercial drivers. Speaker manufacturers will often sell owners the materials that they need to repair a speaker. If you are handy with delicate things, it is worth a try.

In addition to speaker manufacturers, there are companies which sells rebuild kits for approximately \$30 per pair, containing new foam, a special glue, and instructions. If you have a blown or distorted voice coil, this still won't help. A few netters have used rebuild kits from this company successfully.

Contact:

Stepp Audio Technologies
PO Box 1088
Flat Rock NC 38731 USA
800-747-3692

Two other vendors of speaker repair parts are:

Parts Express (sells 8", 10", 12", & 15" repair kits)
340 E First St
Dayton OH 45402-1257 USA
513-222-0173

Simply Speakers
P. O. Box 22673
St. Petersburg FL 33742 USA
800-767-4041 or 813-571-1245

Also check out: <http://www.decware.com/surround.htm> and <http://www.les.safety.net/stepp.html> for directions on replacing speaker foam.

Some speaker manufacturers have very good warranties. Electro-Voice warranties all professional products for life. KEF has a similarly broad warranty on their speakers. Contact

the manufacturer first.

12.14 What computer programs can I use to design speakers?

There are many useful programs available, but none are complete without a good knowledge of speaker design. Further, you will NEED to supplement any program with hand tweaking for the best sound. Finally, no simulation program is ever useful without good model parameters, and the parameters which manufacturers give you are often imperfect, so many good designers strongly recommend your own lab measurements. The Loudspeaker Design Cookbook (see 12.9) tells you how to measure a speaker, and also gives enough theory to feel confident with a good program. You can get a lot done with a simple spreadsheet and the equations in a book like The Loudspeaker Design Cookbook.

For more information on programs for speaker design and on speaker-design hardware, such as measurement systems, get the archive "sahfsd**.doc" from directory:

 usenet/rec.audio.high-end/Software
on "ftp.uu.net". In addition, there are other interesting audio-related files in that directory. Look around. That file is also available on ftp.graphics.cornell.edu in /pub/rahe/software

12.15 Can I magnetically shield my speakers for use near a TV?

You probably will need to buy speakers that are made with an integral magnetic shield. Magnetic shielding is usually done by either shielding the speaker magnet or by cancellation of the magnetic field very close to the magnet, or by both. Shielded speakers are NOT built by lining the enclosure with metal. While it sounds like a good idea, it doesn't work.

A common magnet shield is a mild steel cup around the magnet. This is the cheapest shield, and is usually fairly ineffective.

It also will interfere with the speaker's critical magnet gap, so this type of shield can hurt speaker performance by shorting

the magnetic field and reducing the magnetic flux density in the gap, which can reduce efficiency and affect the speaker's low frequency performance.

Cancellation is done using a reverse-polarized magnet glued to the back of the main magnet. If done right, it can almost completely cancel the rear stray field. In some cases it can also increase the magnetic flux density in the gap, which may or may not be desirable.

12.16 What are all of these abbreviations people use for speakers?

Most of these parameters are well documented in the Loudspeaker

Design Cookbook. (see 12.9) In summary:

Fs Driver free air resonance, in Hz. This is the point at which driver impedance is maximum.

Fc System resonance (usually for sealed box systems), in Hz

Fb Enclosure resonance (usually for reflex systems), in Hz

F3 -3 dB cutoff frequency, in Hz

Vas "Equivalent volume of compliance", this is a volume of air whose compliance is the same as a driver's acoustical compliance Cms (q.v.), in cubic meters

D Effective diameter of driver, in meters

Sd Effective piston radiating area of driver in square meters

Xmax Maximum peak linear excursion of driver, in meters

Vd Maximum linear volume of displacement of the driver (product of Sd times Xmax), in cubic meters.

Re Driver DC resistance (voice coil, mainly), in ohms

Rg Amplifier source resistance (includes leads, crossover, etc.), in ohms

Qms The driver's Q at resonance (Fs), due to mechanical losses; dimensionless

Qes The driver's Q at resonance (Fs), due to electrical losses; dimensionless

Qts The driver's Q at resonance (Fs), due to all losses; dimensionless

Qmc The system's Q at resonance (F_c), due to mechanical losses; dimensionless
Qec The system's Q at resonance (F_c), due to electrical losses; dimensionless
Qtc The system's Q at resonance (F_c), due to all losses; dimensionless

n0 The reference efficiency of the system ($\eta_{sub 0}$) dimensionless, usually expressed as %

Cms The driver's mechanical compliance (reciprocal of stiffness), in m/N

Mms The driver's effective mechanical mass (including air load), in kg

Rms The driver's mechanical losses, in kg/s

Cas Acoustical equivalent of Cms

Mas Acoustical equivalent of Mms

Ras Acoustical equivalent of Rms

Cmes The electrical capacitive equivalent of Mms, in farads

Lces The electrical inductive equivalent of Cms, in henries

Res The electrical resistive equivalent of Rms, in ohms

B Magnetic flux density in gap, in Tesla

l length of wire immersed in magnetic field, in meters

Bl Electro-magnetic force factor, can be expressed in Tesla-meters or, preferably, in meters/Newton

Pa Acoustical power

Pe Electrical power

c propagation velocity of sound at STP, approx. 342 m/s

p (ρ) density of air at STP 1.18 kg/m³

12.17 What are fluid-filled (fluid-cooled, ferro-fluid) tweeters?

These tweeters are built almost exactly the same as other tweeters. They look and act almost exactly the same, too. The only difference is that they have a small, controlled amount of a special fluid inserted into the gap between the magnet and the voice coil.

One big effect of adding this fluid to a tweeter (or to any

speaker) is that it makes the voice coil capable of dissipating more heat. This means that the speaker can have a lighter voice coil, for better performance, or a higher power rating for the same voice coil. The other big effect of this fluid is to add mechanical damping. The frequency response and transient response of the driver will change, possibly for the better.

In addition, this fluid may help center the voice coil, may lubricate the voice coil, and may help keep dirt out of the gap.

This fluid will not increase the magnetic field, concentrate the magnetic field or otherwise change the magnetic circuit. Nor will it cushion impact if the voice coil bottoms.

The fluid used for this purpose is often called "ferrofluid". It consists of sub-microscopic particles of magnetic material suspended in special oil. This fluid stays in the gap because of the strong magnetic pull of the magnet. There is some debate over whether these fluids can dry out with time. Manufacturers claim that the oil used is non-volatile.

It is possible to use ferrofluids in mid-range drivers and woofers. However, as tweeters tend to have the most fragile voice coils, tweeters have the most to gain from ferrofluid. There are various different fluids on the market, some of which have characteristics tailored to tweeters, some to woofers, etc.

It is very risky to blindly add fluid to a driver. It may not be compatible with the adhesives used in the driver, may not be practical with the particular driver layout, and is impossible to remove. Permanent driver damage is possible.

12.18 Should I use spikes under my speakers? Pennies under the spikes? Spikes prevent speakers from rocking. They also couple the speaker directly to the floor. Spikes will pierce carpet.

Some spikes will damage carpet. Most will just put a small hole in the carpet which is invisible. Putting a heavy speaker directly on carpet will cause a permanent mark on the carpet. Spikes can prevent this.

If you have a pretty hardwood floor, then spikes will definitely

damage the finish. A rigid disc under the spike will distribute

the load and lessen the damage. Any coin should work fine.

Using

a coin will not change the speaker/floor interaction. Do not

use

a coin with a carpeted floor. Alternatives to spikes for wood floors are Blu-Tack and similar products. (see 12.19)

If your floor is extremely rigid, then the spikes will make the speaker more rigid. If the floor is more conventional, such as a suspended floor or a wooden floor over joists, spikes can have a positive or negative effect, depending on the resonant characteristics of the floor/speaker system.

The counterforce resulting from a forward cone motion in a speaker may try to move the speaker backwards, but spikes will have little or no effect on this. Most audible effects from spikes are due to coupling the speaker to the floor, so it will be less likely to resonate on its stand. Some argue that in most cases, spikes will have no audible effect at all. Try it for yourself.

12.19 How do you couple speakers to speaker stands?

Ideally, your speakers should sit flat on the speaker stand or floor. They shouldn't see-saw back and forth if nudged.

One good way to accomplish this is to use a small dab of putty under each corner of the speaker. There are a few common putties used for this, but all share the properties of being very elastic and staying flexible indefinitely. These putties are inexpensive, removable, and reusable.

Try either Blu-Tak, which is available in the UK from office supply stores for cleaning typewriter elements, Faber Castell UHU Hold-It, which is available in the US from office supply

stores for holding up pictures, DAP's Fun-Tak, which is sold in hardware stores for holding up pictures, or Pritt Buddies.

12.20 What is a Sealed, Ported, Bass Reflex, Acoustic Suspension, Bandpass, and Coupled Cavity Speaker? Which is better?

All are "direct radiator" enclosures, so called because the sound is produced directly from the driver (the "radiator") without the assistance of a contrivance such as a horn.

SEALED BOX:

The simplest direct-radiator system. The rear of the driver sees a sealed enclosure, and none of the rear output of the driver contributes to the sound output. Depending upon how stiff the mechanical suspension is vs how stiff the enclosed air in the enclosure is (and that's a function of the size of the box), you can have either an Infinite Baffle enclosure, in which the mechanical suspension is the dominant source of system stiffness and the box is large; or an Acoustic Suspension enclosures, where the air in the box is the dominating stiffness, and the box is small.

Sealed boxes tend to be the lowest efficiency systems for a given box size and bass cutoff frequency.

VENTED ENCLOSURES:

Also the same as Bass Reflex, Ported, or Passive Radiator. Here, an aperture in the box provides a means for the rear output of the cone to contribute to the total output of the system. However, it only contributes over a very narrow range of frequencies. In fact, in a properly designed system, the front output of the cone is reduced at the same time the output of port increases, so the port DOES NOT ADD to the output of the woofer, it REPLACES the output of the woofer at these frequencies. This, if done properly, can significantly reduce distortion and increase power handling at very low frequencies, a region that can be difficult for drivers.

Vented systems can be up to 3 dB more efficient than a sealed box system that has the same bass cutoff frequency and size.

BANDPASS:

These are compound systems in that they have at least two

enclosures: one on the front and one on the rear of the driver.
The enclosure on the front, which looks remarkably like a vented box (because it is), acts as a low pass filter, and, can couple the output of the woofer more efficiently to the outside.

They have several useful advantages. For example, the front enclosure can be used as a very effective acoustic crossover, filtering out mechanical noises generated by the woofer, something no electronic crossover can do. For very low frequencies, such an acoustic crossover can be far less expensive and more easily designed than an equivalent electronic crossover.

They are called "bandpass" because the combination of the rear enclosure and the driver form the high pass portion while the front enclosure forms the low pass section. Making the bandwidth of the system narrower raises the efficiency of the system.

COUPLED CAVITY:

A variation of bandpass and vented systems, they are the results of a designers attempt to solve specific problems. They consist of two or more rear enclosures, each coupled to the next by a vent. Each enclosure/vent combination is another resonant system, and the combination is, essentially, a high order, multi-tuned resonant system.

Generally, these systems have quite complex response and are difficult to design. No comprehensive theory on their operation exists like that for sealed, vented and bandpass systems.

12.21 What is the best material to make speaker boxes out of? Why?
An ideal speaker cabinet material would be very stiff, so that it would not tend to move with variations in box air pressure.

It would also be very well damped, so that if it ever does deflect from air pressure, it will come back to the original position without resonating. It would also have a very high resonant frequency (supersonic), so that low frequency box air pressure would not cause it to resonate. An attractive

material

is preferred, and additional credit is given for a material which is easy to cut, glue, and finish. A great material

would

be cheap, too. Finally, it would be nice if the material were light, because we all have to move our speakers sometimes, and it's hard to appreciate good speakers with a sore back.

With all of those attributes, it would seem that no material is perfect. However, there are many materials that have enough of the above good attributes to make excellent speaker cabinets. Yet each has advantages and disadvantages.

In the list of good speaker box materials below, letters are used to indicate which attributes the material possesses.

S = Stiff
D = Damped
H = High Resonance
A = Attractive
M = Machinable
C = Cheap
L = Light

MEDIUM DENSITY FIBERBOARD (MDF): SDMC This is the most practical

material for quality speakers. It is harder to find than plywood,

but most lumber yards can special order it. It cuts very nicely

and has a smooth surface. It takes veneer very well. However, bring a helper when you pick the stuff up. One sheet is very heavy. MDF is harder on tools than common wood, but easier than

particle board. This is the material that many great speaker makers use. US \$45 for a 4'x8'x1" sheet. Density: 50 lbs/cu ft.

POLYCARBONATE (LEXAN): DM A clear or solid-color

polycarbonate

box can look strikingly good. However, this is not a cheap material. To locate it, look in the classified directory

under

PLASTICS. US \$400 for a 4'x8'x0.5" sheet. Density: 75 lbs/cu ft.

Acrylic (Plexiglass) is cheaper than Polycarbonate, but weaker and poorer damped (not recommended).

CORIAN (tm), FOUNTAINHEAD (tm), AVONITE (tm), SURELL (tm), GIBRALTAR (tm): SDA Regardless of the brand, these synthetic countertop materials come in a wide array of colors and look beautiful. They are hard to buy, and different to work with. They take special glue to bond and require wet sanding with very fine paper to finish. You can tap it, but it's too

brittle

for wood screws. Helicoil inserts are very effective. Yet an experienced builder can complete a cabinet in under an hour, from raw material to final finish. Corian is acrylic mixed

with

powdered aluminum trihydrate clay filler. Avonite, Gibraltar, and Surell are polyester resin mixed with filler. One user commented that Corian is easier to use and is easier to make invisible seams than the other synthetics. It has been said that Corian is actually easier to use than wood, but that depends on your equipment and experience level. Estimated

cost

for Corian is US \$20 per 1'x1'x0.5". Density: 100 lbs/cu ft. Available from:

Art Specialties
74 North Aurora St
Lancaster, NY 14086
800-724-4008

Ask for their free information pack on working with Corian.

Note: These product names are registered trade marks and apply to specific materials from specific manufacturers.

MARBLE: SDHA One challenge with marble speaker enclosures is cutting holes for the drivers. A carbide bit on a router will work, but it will dull quickly. Marble is also difficult to

glue,

so bracing is difficult. But it sure is pretty when you're

done!

US \$25 to \$45 per 1'x1'x1.25". Density: 160 lbs/cu ft.

PLYWOOD SHEETS SPACED AND FILLED WITH SAND OR LEAD SHOT:

SDAMC

box,

If you have time on your hands and want a great impractical

try this. Make a simple box out of common plywood. Then glue cleats on the outside of the box to space the outside plywood from the common plywood. Glue hardwood-veneered plywood to

the

cleats and pour sand or lead shot into the spaces between the cleats. It won't be light, but with the filler, it will be extremely well damped. In addition, if you use strong cleats and glue well, the box will be extremely stiff. One person

used

different size Sonotubes as an alternative to plywood, and filled the space between them with sand. Be sure to sterilize the sand in your oven before putting it in the box.

ALUMINUM SHEETS SPACED AND FILLED WITH ALUMINUM HONEYCOMB (Aerolam): SDHL Airplanes use this material for flooring.

Next

time a plane crashes in your neighborhood, see if you can get the wreckage for your next speaker project. You can't get a better, light-weight material. Celestion has exploited this

for

some great products. If you're really ambitious, you can make your own sandwich out of high-quality plywood faces and a

thick

honeycomb core. You will probably need an epoxy to glue the honeycomb to the plywood. A home-brew sandwich is easier to

cut

and glue than Aerolam.

FORMED CONCRETE: SDHC There are tricks to working concrete,

such

as to cast braces, rebar, and steel-wire right into the mix. Also, some concrete is better damped than other. Remember to

oil

your concrete forms so that they can be removed. Most

concrete

speakers use an MDF front panel, but you can pour one if you

use

cardboard tubes or plywood rings to mold the concrete into the shape of a speaker cutout. Alternately, you can make a common veneered plywood speaker box and cast concrete inside it for stiffening.

bracing

Any box can be improved by making the walls thicker, by

have

the walls, and by stiffening the walls. The stiffness of a material goes up as the cube of the thickness, so a slightly thicker material is much stiffer. A thicker panel will also

faster

a higher resonant frequency because the stiffness goes up than the mass.

cheaply.

Consider lining the inside of your speaker with ceramic tile, attached with thinset mortar. You can get tile remnants

before

They are easy to apply and can be added as an afterthought to an imperfect box. However, be sure to attach all braces

tiling, because it is hard to attach anything to tile.

Also consider bracing any weak parts of the box. For example, all joints will benefit from a wooden cleat. The back of the box will benefit from stiffeners where the speaker terminals are attached. Most importantly, brace the front panel, or make it out of a double thickness of material.

12.22 What size fuse or circuit breaker should I put in my speaker to protect it from damage?

Most modern speakers consist of a box containing more two or more drivers interconnected through a network of inductors, capacitors, and resistors. One fuse or circuit breaker in series with that array can't possible protect all drivers.

speaker

Conventional circuit breakers are a very bad choice for

protection. They add series resistance, series inductance, and lousy electrical contacts, all tending to degrade performance. Moreover, breakers have a trip characteristic that does not match the damage mechanisms of speakers.

Fuses are a better choice, but still are not very good. This is because speakers have complex thermal behavior. Loud playing will warm up the voice coil making it more sensitive to

damage. No fuse takes this into account correctly. A fuse will do a better job of protecting tweeters, but is still not perfect.

If you want to protect a speaker with a fuse, use the lowest current, fast-blow fuse which will not blow during normal listening. This may trip prematurely in a very loud passage, or may degrade sound quality, but it is your best bet for fuse protection. For a woofer, start with a 1 Amp fuse and work up. For a tweeter, start with 100mA and work up.

There are also cheap tweeter protectors available which

contain a light bulb and a resistor potted in a small tube. They work pretty well, and if you reduce the tweeter network's series resistance by a few tenths of an ohm, they are not terrible

for the sound. But they are audible and not failsafe.

12.23 Why are speakers labeled + and - or Red and Black?

Speakers make sound by pushing and pulling at the air with the motion of their cones or diaphragms. When a positive voltage is applied to the red or "+" terminal on a standard speaker, it causes the cone to move outwards and push air.

If you have two speakers side by side and one cone moves out while the other moves in, air will move between the two speakers but not much sound will escape. The two cone motions will cancel each other. So when you have two speakers close together, it is vital that they be wired "in phase", with positive voltage going to the "+" terminal of both speakers at once. You can do this by wiring the speakers in parallel or series. In almost all cases, parallel is preferred. If wiring speakers in parallel, the "+" output should go to both "+" terminals and the "-" output should go to both "-" terminals. If wiring speakers in series, the "+" output should go to one "+" terminal. The other terminal ("-") should go to the second speaker "+" terminal. The other terminal ("-") of the second

speaker should go to the "-" output. See the FAQ section on amplifiers for more on series and parallel connections.

Even if speakers are not side by side, it is good to wire them in phase. For very low frequencies, speakers 15 feet apart are effectively close together and the same cancellation effects mentioned above apply. For higher frequencies, the effects are more subtle but still important. One symptom of wiring speakers wrong is that the stereo effect is imperfect. Instead of a main sound seeming to come from the center, the sound of the lead vocalist, for example, may seem to come from outside the room. Other odd effects are also possible.

So when in doubt, always wire "+" to "+".

12.24 What is the best "stuff" to fill a speaker cabinet with?

The following discussion will focus on practical facts on speaker cabinet stuffing and on sealed systems. Theory is limited in selecting speaker stuffing. Vented system do share a few of these same issues and will also be mentioned, but the goals and physics of stuffing a vented box are different than those of a sealed box.

NHT speakers use polyester fill. Some use a Danish polyester that mimics the properties of fiberglass very closely. Excluding this special poly, there are two kinds of polyester available: pillow stuffing, and audio-spec polyester.

Forget common pillow fill. It's cheap and easy to get. If you use enough, it will damp the midrange, and that's a lot better than an empty box but it has little effect on lower frequencies.

"Mountain Mist Polyester Fiberfill" from Stearns Technical Textiles is a common, inexpensive material that is said to perform as well as audio-spec polyester. Stearns also sells

"Fiberloft Premium Grade Polyester" to some speaker makers. Mountain Mist is a coarser fiber than Fiberloft, but both are the same composition. We have no information on differences in acoustic properties between Fiberloft and Mountain Mist, but Fiberloft makes softer pillows and costs more. Both are available from these chain cloth stores:

Cloth World
Hancock Fabrics
House of Fabrics
Jo Ann Fabrics
Minnesota Fabrics

For more information, contact:

Stearns Technical Textiles
100 Williams Street
Cincinnati OH 45215
513-948-5252 or 800-345-7150
<http://www.palaver.com/mountainmist/>
E-mail: stearns@fuse.net

For lining the walls of a vented enclosure to reduce internal reflections, or filling a transmission line to absorb the back wave, highly absorptive wool or fiberglass are ideal. However, these materials do not provide the desired results in a sealed system. They will provide more reflection absorption than polyester, but the latter is quite good in this regard in the critical midrange. In a sealed system you don't want absorption at lower frequencies anyway; you want damping and isothermal conversion. (Author's note: I have tried "all-out" efforts using fiberglass lining and polyester fill to achieve the best of both worlds. I found little practical benefit over polyester alone.)

Most professional designers agree that practical experience, combined with trial and error is the best way to get optimum stuffing material, quantity, and method for a given design. This is why good designers routinely experiment with fill in the development of a new system. If you are designing a system that differs substantially in shape or volume or source impedance (passive crossover) from one of known reference, you will need to experiment to get best performance.

Adjusting the filling is the last step in getting bass right, and is used mostly to fine-tune the system Qtc and resonance.

As increasing amounts of polyester are added to a sealed box, the resonance and Q gradually go down. This can be shown mathematically to be due in roughly equal parts to the effects of simple resistive damping and isothermal conversion. At some point, a minimum is reached, and further material reverses the trend by taking up volume. An experienced designer can find

the

optimum amount of fill in a few trials by monitoring the impedance versus frequency curve as stuffing is added or removed.

Filling also has the important effect of reducing internal reflections, to reduce standing waves and comb filtering. However, the amount of filling has comparatively little effect on this.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments	Internet: neidorff@ti.com
50 Phillippe Cote St.	Voice : (US) 603-222-8541
Manchester, NH 03101 USA	

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: l...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - Part6 - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Rooms 2/99 (part 6 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part6_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Rooms 2/99 (part 6 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:10 GMT

Archive-name: AudioFAQ/part6

Last-modified: 2002/08/29

Version: 2.15

13.0 Listening Rooms and Houses

13.1 How should I place speakers in my room? What size room is best?

You are after two important, distinct goals: flat frequency response and good three-dimensional image. At your disposal is the room size, the room shape, speaker height, speaker placement, listening position, and room treatments. Even

though

good speakers are essential to good sound, room effects are

also

extremely important. In many cases, the differences in room effects will be more noticeable than spending twice as much on speakers!

Here are some generally-accepted-as-good guidelines for good sound. If you use these as a starting point, you will be far ahead in terms of getting good sound from your speakers and room. But these are just a guide. Each room and each speaker is a little different. Experiment to see if a change will help. Also, if the manufacturer recommends something different, give that a try, too. Then use what sounds best to you.

large

For smoothest bass response, a listening room should be as large as possible, have dimensions as unrelated as possible, and should be optimally damped. Although nothing is ever ideal, there are a few room dimension ratios that are better for listening rooms:

Height	Width	Length
1	1.14	1.39
1	1.28	1.54
1	1.6	2.33

If your room isn't shaped like that, don't worry. These effects are not major.

as

Also for smooth bass response, woofers should be at distances from the nearest three room boundaries that are as different

boundary.

possible. In some cases, the line dividing the listening room into left and right halves must be considered a room

Also, for smooth bass response, the listener's ears should be at distances from the nearest three room boundaries that are as different as possible.

All of this is essential because a wall near a speaker boosts the bass from that speaker at some frequencies. If a speaker is the same distance from three walls, then some frequencies will be emphasized much more than others, rather than slightly more.

For best three-dimensional image, a listening room should

have

good symmetry about the plane between the two speakers. This means that if one speaker is in a corner, the other speaker must be in a corner. If this symmetry is not right, the first reflection from the wall behind one speaker will be different from the first reflection from the wall behind the other

speaker

and critical parts of the stereo signal will be damaged.

Also, no large object should block the path from speakers to listener or from speaker to speaker. Speakers should be elevated so that tweeters are at listener ear height. The distance between speakers should be no greater than the

distance

from each speaker to the listener. Finally, the tweeters

should

be aimed at the listeners.

A normal box-shaped listening room with bare walls will have "slap echo" which will reduce intelligibility. A good cure is randomly-placed wall hangings consisting of small rugs spaced an inch or so away from the wall to increase sound

absorption.

Another cure is convex-shaped art objects on the walls to disperse harmful reflections. If money is available,

commercial

room treatments such as "Tube Traps" and "RPG Diffusers" are also valuable, but many of the benefits of these exotic

devices

are available with simpler techniques.

As a general rule, in a good room, speakers and listener can

be

close to room boundaries with minimal adverse effects. In a

bad

room, a good strategy is to place both speakers and listener

as

far away from room boundaries as possible.

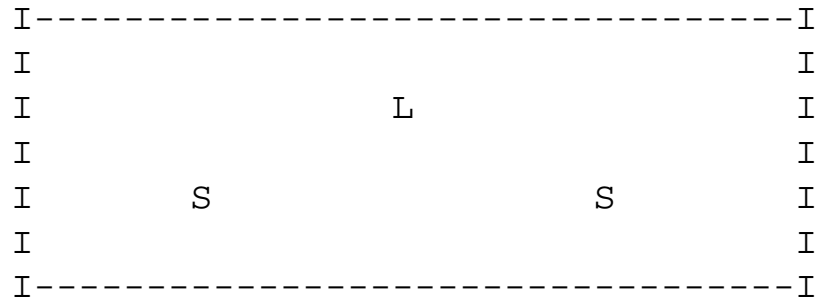
An excellent starting point for speaker placement is to

measure

the listening room diagonal dimensions. Divide that

measurement

by three. Put each speaker that distance from a corner, on the room diagonals.



Place your listening position midway between the two speakers and approximately half way from the speakers to the wall. Be sure that there is nothing in the "triangle" formed by the listening position and the speakers.

Try this and then move things 12" (30cm) at a time to see if you can improve the sound. Your ears will be a better guide than any commonly-available instruments. To keep track of what you are doing, take notes. To remember exactly where you put the speaker on the floor, a practical trick is to mark the floor with a sewing needle and thread.

Some speakers want to be aimed right at the listener (toed in) while others work best pointed straight ahead. Experiment.

13.2 How do I wire a house for sound?

A fundamental principle of physics is that the farther a signal

travels, the more the signal will be degraded. Translate this to mean that the shorter the wire, the better. Understanding this, the idea of running speaker cable between every room of the house isn't as attractive as it first seems.

If you still decide to wire your house for sound, you should do

it at the same time you're wiring for telephone and electricity.

It is possible to wire a house after the walls are closed, but it becomes very difficult.

etc)
for speaker wire in the walls, but this may violate building codes. Check with an electrician or inspector first. It will also confuse future electricians, so label the wire clearly, all along its length.

If you want to make your house like a recording studio, it is best to use the techniques of recording studios. When studios run long lengths of sound cable from one room to another, they drive the cable with 600 ohm line amplifiers. They also use shielded, twisted-pair cable. They only connect the shield at one end of the cable. Finally, they use balanced inputs at the other end of the cable.

13.3 Where can I read more about listening room construction and tuning?

"Building a Recording Studio" by Jeff Cooper
Mix Bookshelf
"Handbook for Sound Engineers"
"The Master Handbook of Acoustics" by F Alton Everest
"Sound Engineering 2nd Edition" by Don and Carolyn Davis;
Howard W. Sams & Co. (C) 1990
"Good Sound" by Laura Dearborn
Introductory, but clear and accurate
"Sound Recording Handbook" by John M. Woram
Howard W. Sams & Co. #22583
Excellent General Reference
"Audio Technology Fundamentals" by Alan A. Cohen
Howard W. Sams & Co. #22678
Overview of Audio Theory
"Introduction to Professional Recording Techniques"
by Bruce Bartlett
Howard W. Sams & Co. #22574
"Modern Recording Techniques" by Hubar and Runstein
Howard W. Sams & Co. #22682
"Sound Studio Production Techniques"
by Dennis N. Nardantonio
Tab Books

"The Uneasy Truce Between Music and the Room"

F. Alton Everest

Audio, February 1993, Pgs. 36-42

"Coloration of Room Sound by Reflections"

F. Alton Everest

Audio, March 1993, pgs. 30-37

13.4 What is white noise? What is pink noise?

"White noise" is characterized by the fact that its value at any two different moments in time are uncorrelated. This leads to such noise having a flat power spectral density (in signal power per hertz of bandwidth), and is loosely analogous to "white light" which has a flat power spectral density with respect to wavelength.

Pink noise has flat power spectral density per PERCENTAGE of bandwidth, which leads to a rolloff of -3 dB/octave compared with white noise.

There are many reasons for using pink noise in audio testing. One is that music has an average spectral content much closer to pink noise than white noise. Another is that pink noise can be readily measured with constant Q bandpass filters and naturally leads to flat plots on logarithmic frequency scales - which correspond to the equally tempered musical scale.

Pink noise is often used with 1/3 octave band filters to measure room acoustics. This idea has merit since 1/3 octave is a convenient number near the limit of our ears ability to detect frequency response irregularities, and because averaging measurements over 1/3 octave bands smooths out the numerous very narrow peaks and dips that arise due to standing waves in rooms.

Another term you'll hear about is Gaussian noise - this is noise with a Gaussian amplitude probability density. Gaussian noise has the amazing property that linearly filtering it preserves its Gaussian amplitude density and that sums of Gaussian random variables are again Gaussian. The two terms shouldn't be confused. It is possible to have Gaussian white or pink noise.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments	Internet: neidorff@ti.com
50 Phillippe Cote St.	Voice : (US) 603-222-8541
Manchester, NH 03101 USA	

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - Part6 - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)

- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Recording 2/99 (part 7 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part7_1063104376@rtfm.mit.edu>

X-Last-Updated: 2003/01/23

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Recording 2/99 (part 7 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:11 GMT

Archive-name: AudioFAQ/part7

Last-modified: 2003/1/22

Version: 2.16

14.0 Recording

There are more different recording systems available today
than
ever before. Digital and analog are both available to the
consumer. With the advent of consumer digital recorders, used
pro analog recorders are becoming available for surprisingly
low
prices. Now may be the time for you to buy a microphone and
recorder and make your first!

14.1 What is DAT? What is its status today?

DAT (Digital Audio Tape) is currently the standard professional digital format for 2-track digital recording. DAT had a short-lived consumer presence, but never "made it". As digital recorders have no tolerance for clipping, using a DAT recorder takes a slightly different knack. The results can be worth it, however, as DAT format offers the same resolution and dynamic range as CDs. DATs record for up to 3 hours on a tape, and can run at three different sampling rates: 32 kHz, 44.1 kHz (for CD), and 48 kHz (the DAT standard). Longplay mode cuts frequency response to 14kHz but adds even more recording time.

14.2 What is DCC? What is its status today?

DCC is Philips' attempt to modernize the regular cassette. DCC decks can play analog cassettes, and can record new Digital Compact Cassettes. They use stationary heads (DATs use rotary heads as do VCR's), and although they are digital, they use lossy compression to fit all the data on the cassette. Although DCC sound quality is far better than the 1960 standard cassette, the DCC does not have the sound quality present in DAT or CD. DCC may be a good choice for consumers who want to assemble mix tapes for cars or walkmans, but is not suitable for any professional applications.

As of October 1996, DCC is quite affordable in price. Some DCC home recorders are under \$200. However, blank DCC tapes are still hard to find and fairly expensive (\$10 each for 90 minute lengths). Also, DCC manufacturers are dropping DCC from their lines, indicating that it is either on the way out or never made it in.

Although the ability to play analog cassettes is a strong advantage of DCC, many people have had trouble with oxide

particles falling off analog cassettes and clogging the gap of the DCC head. This may be due to the extremely low quality of some analog cassette tapes and may be due to the very tiny gap of DCC heads.

Caution: NEVER demagnetize DCC heads. This will permanently damage the heads.

As of May 1997, Philips has announced plans to discontinue DCC.

14.3 What about writable compact discs? What is the status today?

Recordable and rewritable CD recorders and discs are available,

and costs are dropping. As of Dec 1997, recorders have shown up for <\$300 and blank disks are advertised as low as \$2.00 each in bulk. Many people report destroying many disks before getting their machine working correctly, but once people learn the software and hardware steps, archival CDs can be made inexpensively and routinely. For more on CD-R read this excellent document:

<http://www.fadden.com/cdrfaq/>

14.4 What are Dolby B, C, and S, HX Pro, and DBX? Are they compatible?

Dolby B, C, S, and DBX are techniques for increasing the signal/noise ratio of recordings. All work in similar ways: they compress the dynamic range of the sound during recording,

then expand it back upon playback. As much as we would like it to be otherwise, you only get correct reproduction if you use Dolby B to play back a Dolby B tape. Same for Dolby C, Dolby S, and DBX. Dolby HX Pro is the exception.

Dolby B works mostly with higher frequencies; it increases their levels during recording and decreases their levels, and the levels of high-frequency noise such as tape hiss, during playback.

Dolby B tapes can be played back without Dolby B processing, but high frequencies are over-emphasized and the sound will be excessively bright. This can be compensated for to some extent by turning down the treble control. Audio novices often remark that commercially recorded tapes recorded using

Dolby B sound dull when played back with Dolby B; this is because they are accustomed to the boosted high frequencies they hear when playing these tapes without Dolby.

Dolby C achieves greater noise reduction (about 8-10 db) than Dolby B by working with a greater range of frequencies and altering relative levels more; this means that playing Dolby

tapes back with no Dolby processing or with Dolby B, leads to very bad frequency response and a sound that most people find unpleasant. Dolby C may also be more sensitive to variations among decks in exact frequency response, alignment, etc. Some people find that tapes recorded using Dolby C sound best only when played back on the deck on which they were recorded.

Dolby S works with an even broader range of frequencies than Dolby C, and achieves slightly greater noise reduction. It has three advantages over Dolby C: (1) many people find that tapes recorded and played back using Dolby S sound closer to the original than tapes done using Dolby C; (2) tapes

using Dolby S don't sound awful if played back on Dolby B decks, and (3) Dolby S seems to be less sensitive to variations among decks.

DBX is similar to Dolby B, C, and S, but uses the same compression

on all frequencies, high and low. However, DBX is mostly used in the professional market. Very little home DBX equipment is available, and some of that home equipment is no better than comparable Dolby B home systems. All DBX systems are

compatible with all other DBX systems, but incompatible with Dolby. A DBX tape will sound terrible without DBX processing during playback.

All compression/expansion systems suffer two problems. One is due to the fact that compressors can't compress a loud signal before they have heard a bit of it, so that little bit of loud

signal
not
rise
will get through uncompressed. Likewise, quiet passages will be expanded until after they are detected. These delays give rise to an audible problem often called "breathing".

systems
tape
expansion.
For example, if there is a 2dB dip in frequency response at 1kHz in the tape recorder, this will be accentuated to a 4dB dip if the compressor is using a 2:1 ratio. So compression/expansion trades noise for frequency response error. For that reason and the previously mentioned breathing, some people prefer to use their recorder without any noise reduction at all. They prefer a bit of noise to the other errors.

Dolby HX Pro is not noise reduction and does not use compression or expansion. HX Pro is a technique developed by Dolby Labs to increase tape headroom by decreasing the bias when recording signals with a large high frequency component. This allows better transient response, particularly on less expensive tapes, and requires no processing when the tape is played back. Dolby HX tapes can be played back on any system with no decrease in quality.

Dolby Corporation has developed other techniques and other acronyms for products related to surround sound. The phrase "contains Dolby" isn't as meaningful today as it used to be.

14.5 What is the best cassette deck under \$400?

14.6 What is PASC? Can I hear the effects?

PASC (Perceptual Audio Sub-band Coding) is a data-compression algorithm. It increases the length of recording that can be

stored in a given number of data bits by eliminating sounds that the developers' research claims can not be perceived by human listeners. Its most important component is the omission of quiet sounds that occur at the same time and near the frequency of louder sounds. It provides up to a 4x increase in the length of recordings a given digital medium can hold; this is essential to allow full-length digital recordings on DCC (and on MD, which uses a different compression technique). It is not necessary to translate CD data to analog before compressing it using PASC, nor the reverse.

It is very difficult to hear any degradation from PASC, but it is possible, depending on the source and listener. The effect is not a distinctive noise (like a hiss) nor a consistent diminution (like a notch in a speaker's response), but a broad, uncorrelated dropout in a changing collection of sounds that are masked by sounds that you can hear very easily.

Since it is lossy, repeated PASC recording will cause progressive loss, and this signal damage may become easily noticeable. This is a side effect that recording companies hope will have the effect of discouraging piracy via DCC. DCC recorders do have digital inputs so can make one perfect copy of a master, but copy protection prevents digital duplication of a copy.

For more information on audio compression, consult these articles (courtesy of Jonas Palm):

R. Veldhuis, M. Breeuwer, R. van der Waal, "Subband Coding of Digital Audio Signals Without Loss of Quality," IEEE ICASSP, 1989, pp. 2009-2012.

J. Johnston, "Perceptual Transform Coding of Wideband Stereo Signals," IEEE ICASSP, 1989, pp. 1993-1996.

Transform
G. Davidson, L. Fielder, M. Antill, "High-Quality Audio
Coding at 128 kbits/s," IEEE ICASSP, 1990, pp. 1117-1120.

Design
J. Princen, A. Bradley, "Analysis/Synthesis Filter Bank
Based on Time Domain Aliasing Cancellation," IEEE Trans ASSP,
Oct. 1986, v. 34 n. 5, pp. 2161-2164.

P. Duhamel, Y. Mahieux, J. Petit, "A Fast Algorithm for the
Implementation of Filter Banks Based On 'Time Domain Aliasing
Cancellation,'" IEEE ICASSP, 1991, pp. 2209-2212.

Perceptual
J. Johnson, "Transform Coding of Audio Signals Using
Noise Criteria," Journ. Acoustical Society of America, Feb.
1988,
pp. 314-323.

of
2nd Draft-Proposed Standard on Information Technology Coding
Moving Pictures and Associated Audio, document ISO/IEC
JTC1/SC2/WG11 MPEG 90/001, Sept. 1990.

quality
G.Thiele, G. Stoll and M. Link "Low bit-rate coding of high-
audio signals. An introduction to the MASCAM system." EBU
Review
No. 230

14.7 What is SCMS? Can I hear the effects?

SCMS (Serial Copy Management System) is a copy-protection
system

intended to stop rampant piracy of commercial recordings to
digital tape. SCMS allows the home taper to copy from a CD to
a
digital tape, but prevents anyone from digitally copying that
new digital tape.

You CANNOT hear SCMS.

14.8 How can I bypass SCMS?

There are professional devices used by engineers to manipulate the digital bitstream, but they cost several hundred dollars and are not cost effective for consumers. If you need to make perfect digital copies of digital copies, buy a professional digital recorder. Pro models do not have SCMS, are more durable than consumer recorders, and may have better quality electronics than consumer models.

14.9 What's this about a tax on DAT?

Every digital audio tape recorder and every blank digital tape sold in the USA is priced to include a "premium" or "tax". This tax is collected by the US Copyright Office and distributed to the recording artists and record companies that own the copyrights to commercial music. These fees are supposed to repay them for lost royalties.

Many believe that this "tax" is illegal, because it represents an assumption that the buyer will use the recorder and tape to violate a copyright, and not to record their own works. A founding principle of the USA legal system is that everyone is assumed innocent until proven guilty.

If you believe that this law is unjust, write your elected representatives.

14.10 Is it legal to copy an LP, CD, or pre-recorded tape?

In the US today, it may be legal to copy LP's, CD's, etc. for your own private use (such as to copy a CD to play on your walkman). UK law specifically prohibits this, but it is almost never enforced. It is definitely not legal in the US, UK, or almost anywhere else, to copy these sources for commercial purposes, or to give the copies to others.

It is as of yet unclear whether you own the rights to sell or give away a copy of a recording if you made the copy on media which was sold with an included digital audio tax.

14.11 How do I clean and demagnetize tape heads?

First, a caution: DAT recorder tape heads are VERY fragile. Before cleaning the heads on a DAT recorder, get specific recommendations from a very knowledgeable source that is intimately familiar with DAT head cleaning. In the internet, a good source is the DAT-Heads-Digest FAQ. For more

information on DAT-Heads-Digest, see section 20.2, below.

To clean tape heads, use pure isopropyl alcohol and lint-free swabs. Wipe the metal parts of the transport with alcohol (DON'T wipe the rollers!) and allow them to dry. Throw the

swab away after use. Be exceedingly careful when cleaning the heads on a DAT. DAT heads are notoriously easy to misalign by incorrect cleaning.

Practical tape head demagnetizers are available for under \$10.

Try to find one with a plastic coated tip. If you can't find one which is plastic coated. you can slip a drinking straw or plastic tube over the tip for the same effect. This plastic will prevent the demagnetizer from scratching the head.

Before plugging in the demagnetizer, remove all tapes from your working area and unplug the recorder. Hold the demagnetizer away from the recorder as you plug it in. Slowly bring the

tip of the demagnetizer up to the tape head and slide it back and forth across each tape head for five one-second strokes. Then pull it away from the head slowly and go on to the next.

After demagnetizing the heads, use the tip on each metal tape guide with a similar five strokes. Last, slowly pull the

demagnetizer

far away from the recorder and unplug it. Recording engineers use a demagnetizer before each recording session.

14.12 How do I adjust a tape recorder for best results?

Adjusting a tape machine for best results usually requires special equipment and test tapes. Unless you know what you're doing, leave it for a pro. If you are serious about doing it, buy the service manual for your particular tape recorder. It will list a detailed procedure, as well as describe the

correct

test tape and tools.

As for setting of record levels, it is best to experiment

with

different levels on different tape brands. Different formulation will reach saturation for different levels. Generally speaking, the transients on a Chrome tape should

peak

at about +6 dB above 0, though some formulations can take significantly hotter signals.

14.13 Where can I get new pinch rollers or drive belts?

Projector-Recorder Belt Company
Whitewater WI USA
800-558-9572

14.14 What is a good rubber (pinch) roller cleaner?

Teac RC-1 available from
J&R Music World
59-50 Queens-Midtown Expressway
Maspeth NY 11378-9896 USA
800-221-8180 or 718-417-3737

Tascam Rubber Cleaner RC-2 available from:
Tape Warehouse
Chamblee GA
1-404-458-1679

14.15 How can I program a recorder to tape a radio broadcast?

Radio Shack and Panasonic make a clock/radio/cassette that can be set to record at a specific time. Radio Shack also sells 120 minute cassettes, which can be used for 60 minutes per side.

The recorders are not high quality, and the long tapes are fragile, but it works.

You can buy "appliance timers" at hardware stores that will start and stop an appliance at a specific time. Radio Shack sells fancier versions of the same thing for more money.

Gadget

to

switch

for

freaks love "X-10" control systems. These can be configured

do the same thing. All require a recorder that can be left in RECORD mode. Such recorders are identified by a "TIMER"

on the front panel. Many cassette decks have a TIMER switch

use with timers.

than

This can be set to start a recorder at a particular time. As the recorder will be started from a remote control rather

by the power line voltage, no timer switch is required. Radio Shack has a very similar product available for \$99.95, may be less on sale.

Carver made a remote with timer which could be programmed to start recording at a specific time, if you have a recorder with remote control capability.

For the true nerd, there's the programmable remote sold as a Scientific Calculator, the HP-48. Audio remote control software for this fine adding machine exists. For more information, consult the HP-48 FAQ. The HP-48 FAQ contains pointers to a few remote control programs. The FAQ is archived at site rtfm.mit.edu in `/pub/usenet-by-group/comp.sys.hp48`

audio

You can also use a VCR for audio-only recording. Hook the

in to the output of a radio, tuner, or receiver. You may also have to connect some video signal to the VCR so that the sync circuits work correctly.

You can also use a computer's hard drive to record audio. Cybercorder 2000 shareware (\$19.95 to register) schedules recordings on the computer sound card Line-In jack.

<http://skyhawktech.com>

14.16 Will CrO2 or Metal tapes damage a deck made for normal tape?
No. They will work fine. They are no more abrasive than common tape and may actually be less abrasive than very cheap tapes. Recorders which are designed for CrO2 or Metal tape have different bias settings and equalization settings to take best advantage of the greater headroom and to give flat response with these different types of tape. However, they use similar if not identical heads as less expensive tape recorders. Almost all tapes are in some way lubricated, and these lubricants minimize wear and squeaking.

14.17 Why do my old tapes squeak in my car cassette deck?
One problem that will cause this is "binder ooze". The binder is the glue which holds the oxide particles to the backing. With time, this binder can ooze forward and actually get past the oxide particles, so that there is sticky stuff on the surface of the tape. When this sticky stuff goes past the heads, it can cause a slight stick, which will sound like a squeak. You won't feel it with your fingers, but it is there. If you have a prized tape with this problem, consider baking the tape in a home oven at a very low temperature, like 150F. This might cure the problem by drying out the binder.

14.18 Is VHS Hi-Fi sound perfect? Is Beta Hi-Fi sound perfect?

The HiFi recording format is subject to two different problems:

Head-switching noise and compression errors.

To get perfect reproduction, the FM subcarrier waveform being played back by one audio head must perfectly match the

waveform

from the other head at the point of head switching if a

glitch

is to be avoided. If you record and then play the tape on the same VCR under exactly the same conditions, you have a reasonable chance of this working. But if the tape stretches just a bit, or you play it on another VCR whose heads are not

in

exactly the same position, or the tracking is off, the waveforms

will no longer match exactly, and you will get a glitch in the

recovered waveform every time the heads switch. This sounds like a 60 Hz buzz in the audio, which is often audible

through

headphones even if not through speakers.

The same glitch will occur in the video waveform too, but since

head switching always happens during vertical retrace, you won't see it.

Some VCRs have azimuth correctors or Dynamic Track Following which minimize these problems (Philips V2000 and some VHS).

The wonderful signal to noise ratio of VHS HiFi is achieved through the use of compression before recording and expansion after playback. The actual signal to noise ratio of the tape itself is about 35 dB and a 2.5:1 compressor is used to "squeeze" things to fit. Like all companders, this produces audible errors at certain places on certain signals, such as noise "tails" immediately after the end of particularly loud passages.

Worse, compressors often have problems simply getting levels right. That is, if you record a series of tones, starting at -90 dB and working up in 1 dB increments to 0 dB, and then

play

them back, you will almost invariably have level errors. The trend from soft to loud will be there but the steps won't be accurate. Two or three of your tones might come out at essentially the same level, then the next one takes a big

jump

to catch up or even overshoot.

For music, the result will be that the relative levels of some instruments, passages, etc. will not be accurate.

This doesn't matter as much for movies, which tend to have

steady volume level. Also, movie enjoyment is rarely hurt by these level errors. VHS and Beta HiFi is fine for

reproduction

of movie and tv soundtracks. They are also perfectly fine for non-critical audio applications. But VHS and Beta HiFi are

not

serious competitors to DAT, CD, open-reel analog tape, or

even a

high quality cassette deck.

14.19 How do HiFi VCRs compare to cassette recorders? DAT recorders?

VHS HiFi and Beta HiFi are analog recording formats which use modulation techniques to record a video signal and a stereo audio signal on a videocassette. The audio capabilities typically surpass that of the "linear" audio tracks found on

all

video recorders, thus the "HiFi" designation. "HiFi" is essential for getting good sound quality on your video recordings and out of pre-recorded videos.

HiFi is also touted as an excellent audio recorder for audio-only (no picture) applications. Progress in HiFi has modern VHS HiFi equipment on par with the best analog cassette recorders and close to that of the digital formats. VHS HiFi suffers generational loss and noise, but because of the high quality of the AFM (HiFi) track, these generational losses are minimal and not as severe as those of audio cassettes.

Many people use VHS HiFi for recording radio broadcasts, since VCRs often have built-in timers and can record for up to 9 hours. If you use a HiFi video recorder to record from an audio-only source, beware that some decks will not function properly without a video signal for synchronization. If you

are

interested in very good quality sound, use a deck with manual level control.

14.20 What is the difference between VHS HiFi and Beta HiFi?

To record the video and HiFi sound signals onto the same tape area, VHS HiFi uses "depth multiplexing", while Beta HiFi uses "frequency multiplexing". That is, the FM signal for Beta

HiFi

occupies a different frequency band than do the Beta format's

luminance and chroma signals, and is simply mixed with those signals and laid down on the tape by the video heads. In VHS the luminance and chroma signals were too close together in frequency for this to work. VHS HiFi uses a separate pair of heads on the spinning head drum to record the HiFi carrier. These heads' gaps are shaped so that the HiFi carrier is actually recorded at a different depth in the tape than the luminance and chroma signals.

14.21 Is there any good reason to buy a HiFi VCR for common TV shows?
If you do not own a stereo TV, the purchase of a HiFi VCR will

give you the capability to listen to stereo TV broadcasts to your system.

14.22 What is the best cassette tape?

One simple answer to this question is that the best tape is the

tape which was used to align your tape recorder. A second simple answer is that more expensive tapes are frequently better in terms of quality of the backing, durability of the oxide, accuracy of the shell and guides, and life.

Background: When you make a tape recorder, you build electronic

circuits which have specific, non-flat frequency response. These circuits correct for the non-flat response of the tape heads, the recording process, and the tape. These circuits

can be adjusted after the recorder is made, but adjustment is tricky, and may or may not be successful with every tape made.

The designer of the tape recorder picked one tape as their standard when they did the design, and built that recorder to work well with that particular tape. It may work better with a different tape, but it won't necessarily sound the best with what one person calls the best sounding tape.

From a review of frequently given answers to this question, it is obvious that almost every brand of tape has its advocates.

Many brands also have their detractors. Maxell and TDK tend to have a strong following, but that is in part because they own

a

large share of the US tape distribution market.

14.23 What is the best Reel-to-Reel tape?

See 14.22. Just as cassette tape recorders are set up specifically for one type of tape, reel-to-reel tape recorders are equalized and biased so that they are best with one

specific

brand and model of tape. Just as more expensive cassette tapes will last longer and have less noise than cheaper ones, you

can

expect fewer dropouts, better quality control, and lower noise from more expensive reel-to-reel tapes.

The major brands in reel-to-reel tape include Ampex, Scotch (3M), AGFA/BASF, and Maxell.

14.24 What is Type I, Type II, Type III, and Type IV cassette tape?

These are IEC (International Electrotechnical Committee) standards. They provide broad standards for all tapes, and end the need to align a deck for an individual tape. Type 1 is for normal "iron oxide" tapes (Fe_2O_3), Type 2 is for high-bias "chromium oxide" tapes (CrO_2), Type 3 (obsolete) is for FeCr (ferric chrome), and Type 4 is for Fe (Metal). Type 2 tapes tend to be more expensive than type 1, and type 4 tapes are the most expensive. This is because type 2 tapes tend to have less noise and flatter high frequency response than type 1, and type 4 tapes tend to have even flatter highs and even less noise.

Some Type 1 tapes are more expensive than other Type 2 tapes, and may be worth the extra price. More expensive tapes come in better shells, have better lubrication, fewer dropouts, smoother frequency response, and better uniformity from tape to tape. Even though the types imply a particular tape formulations, the type really refers to the tape performance. For example, some iron oxide tapes have an unusual oxide formulation with very small grains that conforms to the type 2 standard better than the type 1 standard. These tapes will be labeled type 2, but may not have any chrome in them.

Most modern cassette recorders sense the tape type by the holes in the back of the housing and adjust bias and

equalization to compensate for the differences. A few top cassette recorders (the Revox and several Nakamichis) automatically align to a particular tape by recording test tones and then setting their own equalization.

In practice, each brand and model tape is slightly different. For the very best recordings, adjust your recorder for the tape you use most, or buy the tape which works best in your recorder. Manufacturers adjust each recorder for a specific tape at the factory. So the best tape might be the one referenced in the recorder owner's manual. In a recording studio, it is common to align the bias and equalization for the specific tape used, and stick with that tape.

14.25 Why do I have hum when I connect cable to my VCR (or TV), which is

connected to my audio system?

What you are experiencing is probably a "ground loop", caused by multiple connections from your equipment chassis ground to

building ground. Since disconnecting the cable or building antenna from the VCR eliminates the hum, the cure is simple. The following info talks about "the cable" but works the same with a coax from a master antenna system.

Go to Radio Shack and buy one each of:

15-1253, "300-ohm TV-VCR Matching Transformer"

This looks like a little box with two screw terminals and a push-on male F (coax) connector.

15-1140, "75-ohm coax/300-ohm twin lead indoor/outdoor matching transformer"

This is a longish box or tube, with a female F connector on one end and a bit of twin-lead coming

from the other. The twin-lead ends in a pair of what are called "spade lugs" (shaped like U's).

Note: each of these part numbers may have a "B" or other letter at the end. These indicate slightly different details of functionally equivalent parts. Don't worry about it.

Connect the two spade lugs on the -1140 to the two screw terminals on the -1253. Make sure they don't touch each

other;
this shouldn't be difficult to get right. This gives you the "isolator", with a female coax connector on one end and a male coax connector on the other.

Just insert the isolator "in line" in the incoming cable lead. ie treat it as you would a (very short) extension cord. You can do this right at the back of the VCR (or whatever the

cable
is hooked to).

Only one of the two units called out here (15-1140) actually provides isolation. Two of the 15-1253 units back to back

will
fine
NOT work. Two of the 15-1140 units back to back will work but will be less convenient.

If you can't find these specific parts, and want to know if the
substitutes you've found will work, test them with an

ohmmeter,
measuring from either the pin or shield of the coax side to either wire of the twin-lead side. If it's not an autoranging unit, set the meter to its highest resistance range. You want to see no connection (ie: infinite resistance, an open

circuit)
between them. As with the parts described above, only one of the coax/twinlead adapters needs to pass the test.

This trick runs the signal through a PAIR of baluns. This is more than is absolutely required to solve this problem, and

may
weaken the signal slightly. This should not be a problem on most cable systems. But, some audio stores are beginning to carry a unit made expressly for this purpose. It contains a single 75 ohm to 75 ohm isolation transformer. This should introduce less signal loss. It will also be better shielded than the two baluns (see next paragraph). Under \$10 would be

an

appropriate price.

The back-to-back baluns may allow "ingress". That is, if you are near to a TV transmitter, the short length of twinlead may pick up broadcast TV signals and mix them with the cable, causing interference. If you can find a prepackaged 75 ohm isolation transformer as described in the preceding paragraph, it should be better in this regard.

Mondial is selling a unit dubbed the "Magic-1"; this does the same job but with three capacitors instead of transformers.

It is said to cause less than 1 dB of signal loss. On the other hand, it costs about \$90.

Yet another solution is to attack the problem at the line-

level audio connection between the VCR and the rest of your stereo. Radio Shack's stereo ground isolators (270-054) are made for this purpose. These go in the line-level AUDIO connections between the VCR (or TV) and the rest of your sound system. If both the line in and line out jacks on the VCR are connected

to the sound system, you'll need two of these isolators. They

are audio frequency transformers and may add some distortion and frequency response error.

14.26 Is Binaural better than stereo? What is Binaural?

Judge for yourself. There are samples of binaural recordings available for free download at:

<http://www.binaural.com>

According to the Binaural FAQ (slightly edited to save space):

<http://www.binaural.com/binfaq.html>

"Binaural...record(s) music and sounds with two tiny omnidirectional mikes at the entrance to the ear canals on an artificial head...This includes even the fleshy ridges of the outer ears which modify the frequency balance of sounds depending on the direction from which they originate...

"...A stereophonic system...uses loudspeakers but requires an infinite number of channels for perfect reproduction...

(Binaural) requires only two channels for perfect reproduction but involves the use of a pair of head receivers [drivers]

tightly to the ears for each listener. All listeners with such a system can be given the illusion of sitting in the best seat in the concert hall. Harvey Fletcher in the SMPTE Journal Vol. 61, September 1953."

"The binaural experience is striking, and requires no special equipment besides stereo headphones and binaural recordings. However, the 'perfect reproduction' mentioned by Fletcher is not necessarily achieved by all listeners due to variations in dummy heads, headphones and individual hearing. The astonishing realism is heard by nearly all, even with the most inexpensive headphones. But many have trouble localizing

sounds directly in front or in back, and for some the sounds seem to occur inside their skull (just as with listening to stereo on headphones) rather than outside. Better matching of HRTFs

(Head Related Transfer Functions) can correct some of these

problems, and with recent advances in digital signal processing there

may soon be a solution. It would involve a processor similar to

the Dolby Headphone circuit - which provides a virtual 5.1

surround field on ordinary headphones, but allowing for the proper EQ and phasing to map the binaural sounds seamlessly in a 360-degree sphere around each listener."

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments | Internet: neidorff@ti.com

50 Phillippe Cote St.
Manchester, NH 03101 USA

| Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: l...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Wire 2/99 (part 8 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part8_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Wire 2/99 (part 8 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:11 GMT

Archive-name: AudioFAQ/part8

Last-modified: 2000/4/12

Version: 2.15

15.0 Wire

More than any other topic, speaker cables and equipment interconnects seem to use up [rec.audio.*](#) bandwidth echoing the same theoretical arguments, testimonials, and opinions. Controversy can be stimulating, educational, and also amusing.

Please try to keep postings aimed at one of those three goals,
and avoid the insults and emotion. Also, try to avoid

echoing a common position or principle, as described below.

15.1 Do speaker cables matter?

To avoid confusion and repetition, here is some terminology, thanks to Steve Lampen of Belden Wire & Cable Co.

A wire is a single conductor made up of one or more conducting elements, but all configured (as in a stranded design) to act as a single conductor. Mostly, this is coated or covered by plastic, rubber, enamel or similar insulators.

Groups of wires are called cables. So zip cord is a cable, because it contains more than one insulated conducting element. Coaxial cable is also cable.

Cables can introduce noise into the signal, act as a filter (and thus change the frequency response of the system), attenuate the signal (change the amplitude), and provide nonlinearities from oxidized or otherwise poor connections. Nonlinearities can distort the signal which add harmonics. Nonlinearities can also rectify or demodulate higher

frequency

signals into audible signals.

It is quite scientifically conceivable that some cables do cause a difference in sound, because of the differences in DC resistance, interconductor capacitance, and connector

attachment

alone. The effects of exotic conductor weaving and materials are not so well established. In general, these effects (once we eliminate DC resistance), seem to be small. However, if

your

system is at least fairly good, then some folks have observed (although not in an experimental, double-blind sense) significant differences in system performance with different cables. The effects are said to be quite system specific; the only real guideline is to try them and see which ones seem to sound better in your system.

Roughly speaking, the price ranges for speaker cables is low (under \$1/ft), medium (under \$6-8/ft), and high (up to \$100/

ft

and more). Try to arrange it so you can trial such cables; at

several hundred dollars per set, experiments can be expensive.

In any system or experiment, it is essential that the differences between cables be separated from the differences between connectors.

You should have an EXTREMELY solid connection between cable

and speaker. Speakers operate at very low impedances, so that bad connections will create significant artifacts or signal

losses at any power level. For example, if the connection has a

linear resistance of just 1 ohm, the speaker damping factor may be changed, and the bass may suffer. If the connection contains imperfect metal oxides, then a slightly rectifying junction

will block the signal, producing compression, distortion, and

other non-linear effects.

There are many magazine articles on cables with various perspectives which are worth reading, including:

"Speaker Cables: Testing for Audibility"

Fred E. Davis

Audio, July 1993, pgs. 34-43

15.2 What speaker cables are available and how good are they?

There is a wide range of speaker wire available, ranging from 30ga zip cord (~\$.10/ft) to exotic wires costing over \$300/ft. The material used ranges from copper to oxygen-free copper (OFC) to silver. (There are a bunch of others as well.)

Oxygen-free copper is probably NOT any different from common copper in sound. If you hear a difference between two cables, it is not a difference between oxygen-free and common copper.

Resistance may be significant for speaker cables. The higher the resistance, the more the cable will affect the sound, all else equal. The resistance characteristic of metals is

called resistivity. The resistivity of copper is 1.7 microhm-cm. Silver is very slightly lower, 1.6. Gold is a bit higher,

2.4.

Silver and gold are different from copper in other ways than resistivity. Gold does not oxidize in normal environments, so gold contacts will not need periodic cleaning and will not create rectifying junctions. Silver will oxidize, but the oxide of silver is conductive, so oxidized silver will still make good contact. Copper oxide is a bad conductor. Oxidized copper contacts may insulate, may conduct, or may rectify. Copper is a bad material for cable terminals, but this may or may not mean anything for the conductor itself.

15.3 What can I use for budget speaker cables?

First, a few words on terminology. Wire is sized by AWG or BS gauge number. Larger numbers represent smaller wire. AWG 40 (also called 40 gauge) is as fine as human hair. AWG 12 is

2mm

or .081" diameter. If you reduce the AWG number by 3 (such as from 29 to 26) then the wire cross-sectional area increases

by

a factor of 2 and the series resistance drops by a factor of

2.

Some wire is classified as solid, because it contains one strand per conductor. Other wire is called stranded, because it consists of many strands per conductor. Stranded wire is far more flexible than solid wire. Most wire is made from drawn copper. Some wire is sold that is claimed to be made with a process that produces oxygen-free copper. Oxygen-free copper has a different metallurgical structure than common copper and may or may not conduct current better.

Some critical listeners have reported excellent sound from

large

diameter solid copper wire, such as home wiring "Romex 12-2". At least one expert has said that common 18-gauge solid copper hook-up wire sold by Radio Shack also works very well. Also recommended on a budget is Sound King wire, a 12 gauge oxygen free copper stranded cable. This is available from MCM Electronics for \$.39/ft.

Scientifically, thinner wire has more resistance than fatter wire, so fatter wire will have less resistance-related

effects.

Resistance effects can be eliminated by using at least 12 gauge wire, particularly for long runs. Of course, shorter runs are always preferred, because they come much closer to the ideal zero-length wire, with no resistance, no capacitance, no inductance, and no change in signal.

15.4 What can I use for budget speaker connectors?

The worst connectors are push-down, or spring terminals.

Screw

terminals with solid copper wire are much better. Gold-

plated

binding posts and gold spade lugs are inexpensive by

audiophile

standards and are extremely stable. Binding posts with spade lugs can be tightened to get a very good mechanical joint,

and

may offer the lowest electrical resistance of any connector.

Gold plated banana plugs and jacks are very good speaker terminals. Good ones are more expensive than gold spade

lugs,

however, they also provide a bigger area of contact, and are more convenient when you must frequently reconfigure the

system.

Banana plugs should be periodically monitored for corrosion

and

loss of spring tension. Monster offers a banana-plug

connector

with an expanding center pin that forms an even better connection than common gold banana plugs. At approximately

\$25

per pair, the Monster banana plugs aren't a budget connector.

All else equal, connectors with gold surfaces are better than connectors with any other surface. This is for two reasons. First, gold is extremely inert, meaning that unless gold is exposed to very harsh chemicals or harsh vapors, it will not corrode or oxidize. It will remain a pure, low-resistance conductor. Second, gold is quite soft, so that if a gold-plated connector is squeezed between two metal surfaces, it will deform slightly to fill scratches and voids, giving a very broad, low-resistance contact area.

Corrosion of connectors is often a problem. Gold-plated terminals and connectors somewhat avoid this problem; problems with other connectors can be mitigated by unplugging and replugging the connector on a regular basis, cleaning the contact areas with a pencil eraser, or by using a contact enhancer such as Cramolin or Tweek. When you use a contact enhancer, be very sure to follow the directions, and avoid spreading enhancer about your equipment.

15.5 What about interconnects, such as the cable between tuner and amp?

Line-level interconnects conduct smaller signals than speaker cables; the typical signal ranges from -2V to +2V (the CD output standard) with currents in the microamps (the corresponding values for speaker cables attached to a largish power amp might be -70V to +70V and currents of many amps). Line-level interconnects can be divided into single-ended (or unbalanced), and balanced interconnects. Home audio is almost always single-ended interconnects.

Single-ended interconnects almost always use a form of the RCA connector (or phono plug). RCA plugs form fair to poor connections that degrade with time as corrosion works into

the metal-metal contact and as the spring tension of the connectors

relax. Gold-plating reduces the effect of corrosion and

locking RCA connectors solve most of the mechanical problems.

However, these premium phono connectors are rare and expensive. For example, a gold-plated Vampire locking RCA plug costs approximately \$23/pair. If RCA connectors weren't a de facto standard, we'd recommend against them.

Unbalanced interconnect wires vary in geometry, material and price. Cheaper wires have a single conductor (normally stranded) and a shield and cost \$.20-\$2/ft. Medium

(complexity and price) wires have two conductors (often arranged as a twisted pair) surrounded by a shield and cost from about

\$3-\$20/ft. Exotic wires have all sorts of geometries and materials (such as stranded silver conductors, or ribbon

cable

braided around a core, or in one extreme case, a tube filled with mercury!). Prices may be as high as \$200-\$300/ft.

Balanced interconnects have three conductors: two for the

signal

one for ground, and additionally a shield. The standard connector for balanced cable is the ITT/Cannon XLR connector, which is quite good mechanically (they lock). Equivalent connectors are also available from Switchcraft, Neutrik, and other vendors. If you have to run cables longer than 12 feet

or

4 meters, the greater noise immunity of balanced

interconnects

is often a good idea. For this reason, balanced connectors

are

standard equipment in professional installations such as studios, public address systems, and broadcast stations.

There

is not much variation in balanced cables. The three brands mentioned above are known to be rugged, high quality and moderately priced. Slightly weaker imported connectors are available, but they aren't dramatically cheaper. Better connectors are also easier to assemble and have a more durable cord strain-relief.

For most systems, the most important aspect of a cable are the mechanical reliability of the connectors; in particular, the joint between connector and wire, and the joint between connector and socket. Typically, interconnect cables are short. It is worth getting just the right length; cables often come in .5 meter increments. With quite good systems, some people observe differences in sound between various interconnects. This is quite system-specific and the same advice as given above applies: try several brands. Most good dealers will loan interconnects for home evaluation.

In cables where the shield does not carry the signal or

ground,

the shield is normally only connected to ground at one end. In systems where there are significant differences between

ground levels on various components, it may make a difference which way such cables are connected. Typically, the end

where the shield is grounded should be at the source of the

signal. Often, such cable has arrows on it pointing in the direction of the signal flow. In any case, try both orientations.

There are many objective reasons why cables might cause differences in sound by interacting with the drivers in the signal sources as well as by providing non-linear effects in

the RCA connector. Most of these effects are again related to interconductor capacitance and resistance, and the quality of the shielding provided by the "shield" conductor. In

balanced cables the quality of the "twisted pair" inside the shield is also important. One might note that a shield protects from

only capacitively coupled interference, and not from any magnetic field interference. The twisted pair in a balanced line

provide some magnetic rejection, as does steel conduit. However,

steel conduit has other characteristics which make it undesirable for audio in general.

15.6 What about Phono Interconnects:

Phono interconnects are part of the link between a cartridge on a turntable and a preamp (or head amp or receiver). They are

a special case of line-level interconnects because the signal

is much lower, typically 1 to 50 millivolts. They are also intended to operate into a higher impedance, typically 47K

ohms, and form part of the capacitive load for the cartridge.

The low signal levels mean that the shielding of the cable,

and

the presence of a separate drain/shield are more important,

as

is a good ground. A separate solid ground should come along with the cable as a separate lead co-routed with the cable.

In addition, the low signal levels make a good solid

connection

to and through the connectors MUCH more important, because of the greater sensitivity to low-level nonlinearities.

Wire capacitance is often ignored in line-level interconnects; however, in a phono interconnect, it may constitute half of

the

total capacitive load of the cartridge. Obviously, then, two cables with significantly different capacitances should sound differently. In this sense, the "right" cable for one

cartridge

may be too low or high in capacitance for another cartridge.

For low-impedance cartridges (most moving coil cartridges), the wire must have low resistance to prevent cartridge

unloading

and frequency-dependent signal loss. In addition, as the signal levels are quite low, shielding is important.

Unfortunately, copper shields do not block stray magnetic fields, so in the case of phono cables, careful routing may

be

even more effective at reducing hum than special wire.

15.7 Is there really a difference in digital interconnects?

There are now three kinds of digital interconnects that

connect

transports to D/A converters: coax, plastic fiber (Toslink)

and

glass fiber (AT&T ST). In theory, these should sound EXACTLY the same (bits are bits). However, this assumes good circuit design (in particular, the clock recovery circuits of the

DAC,

and careful consideration of electronic noise) which may be compromised because of cost considerations or ignorance.

Note:

different signaling schemes are used on plastic and glass

fiber.

In any case, some people claim to hear a difference; of those who do, most seem to prefer the glass fiber. However, the technology of fast digital data transmission in consumer electronics is evolving very quickly now. Any specific recommendation should be treated with suspicion until the industry matures.

15.8 Can I make very good interconnects myself?

Yes. You will need to be the judge of whether or not they are as good as \$100 interconnects, but it is easy to make interconnects that are better than the \$2.00 set which comes with new equipment.

There are two necessary ingredients: two-conductor shielded cable and RCA connectors. There is a lot of debate over what is the best cable, but in general, the lower the capacitance per foot, the better. Choice of insulation is harder. There may be an advantage to polypropylene or teflon over polyester or rubber, but even that is debatable. If you are buying wire from an electronics distributor, some have successfully used Belden 1192A microphone cable. It is rubber insulated, so

very

flexible. Another recommended cable is Belden 8451. This is a polypropylene cable with foil shield. Finally, consider Belden 89182. This is foamed teflon insulated, so very low capacitance, and foil shielded. If you plan to make a long cable, this low capacitance cable may be the best choice.

There is also a variety of RCA connectors available. A good connector would be gold plated and machined to tight tolerances. A poorer connector will not fit as well, will make poorer contact as the connecting surface oxides, and will lose its springiness with use.

When wiring the cable to the connector, use one wire for signal, (the tip of the RCA connector) and one wire for ground (the shell or outer conductor of the RCA connector).

Some cables use a foil shield which is difficult to solder. These cables typically have a drain wire parallel to the foil which can be used for soldering. Others use a braided shield.

Regardless of which type of wire you have, connect the shield or the shield drain wire to ground on only ONE SIDE. This will stop noise picked up by the shield from causing ground noise.

It can be a touchy job soldering RCA connectors. Before you use your new cables, check with an ohmmeter or a continuity tester to make sure that you have not accidentally sorted the signal and ground leads together, either with a stray drop of solder or a loose wire strand.

15.9 Is there a standard for wiring balanced XLR-3 cables?

Yes. Connect pin 1 to ground/green, pin 2 to white, and pin 3 to black. Herb Hamilton suggests that you remember "George Washington Bridge" and then use the first letter of each word (GWB) to help you remember Green=1, White=2, and Black=3. This same wiring convention works for balanced line level signals and balanced microphone cables.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments	Internet: neidorff@ti.com
50 Phillippe Cote St.	Voice : (US) 603-222-8541
Manchester, NH 03101 USA	

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - Part8 - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Retail 2/99 (part 9 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part9_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Retail 2/99 (part 9 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:12 GMT

Archive-name: AudioFAQ/part9

Last-modified: 1999/11/19

Version: 2.15

16.0 Retail

16.1 Should I use an up-scale retail store?

This is probably the best place to listen to gear in a
controlled environment, next to your home. This is the best
place to find expensive, high quality gear. This is the
place

which is most likely to have a good policy on home trials and
a liberal return/upgrade policy. This is also likely to be

the most expensive place to shop. One exception to this is that these stores have the ability to sell demos, returns, and discontinued gear at very advantageous prices.

Some up-scale dealers will negotiate price on large systems or expensive purchases. It never hurts to ask.

There are definitely better and worse local hi-fi stores. If you find a really good one, it is probably worth the extra

money to buy from them, rather than from discounters. A really

good store will not push you to buy what they want to sell. A

really good store will allow you to take your time with your

decision. A really good store will not distort the truth in describing equipment. A really good store will help you get the most

out of your purchase by showing you how to set it up. They will tell you what placement works best for the speakers. (Don't believe them if they tell you to put them anywhere.) A

really good store also selects their lines carefully. They don't

want dissatisfied customers or warranty returns any more than you

do. A really good store will also have technical equipment and/or skilled technical people that can perform tricky adjustments correctly, such as cartridge and tonearm alignment.

Due to the nature of the customer, a hi-fi store in a

shopping mall is likely to use high-pressure sales techniques. They

know that the majority of their customers are distracted easily by 299 other stores. Most of their sales go to customers that come in for 3 minutes, select something, and leave. There are exceptions to this, of course, but if there was a good generalization, it would be to look elsewhere. There are

stores in large buildings, small buildings, private homes, shopping plazas, and every other conceivable venue. Search from among

these to find one that meets your needs and fits your style.

16.2 Should I use a discount store?

If you need to listen carefully before making up your mind, discount stores can be very frustrating. If you know exactly what you want, then this can be a great place to save money. Don't expect knowledgeable sales help or after-sale support.

Be

sure to ask about the warranty (see 19.1 below on warranties).

16.3 Is it right to negotiate price?

Most people feel that it is fair to negotiate. Some feel that

it is fair to lie in negotiating, as the sales people frequently

lie to you also. Others think that lying to get a lower price

is an immoral practice. It may even be illegal, an act of fraud.

Some people feel that if you negotiate over price, you encourage

stores to mark prices artificially high, so that the stores have

room to negotiate. Others feel that in negotiating, you are asking the store to accept a lower profit, or asking the

sales person to take a lower commission and are directly hurting them.

16.4 How can I negotiate price effectively?

A great source of information on this topic is available from books on buying a new or used car. However, some very helpful

general tips include:

- Know the competition and the dealer.

- Know the gear.

- Know the prices available elsewhere.

- Believe in your research, not their words.

- Stand your ground.

- Be nice to the people but hard on the deal.

- Be prepared to walk away if they won't agree.

Expect their lines and prepare responses in advance.

the
the
that
noise

For example, expect the dealer to claim that Nakamichi deck is the best cassette deck on market. Be ready with a reply such as at price, you can buy a DAT machine which has better frequency response, lower signal to ratio, etc.

16.5 It sounded great in the store. Is it great?

golden

Never let anyone else pick stereo for you. Especially not speakers. They all sound different, and you don't need a ear to hear the differences. Listen for yourself and ignore what the sales people say.

deposit.

If you are still unsure, ask the sales people to let you take the gear home for a home trial in exchange for a large

Home auditioning takes 99% of the risk out of store auditions.

16.6 Do sales people try to trick the customer?

aren't
sell
equipment
this
be

Some do and some don't. Some will treat unpleasant customers badly and treat friendly people well. Most sales people wealthy. They sell stereo to make a living. If they can you a more expensive piece of equipment or a piece of equipment with a higher profit, they will make more money. Usually, figures into everything they say. Some sales people claim to be altruistic.

starve
personality,

Some sales people really are open and honest. They may with this approach, or they may have a nice enough a good enough product line, a good enough store behind them,

or

enough technical background to overcome this "limitation".

16.7 How can sales people trick the customer?

Often, a customer will trick him or herself without help. We are often swayed by appearance, sales literature, position of the equipment in the show room, and our own desire to buy

what

others will like.

Some times, the sales person will actively try to push a particular piece of equipment by demonstrating it against another piece of equipment which is inferior or defective.

Some sales people will demonstrate a set of speakers while simultaneously driving a subwoofer, even though they are not telling you this. With the subwoofer, it probably will sound better.

Some sales people will demonstrate one set of speakers louder than others. Louder almost always sounds better.

Most stereo buyers go into the store, spend a few minutes selecting what they want, lay down big bucks, and leave.

They

don't need to be tricked. They don't listen carefully. They trust the sales person's choice as best in their price

range.

For non-technical reasons, these people are the most likely

to

be satisfied with their purchase.

16.8 What should I ask the sales person?

What do you want to know? Seriously, the best questions are those which the sales person can answer without distorting

the

truth. Don't ask a sales person to compare their brand to a brand they don't sell. Don't ask "how good is the ...". Ask questions of fact.

Here are some questions you may want to ask:

If I don't like it can I return it for a full refund?

Can I try this out at my home in exchange for a

deposit?

What does the warranty cover? For how long?

What do I need to know to set this up for best sound?

Do I get a manufacturer's warranty with this?

Where do I take this to get it repaired under

warranty?

Where do I take this to get it repaired out of

warranty?

16.9 How do I impress the sales person?

Why would you want to? You have money and he doesn't.

16.10 How do I get the best service from a sales person?

Be honest with the sales person. Set some reasonable request and ask them to meet it. For example, say that you will buy this if you can try it at home first and listen to it side-by-side with a piece from another store. Alternately,

say

that you saw the same thing at store Z for \$xx less, but you will buy it from the guy if he will match the price.

16.11 What is "street price" or "list price"?

Street price represents the price which you would pay if you went to a store and bought the product. It isn't a sale price or the published price, just the actual, common selling price.

Some manufacturers tell their dealers to sell right at list price. Others provide a low enough wholesale price that the selling price can be significantly below "list price". List price is generally meaningless, so street price is a more realistic comparison price.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments
50 Phillippe Cote St.
Manchester, NH 03101 USA

Internet: neidorff@ti.com
Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Mail Order 2/99 (part 10 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to see.](#)

There are reader questions on this topic!
[Help others by sharing your knowledge](#)

Message-ID: <AudioFAQ/part10_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/11/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Mail Order 2/99 (part 10 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting, buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:12 GMT

Archive-name: AudioFAQ/part10

Last-modified: 2002/11/30

Version: 2.16

17.0 Mail Order

Mail order is appealing. The general hope is that by using mail

order, you avoid pushy sales people, you pay fixed, discounted

prices, and you have written catalog descriptions to help you select your purchase. In practice, most mail order today is "phone order", in that the company completes the deal with a phone call. Many of the "mail order" companies don't even

have

price lists or catalogs. They are just retailers that are willing to sell over the phone and ship the merchandise to you. In some cases, retail store sales are better deals than mail order. Don't expect the lowest price from the first

place

you call. Also, don't expect excellent service from everyone, and especially not from the company with the lowest price.

17.1 Who sells brand XXX equipment mail-order?

Consult the rec.audio.marketplace mail-order survey published

by

nau@SSESCO.com (William R. Nau) or contact William Nau

directly.

This survey is also available via FTP in the pub/rec.audio directory of SSESCO.com. If you have any mail order experiences to share, please send them directly to William

Nau.

17.2 Is the stuff sold by DAK really awesome? Damark?

DAK is out of business. It is believed that DAK went out of business because they invested too heavily in 80286 PCs as the price and demand dropped. Dave Platt joked that the

closing

of DAK resulted in the great superlative shortage of 1995, because DAK used many wild claims in their advertisements.

Regarding Damark, their products seem to be as described, but not necessarily bargains. In addition, there have been a number of consumer complaints against Damark for charging for products not ordered.

Doug Purl reports that DAK was named after and owned by Drew A. Kaplan and that Damark is named after and owned by Drew

And

MARY Kaplan, so these two companies may share more than style.

Richard Bollar did some research and came up with a different origin for the name Damark: "The firm's moniker is a combination of the first names of the founders, David Russ and Mark Cohn, who had both worked at COMB, a discount mail-order house. They became vendors to COMB, but when that company refused to pick up some of their merchandise, they started

their own catalog business. At first they continued to sell to their former employer, but when it forced them to decide whether to be suppliers or competitors, Cohn and Russ decided: they started DAMARK in 1986."

Whichever is true, be cautious when buying any product without an audition. Ignore any wild claims or comparisons to products costing many times more. There are many examples of

excellent,

expensive products that are worth every penny, but don't sound great. Someone could honestly claim that their product sounds better than products costing ten times as much, yet they could still be selling an inferior product with poor sound.

17.3 Is the stuff sold by Cambridge Sound Works really awesome? What about the other brands of tiny satellites and subwoofers?

Many experienced listeners report that the systems sold by Cambridge Sound Works which consist of two small satellites and one medium sized subwoofer are a poor value if your goal is best sound quality for the money. However, the convenience of tiny satellites is important to some people.

Perhaps someday, someone will develop a great tiny satellite plus subwoofer system, but all examples so far seem to suffer from lumpy frequency response and poor reconstruction of the stereo image. The same complaint applies to similar systems from other makers. Some believe that it is essential to have all of the left channel sound coming from the exact same location for best stereo image and smooth frequency response. This premise implies that tiny satellite plus subwoofer

systems

will always be inferior.

Cambridge Sound Works also sells more conventional tower and bookshelf systems. These, like many other speakers on the market, are worth a listen.

However, the authors of this FAQ strongly recommend that you ignore all recommendations and make your decision based on your own personal listening tests.

17.4 What should I watch out for when buying mail order?

Many of the cautions mentioned in warranties (20.1) apply. Look for a store which has been around a long time. Look for friends which have dealt with the store and been satisfied. Look for a store which does not lie or stretch the truth.

17.5 What is gray market?

See warranties (20.1), below.

17.6 Are there any good mail-order sources for recordings?

Alas, Noteworthy is out of business as of November 1996.

BMG and Columbia also sell CDs mail-order, but have a smaller list of offerings and higher prices. However, BMG and

Columbia

have interesting deals to entice new customers. Read the fine print before you sign to be sure that they are right for you. BMG and Columbia both have promotional offerings to "members" which allow you to buy two or three discs for the price of one. These can be very good deals, if you want what they have. Look at their advertisements in common magazines and Sunday newspapers for a better idea of what they carry. They list much of their line in their ad. Don't expect much more. For more information on BMG and Columbia, see section 10.13, 10.14, 10.15, and 10.16 of this FAQ.

Tower Records has a mail order department which also sells

CDs.

Tower is a large retail chain. Many have bought from their retail outlets happily. They do not have a catalog of their

own,

but will sell you a Schwann or similar catalog and offer to

get

virtually any disc out of those catalogs. Contact:

Tower Records Mail Order Department

692 Broadway

New York City, NY 10012 USA

800-648-4844 or 800-522-5445

Another source is Music New Hampshire; 800-234-8458. They sell many \$3.79 post-paid sampler CDs and also many independent

label

single-artist discs. Most single artist discs are \$15.00 each. Shipping is \$3 for 1-3 discs and \$5 for 4-up. Their stuff is

mostly obscure artists. They have Rock, Jazz, Classical, Folk, Country, and Children's offerings. Affiliated with CD Review.
Music New Hampshire - Wayne Green Inc
70 Route 202N
Peterborough NH 03458-1107 USA

If you like the idea of buying CDs by Modem, consider
The Compact Disc Connection
1016 East El Camino #322
Sunnyvale CA 94087 USA
Voice 408-733-0801
Modem 212-532-4045 New York City NY
312-477-3518 Chicago IL
408-730-9015 Sunnyvale CA
617-639-0238 Boston MA
Telnet cdconnection.com

They have a collection of over 120,000 CD titles. People have said that their service is excellent. Prices are fairly good. Shipping is \$3.50 for orders under \$100.00 and free for larger orders. They do not stock anything, but deliver from the warehouses of their suppliers. This means that some items may be back ordered or completely discontinued while remaining in their on-line data base. They advertise 94.2% of orders in 1992 shipped, though not necessarily immediately. You can

also
get their catalog from ftp.cdconnection.com

There have been a couple of music (cd/lp) mail-order lists compiled on the net - one older list can be found via

anonymous

ftp to ftp.uwp.edu in the file: /pub/music/misc.mailorder.rmm
Someone is revising this file and it should be updated or

found

in a new file name there in the future.

Another list contains vendors that specialize in progressive rock, electronic and experimental music, is maintained by Malcolm Humes and posted sporadically to [alt.music.](#)

[progressive](#),

[rec.music.misc](#), & [rec.music.info](#). This also can be ftp'd from ft.uwp.edu, in the file: /pub/music/misc/mailorder.progressive

Federal Music and Video markets "Discount Coupon Books"

featuring two-for-one CDs and Tape deals. They require payment with the order, which many consider risky. One company that distributes these coupon books for Federal Music is Reed

Music.

The price from Federal or Reed Music with the two-for-one deal is comparable to the price from Noteworthy. So far, no net user has yet related any positive or negative experience with Reed Music or Federal Music and Video. Federal Music and Video has been in business since 1985, so is probably legit.

However,

in that they require payment in advance it is probably safer to avoid them completely and use a discounter like Noteworthy. Occasionally, a new dealer will pop up offering free CDs and/or a great coupon book. They may be a dealer for Federal. Save your money.

There is a list of mail-order music companies on the web:

<http://www.razorsedge.net>

Most seem to be specialized smaller dealers.

When considering mail purchases of CDs, consider shipping costs.

It is common for people to charge between \$1 and \$3 per disk for

"shipping and handling". This makes mail order less attractive,

but may be equally balanced by a lack of sales tax.

Get archive "mailorder.txt" from "/pub/cd" on "jammin.nosc.mil"

for a complete list of mail order music sellers.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments
50 Phillippe Cote St.
Manchester, NH 03101 USA

Internet: neidorff@ti.com
Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* Networking 2/99 (part 11 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part11_1063104376@rtfm.mit.edu>

X-Last-Updated: 2003/08/01

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Networking 2/99 (part 11 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:13 GMT

Archive-name: AudioFAQ/part11

Last-modified: 2003/08/01

Version: 2.16

18.0 Network Protocol

18.1 What are the audio newsgroups? Which group should I post to?

It is important to post to the right group. There are a few reasons for that. First, you want to be read by people who are knowledgable and/or interested in your topic. Second, you want to avoid the ire of people who don't have your perspective or won't tolerate your ignorance. The audio newsgroups are frequented by a wide group of people, including

some outspoken experts who know their stuff and some serious purists who won't consider lower levels as acceptable.

That said, here's the list of newsgroups and an explanation of their content:

[rec.audio](#): The original newsgroup, which is being phased out.

[rec.audio.car](#): This newsgroup supports discussion on

different

brands and models of car stereo, and also is an open forum for talk about car stereo installation, speaker selection, custom crossovers, and the special noise problems which occur in cars.

[rec.audio.high-end](#): This newsgroup caters to audiophiles and serious music lovers who are interested in discussing the subtle differences between expensive equipment,

the

nuances of selecting the best cables, the love and

lore

of LPs, and other details of audio that are inaudible

to

the untrained ear. Currently, [rec.audio.high-end](#) is the only group which is available by e-mail. To get this group sent to you, contact:

audio-request@lerc.nasa.gov

This is also the only group which is moderated. This group has specific, enforced posting guidelines.

There is no cross posting allowed to [r.a.h-e](#). Please read the frequently posted info on posting before posting to [r.a.h-e](#).

[rec.audio.high-end](#) also has a FAQ. Please obtain and read the [rec.audio.high-end](#) FAQ before posting.

[rec.audio.marketplace](#): Here's the place for selling and buying equipment. This is also a good place to discuss dealers, pricing, product sources, and models with specific features.

[rec.audio.misc](#): If you don't think it fits well in any other newsgroup, post it here.

[rec.audio.opinion](#): Everyone has opinions. Share yours here. Not sure which is better? Ask here. Think you hear a difference? Say it here.

[rec.audio.pro](#): This newsgroup is dedicated to professional audio. It includes discussion on record production,

studios, studio equipment, DJ equipment, recording concerts, sound reinforcement, mastering, mixing, special effects, and other topics which might apply

to

audio professionals. If you are a home audio buff

but

like tape recording, you can find good advice here.

rec.audio.tech: Discussion here is about audio theory, home made audio equipment, specifications, and other technicalities.

[rec.audio.tubes](#): This is a group discussing tube circuits, tube equipment, and the characteristics of vacuum tubes in general (UK translation: Valves).

alt.home-theater-misc: Discussions of home theater, including surround sound processing, speakers, large screen video, and media.

If the appropriate group is not available on your server, post to rec.audio.misc.

18.2 What network mailing lists are out there which aren't on usenet?

There is an informal group of people interested in using DAT recorders to record "Grateful Dead" concerts. These people

call

themselves "Dat-Heads" and have a daily E-Mailing List. This is also a great resource for DAT information. They maintain an excellent DAT FAQ with detailed information on DAT machines and tapes. The FAQ is a bit obsolete, but still great. To subscribe to the list, or get a copy of their faq, send a message to:

DAT-Heads-Request@fedney.near.net

Include one of the following as the body of the message:

SUBSCRIBE

SEND FAQ

There is also a general turntable chat mailing list. To subscribe to this list, send a message to:

analogue-addicts-request@maths.ex.ac.uk

asking to join the mailing list.

There is the bass mailing list, devoted primarily to low frequency reproduction, although there is also much discussion

of general speaker building issues. To suscribe, send
subscribe bass <address> to listproc@mcfeeley.cc.utexas.edu

There are two mailing lists devoted to mini-disc related
issues.

To subscribe to the MD-L list, send mail to:

listserver@nsth.ca

with the following request in the body of the message:

subscribe MD-L Your Name

To subscribe to the minidisc-users list, send mail to:

minidisc-users-request@steffi.dircon.co.uk

with the word ``subscribe'' as the body of the message.

There is a general interest audio mailing list sponsered by
"Sound Practices" magazine. To subscribe, mail to:

sound-request@tpoint.net

with the word ``subscribe'' as the body of the message.

There is a technical audio mailing list (hifitech) for end
users (not studio or professional). To subscribe, mail to
MAJORDOMO@LISTS.OULU.FI As your message, type:

subscribe hifitech

The SOUND list has discussion about kits, DIY speakers, etc.
To subscribe, mail to LISTSERV@ACM.ORG As your message, type:

SUBSCRIBE SOUND firstname lastname

RADIO-L is an electronic dicussion forum for Digital Audio
Broadcasting. To subscribe, mail to LISTSERV@TC.UMN.EDU

As your message, type:

SUBSCRIBE RADIO-L firstname lastname

RADIO-L archives are available at <http://magi.com/~moted/dr>

DASP-L is a forum for discussion of digital acoustic signal
processing. To subscribe, mail to DASP-L-request@CESNET.CZ

18.3 Should I post a question about "XXXXXXX"?

If it isn't addressed in the FAQ and it isn't a question for
one individual, do it! However, try to post to the right
group (see above).

18.4 How can I suggest a change to the FAQ?

Send an E-Mail message to neidorff@ti.com and explain your suggestion or correction in detail.

18.5 Where is the FAQ for rec.audio.* archived?

This FAQ is available by ftp from `rtfm.mit.edu` in
`/pub/usenet/news.answers/AudioFAQ`

To get the entire FAQ from this archive, you need to get all 13 of the following files:

- part1
- part2
- part3
- part4
- part5
- part6
- part7
- part8
- part9
- part10
- part11
- part12
- part13

The FAQ is also available on the world-wide web at these sites:

<http://www.faqs.org/faqs/AudioFAQ/part1/index.html>

<http://www.cis.ohio-state.edu/hypertext/faq/usenet/AudioFAQ/>

<http://www.unik.no/~robert/hifi/faq/>

<http://www.lib.ox.ac.uk/internet/news/faq/rec.audio.tech.html>

<http://www.cs.ruu.nl/wais/html/na-faq/AudioFAQ-part1.html>

<http://www.ucsal.f.ac.uk/cgi-bin/faq?AudioFAQ/part1>

18.6 What does FAQ stand for?

FAQ stands for "Frequently Asked Questions". It is assumed that a FAQ also contains FGA or "Frequently Given Answers". The rec.audio.* newsgroups have few FGAs due to the personalities involved and the subjective nature of audio. For that reason, this document is called a FAQ.

18.7 Why did I get a bitter reply when I posted a simple opinion?

Some feel that rec.audio.* is populated by people with very strong opinions. The whole audio industry is filled with opinionated people.

However, for the most part, these people like voicing their

opinions and reading others. What may have sounded like a severe rebuttal may have instead been an outlet for the other person's frustrations or a challenge to you to "play the `rec.audio' game" and back up your words with some spirit.

Be sure to stay light when reading rec.audio. Otherwise, you are likely to take yourself and everyone else too seriously.

18.8 Can I post a "FOR SALE" notice on rec.audio?

The newsgroup rec.audio.marketplace is specifically for these postings. Do not post For Sale to any other rec.audio.* group, except perhaps rec.audio.high-end. Only post to rec.audio.high-end if the item is of interest to the high-end crowd. rec.audio.high-end is moderated, so if the post is deemed inappropriate by the moderator, it will not post.

All For Sale posts need to have a real name and a real phone number. It is also very valuable to include your location, so that people can determine if shipping will be cheap or impractical.

Usenet is not for commercial purposes, so if you are associated with a store or other retail operation, this is the wrong place for your advertisement. If you have some used personal gear or something you bought and don't need, feel free to post.

If you see an advertisement for a store that has a great deal, AND people had been asking about where to buy that item cheap, you might want to tell the readers on rec.audio.marketplace about it. However, avoid commercializing. Something like:

Pete's Audio has JVC PS992 for \$435, which is 40% less than anywhere else; If interested 202-555-1212.

should be fine. Avoid posting their entire price list, or using too many superlatives. If commercialism leaks into Usenet, it could materially hurt us all.

When posting something for sale, have a concise but complete subject line. Come to think of it, this is good advice for

any post. Some use abbreviations like WTB (the poster Wants To Buy) or WTS (the poster Wants To Sell). Here are some examples of good subject lines:

Subject: WTB 100W Receiver any condition

Subject: 4Sale Power Amp PS 352 \$500 San Francisco area

Subject: 4Sale Stereophile Back Issues 4/88 to 6/92

Think about who you are willing to sell to before you post. If it is fragile or heavy, you may not want to ship it, so you may restrict to people who are close enough to pick it up. Use the Distribution: header to restrict your posting area. If you will only sell to people in Texas, don't distribute it to Australia. Check with your system administrator if you aren't familiar with the options you have for Distribution. Different sites have different restriction codes available. Distribution headers don't always restrict distribution, so it is still a good idea to include the target area in the Subject.

Anyone buying or selling needs to understand that Usenet contains no mechanism to protect the buyer's money or the seller's property.

There is a frequently posted message "A Guide to Buying and Selling on Usenet" which talks of other issues on the subject. This is posted to news.answers as well as other newsgroups. It is also available by ftp from "rtfm.mit.edu" in "/pub/usenet/news.answers/radio" as file "swap-guide".

18.9 Can I cross-post? Should I cross-post?

Cross posting means sending the message/posting to more than one newsgroup. This is more efficient than posting the same message twice, as it stores less space on disks, takes less time to transmit, etc. If you need to address the message to more than one newsgroup, put all newsgroups in the Newsgroup: line.

However, there is rarely a reason to cross-post to many of the rec.audio.x newsgroups. If you have a repair question, it belongs in rec.audio.tech and no where else. If you are selling a tuner, post to rec.audio.marketplace. Want opinions on the right cable? Post to rec.audio.opinion. Not sure?

Post to rec.audio.misc.

18.10 Are there any sites containing audio files available for ftp?

Yes. Try ftp.uu.net directory "usenet/rec.audio.high-end".

18.11 Are there any audio-specific World-Wide Web sites?

Zillions of them. Here are some places to start:

Robert's page pointing to many Audio pages

<http://www.unik.no/~robert/hifi/hifi.html>

Dan and Steve's Audio-Related page

<http://www.qnx.com/~danh/info.html>

rec.audio.* FAQ with Search Engine

<http://hydra.unik.no/%7Erobert/hifi/faq/>

BMG and Columbia CD Music Club Unofficial Lists and FAQ

<http://www.eskimo.com/~bloo/cdfaq/toppage.htm/>

Ambisonic Surround Sound FAQ

http://members.tripod.com/martin_leese/Ambisonic/

Tube related stuff

<http://www.interport.net/~blackie>

Speaker Repair FAQ

<http://www.paranoia.com/~filipg/HTML/FAQ/BODY/>

[F_Speaker.html](#)

William Nau's Mail Order Equipment FAQ

<http://www.ssesco.com/nau/mailorder.htm>

Audio Web

<http://www.audioweb.com/>

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments
50 Phillippe Cote St.
Manchester, NH 03101 USA

Internet: neidorff@ti.com
Voice : (US) 603-222-8541

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs

- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)

FAQ: rec.audio.* The Press 2/99 (part 12 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to](#)
[see.](#)

There are reader questions on this
topic!
[Help others by sharing your](#)
[knowledge](#)

Message-ID: <AudioFAQ/part12_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* The Press 2/99 (part 12 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting,
buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:13 GMT

Archive-name: AudioFAQ/part12

Last-modified: 2002/02/17

Version: 2.15

19.0 The Press

19.1 Which magazine should I read?

Which ever one you like. None are absolutely objective.
Here's a list of some common ones:

audioXpress (\$30/yr 12 issues) (Do-it-yourself)

Note: This is the successor of Audio

Amateur,

Glass Audio, and Speaker Builder Magazines
Audio Amateur Publications
Box 576
Peterborough NH 03458 USA
603-924-9464
<http://www.audioxpress.com>

Audio Critic (US \$24/yr 4 issues) (High-end)
PO Box 978
Quakertown PA 18951 USA
215-538-9555 or 215-536-8884

audio Musings (US \$24/year 6 issues)
25500 Hawthorne Blvd. Suite 1250
Torrence CA 90505 USA
Editorial Office 562-424-7911
Business Office 310-378-6011

Audio Observatory (US \$15/year 12 issues)
22029 Parthenia Street
West Hills, California 91304

Audiophile Voice (\$18/year 4 issues)
Subscriptions: Michael Tantillo
132 Beach Avenue
Staten Island 10306 USA
Phone 718-351-9365
Editorial Office: 2001 Palmer Ave Suite 201
Larchmont, NY 10538-2420 USA
Phone 914-833-1417
FAX 914-834-4070

Bound For Sound (US \$18/yr 12 issues) (High-end)
220 North Main St
Kewanee IL 61443 USA
309-852-3022

Car Audio and Electronics (\$19.95/year 12 issues)
Avcom Publishing Ltd
21700 Oxnard Street
Suite 1600
Woodland Hills CA 91367 USA
818-593-3900

CD Review (Music Reviews; all tastes, only CDs.)
\$19.97 per year 12 issues
PO Box 588
Mount Morris IL 61054 USA

Hi-Fi Choice (Mid-fi. Comparative reviews with

graphs,

tables, and subjective commentary;
'Buying Guide' section)

Dennis Publishing Ltd.
14 Rathbone Place
London, W1P 1DE, UK
+44 71 631 1433

Hi-Fi News and Record Review (Broad. Good new record
reviews. Good equipment measurements)

Subscriptions Department
Link House Magazines Ltd
1st Floor
Stephenson House, Brunel Centre
Bletchley, Milton Keynes MK2 2EW, UK

Hi-fi+ (Mid and high end with reviews and tweak tips)

Available in US/Canada thru Disticor outlets
Unit 12, Albany Business Park
Cabot Lane, Poole, Dorset. BH17 7BX, UK

<http://www.hifiplus.com>

Hi-Fi World (Friendly, lower-to-mid-fi magazine)
(reviews and "how things work" articles)

Audio Publishing Ltd
64 Castellain Rd
Maida Vale
London W9 1EX, UK
+44 71 266 0461

In Terms Of Music (Emphasizes music reviews, new)

PO Box 268590
Chicago, IL 60626 USA
312-262-5918

International Audio Review (US \$38/yr, 12 issues?)

2449 Dwight Way; Box 4271
Berkeley CA 94704 USA

Positive Feedback Mag. (US \$30/yr 6 issues) (high-end)

Positive Feedback
2939 N.E. 155th Avenue
Portland, OR 97230 USA
503-256-1300

Primyl Vinyl Exchange (Equipment for LP users)
(US \$15/yr 6 issues, \$20 International)

PO Box 67109
Chestnut Hill MA 02167
617-739-3856

pvx@ma.ultranet.com

Sound Practices (US \$20/yr 4 issues) (Do-it-yourself)
Box 180562
Austin, TX 78718
(512) 339-6229 Voice/Fax
72411.533@compuserve.com

Stereophile (US \$20/yr 12 issues) (High-end)
110 5th Avenue
New York, NY 10011 USA
800-666-3746 or 212-229-4896

Stereo Review (US \$6.97/yr 12 issues. Lower end/mass
market)
Subscription Office: PO Box 52033
Boulder CO 80323-2033 USA
Editorial Office: 1633 Broadway
New York, NY 10019
212-767-6000

The Absolute Sound (US \$46/yr 8 issues) (High-end)
Subscription Center: Box 6547
Syracuse NY 13217 USA
800-825-0061
Editorial Office: 2 Glen Avenue
Sea Cliff, NY 11579
516-676-2830

The \$ensible Sound (US \$29/yr 6 issues) (Mid/High-end)
403 Darwin Drive
Snyder NY 14226 USA
800-695-8439
e-mail SensiSound@aol.com
<http://www.sensiblesound.com>

Ultra High Fidelity (UHF) (High end, no advertising)
Box 65085, Place Longueil
Montreal PQ J4K 5J4 Canada
514-651-5720

What Hi-Fi (Mid-to-high End; comparative, subjective
reviews. Contains it's own buyer's

guide

with recommendations)
Haymarket Trade & Leisure Publications Ltd
60 Waldegrave Road
Teddington, Middlesex, TW11 8LG, UK
e-mail answers@whf1.demon.co.uk
+44 181 943 5000
US Enquiries should go to:

Eric Walter Associates
Box 188
Berkeley Heights NJ 07922 USA
201-665-7811

You can find e-mail addresses for many magazines at
www.audioweb.com

19.2 Which reviews are better?

Some reviews are so colorful and exciting, that they make great journalism and fun reading. Lets ignore these for now, even though they have their place.

Beware of reviews from magazines that advertise the same product. The likelihood of bias is too high. Unfortunately, that rules out 99% of the reviews in magazines.

Stereo Review has a bad reputation for loving everything made by every advertiser. Even high-end journals such as Stereophile and The Absolute Sound can be influenced.

A classic example of misleading reviews occurs with equipment submitted to a magazine for review. The manufacturer may

send the editors a carefully built, adjusted piece for review.

The magazine will honestly rave about it. The manufacturer will

then send the design off-shore for more economical manufacture and assembly, and the quality will suffer. Lower quality

components will be substituted for prime parts. Adjustments will be

made to wider tolerances or will not be made at all. The design

may be completely changed to make it more manufacturable. You

will unknowingly get a completely different piece than reviewed.

Home auditions with one or two candidates from each of a few dealers are your best guide to be sure that you get what you want and pay for.

19.3 Is Consumer Reports right?

Consumer Reports is the most objective testing lab we have ever found. Unfortunately, they are also the world's least specialized testing lab. They market their testing to the average consumer. The average consumer will not hear some of the subtle differences which audiophiles hear. For that reason, Consumer Reports ignores issues that others feel vital.

Consumer Reports also insists on basing their audio testing predominantly on lab measurements. Although lab measurements do tell many differences between devices, interpreting lab measurements for best sound is difficult or impossible. For example, it is very hard to compare two speaker frequency response curves and tell which will sound better. Some \$3000 speaker frequency response curves look worse than some \$600 speaker curves, even when tested in the same setup. On the other side of the issue, Consumer Reports has improved its test methods, and will continue to improve. Expect the accuracy of their reviews to improve with time.

The Consumer Reports frequency-of-repair data base is larger than any similar data base published and can be trusted as well as any statistic.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments	Internet: neidorff@ti.com
50 Phillippe Cote St.	Voice : (US) 603-222-8541
Manchester, NH 03101 USA	

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If

interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - Part12 - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

FAQ: rec.audio.* Misc 2/99 (part 13 of 13)

[Not finding the answers you need?](#)
[Submit your question for others to see.](#)

There are reader questions on this topic!
[Help others by sharing your knowledge](#)

Message-ID: <AudioFAQ/part13_1063104376@rtfm.mit.edu>

X-Last-Updated: 2002/08/30

Newsgroups: [rec.audio.tech](#), [rec.audio.opinion](#), [rec.audio.misc](#),
[rec.audio.marketplace](#)

Subject: FAQ: rec.audio.* Misc 2/99 (part 13 of 13)

Reply-To: neidorff@ti.com

From: neidorff@ti.com

Summary: Answers to common questions about audio equipment, selecting, buying, set-up, tuning, use, repair, developments, and philosophy.

Date: 09 Sep 2003 10:51:13 GMT

Archive-name: AudioFAQ/part13

Last-modified: 1999/11/19

Version: 2.15

20.0 Miscellaneous

20.1 What do I need to know about warranties?

Warranties have a few basic components. The first is the term of the warranty. The second is what is covered. The third is who supports the warranty. The fourth is what restrictions.

Term is fairly self evident. What is covered is more detailed.

In audio electronics, typically everything is covered with a "parts and labor" warranty. Often mechanical components such as tape heads are covered by different terms, such as shorter terms on labor and longer terms on parts. Likewise, speaker warranties vary widely, from unconditional with no term limit to a basic 30 days parts and labor.

Some warranties come from the manufacturer. Others come from the dealer. Still other warranty support is available with certain premium charge cards.

A common restriction on some warranties is that the equipment is not covered unless it is sold by an authorized dealer. A few dealers have lied about being authorized dealers. Equipment sold by an unauthorized dealer is almost always sold

completely legally. This unauthorized dealer may, in fact, be fully authorized to sell, but not authorized to sell manufacturer's warranties. In buying gear this way, dealers can get it cheaper, and provide the service themselves. This kind of

gear, with a full warranty from the dealer is referred to as gray market equipment. Manufacturers discourage buying from these gray market dealers, but the risks are fairly low. If the dealer is local and well established, the risks are minimal.

If you buy equipment mail-order, a dealer warranty may be a pain in the neck, especially if you have to ship the gear to the dealer more than once to get it fixed correctly. Then again, some factory service requires shipping gear far away at your expense, too.

Frequently, home audio equipment is sold with a warranty restriction that if the gear is used commercially or in any profit-making enterprise, then the warranty is void. This is to

protect the manufacturer from having to frequently repair equipment meant for light service. Professional audio equipment often comes with very liberal warranty terms, such as lifetime parts and labor. Professional gear takes heavy use and severe wear from constant transportation. It is expected to be able to take this abuse.

All gear, electronic and mechanical, is known to have three principal failure modes: abuse, infant failure, and end-of-life failure. In addition, a few of the failures occur at random.

Infant failure (also called juvenile failure) occurs in the first fifty hours of use, and is the principal responsibility of warranties. Infant failure is frequently caused by defective parts or a design defect.

Abuse failure is that caused by a person who pulls a cable too hard, bangs the equipment on the table, pushes the controls too firmly or too fast, or does anything else which the manufacturer did not expect. These are the gray areas of warranties. They do not represent a manufacturing defect in the manufacturer's eyes, but they do leave you with a broken device. To get the best chance of coverage against this kind of failure, select a brand or a dealer with a very liberal warranty policy.

End-of-life failures are rarely covered by warranty. Tape heads have a finite, calculable life, as do rubber rollers, speakers, cables, batteries, bearings, and motors. The life of some of these components can be extended by intelligent care. For example, the life of common rechargeable batteries can be extended by good recharging practice. Likewise, some

cleaners

can dry out rubber, and will lead to premature failure. Don't expect warranty support for any of these problems, and if you get it, feel lucky.

20.2 What is blind testing? Non-blind? Double-blind?

If you want to compare pieces of equipment, recordings, or people, you could run an experiment. You could select an experimenter to initiate various trials, select some subjects to listen to the sounds, and then ask the subjects questions about what they hear. However, if you want meaningful results, it is necessary to set up the experiment correctly, and ask the right questions.

One of the major problems with any experiment is that the subjects may become aware of the experimenter's hypothesis and allow this awareness to influence their behavior. One technique for preventing such bias is to keep the person who conducts the experiment unaware of the hypothesis of the research. Unfortunately, experimenters invariably form SOME hypothesis of what's going on, and these hypotheses affect how they deal with subjects.

A more reasonable solution involves allowing the experimenters

to know the true hypothesis but somehow keeping them ignorant of the specific experimental condition of each subject. This is known as a Partial Blind Experimenter technique. An

example

of this is that the person running an experiment knows that

the

main experimenter wants to determine which connecting cables are best at signal carrying, but would not know which cables are being used at any given time during the experiment.

It is also important for subjects not to become aware of the experimenter's specific hypothesis. Subjects often become highly responsive to any cues, intended or unintended, in the research situation that suggest what they are supposed to do to appear normal or "to make the study come out

right."

This problem can be present in judgment experiments, particularly those in which each subject is exposed to more

than one variation of the stimulus. Such a procedure, by its very nature, increases the probability that the subject will begin to guess which aspects of the experiment are being systematically varied by the experimenter.

Many studies avoid this problem with what is called a Blind Subject technique. Using this approach, subjects are not

specifically what the hypotheses are. Additionally, subjects are not told what specific experimental conditions they are

For example, a subject might be told that he/she is supposed

determine which stereo system sounds better, when in fact the experimenter wishes to examine which color or appearance of

same components looks better to subjects.

When both a Partial Blind Experimenter technique and a Blind Subject technique are used at the same time, this is called a Double Blind experiment. Double Blind experiments have

probability of producing statistically valid results than Partial Blind Experimenter alone, Blind Subject alone, or

techniques. Double Blind experiments are highly recommended.

20.3 Where can I get a service manual or parts for brand XXX?

The most reliable source of supply is the manufacturer's

office in your country. Here is a list of company contacts

may be helpful in the US. (Please send additions & corrections etc. to neidorff@ti.com.

AOC	800-775-1262
Akai Service Center	818-794-8196
AR (now part of NHT; see NHT)	
(AB Tech Services	800-225-9847
Ex AR Employee; Repairs old AR products)	
Cannon	516-933-6300
Casio	201-361-5400
Daewoo	800-782-4922

Emerson Radio	800-388-8333
Sanyo/Fisher	213-605-6756
General Electric	800-447-1700
Goldstar	800-222-6457
Hitachi	800-526-6241
JVC	800-252-5722
Kenwood	213-639-9000
Philips/Mag/Sylvania	615-475-8869
Mitsubishi/Akai	714-220-1464
NAD	508-429-2525
NEC	201-882-9008
NHT	707-747-3331
NHT	800-969-2748
NHT	800-648-9993
Nutone	800-543-8687
Onkyo	201-825-7950
Panasonic/Quasar	215-741-0676
RCA	317-231-4151
Samsung	800-542-1302
Sanyo	800-421-5013
Sharp	800-526-0264
Sony	800-282-2848
Soundesign	800-888-4491
Teac	213-726-0303
Teknica	800-962-1271
Toshiba	201-628-8000
Vandersteen	209-582-0324
Zenith	312-745-5152

Alternately, contact one of the repair parts dealers listed in section 10.15 above. MCM and Parts Express offer free catalogs which can be very helpful for locating parts.

20.4 Where can I get good repairs on brand XXX?

20.5 How can I take 115V gear over to a 230V country or vice versa?

Some equipment is available with an international power supply,

which can be rewired by any serviceman to either power line voltage. If you expect to be moving abroad, look for this kind

of equipment. Often, the same model is available both as US only and as International. Some equipment will be rewirable

and

won't say it. Adcom amps are known to be rewirable.

to

If you rewire equipment from one voltage to another, be sure also change the fuse(s). The correct value is often printed

on

the case or chassis of the equipment. If an amplifier, for example, is rewired from 115V to 230V, the fuse current rating needs to be reduced by 50%.

voltage,

If you know that your gear is limited to one power line

would

you can order a new power transformer for that receiver, CD player, amplifier, or tuner which will be wound differently. Contact the manufacturer's local service center. This can be very expensive. A new transformer for a 40 watt receiver

wholesale for under \$25 but cost \$75 from a service center.

Another alternative is to buy a power transformer that will convert 115V to 230V and vice versa. This is only practical for smaller gear. Larger power amps require prohibitively massive and expensive transformers. Also, the addition of a transformer may hurt the sound quality.

prices.

Here are some common transformer models and 1992 list

voltage

Power ratings are total line current multiplied by line

(2A at 115V is 230 watts). Larger transformers cost more.

Some

of the costlier transformers are constructed with plugs and jacks for immediate use. Those marked * have wire leads and need safe connections to be used.

different

Before spending money, check into other things about audio in the new country. Broadcast frequencies are slightly

bought

in some countries than in others, so a receiver or tuner

in one country may not be able to receive some or all of the stations in another country. The US separates the AM

broadcast

band frequencies by 10kHz while the UK uses 9kHz. Similarly, the US separates FM stations by 200kHz, where the UK has stations on a 50kHz spacing pattern. It MAY be very simple

to

modify a receiver from US to UK spacings, but may not. Last, but not least, some equipment will NOT work well on 50Hz

power.

Also, FM Radio preemphasis is different in North America and Europe. One uses 50us while the other uses 75us. To change receiver deemphasis may require a modification by a technician with special factory information.

Also, power line frequency is 50Hz in some countries and 60Hz in others. Some equipment will overheat if it was engineered for 60Hz operation and run on 50Hz power lines. Some

equipment

uses the power line frequency as a reference for motor speed, such as turntables and tape decks. Check the label first.

Step Down (230V in, 115V Out)

MagneTek/Triad	N1X*	50 Watts	\$11.83
Stancor	P-8620*	50 Watts	\$14.16
MagneTek/Triad	N3M	85 Watts	\$29.95
Stancor	P-8630	85 Watts	\$43.65
MagneTek/Triad	N6U*	200 Watts	\$25.72
Stancor	P-8632	200 Watts	\$51.80
MagneTek/Triad	N5M	250 Watts	\$42.60

Step Up (115V In, 230V Out)

Stancor	P-8637	85 Watts	\$43.10
MagneTek/Triad	N150MG	150 Watts	\$49.46
MagneTek/Triad	N250MG	250 Watts	\$54.69
Stancor	P-8639	300 Watts	\$55.51

The Stancor and MagneTek Triad lines are carried by large electronic distributors.

20.6 Are there really good deals in country XXX?

20.7 How do I find out how much an XXX is worth?

There is a "Blue Book" for used audio equipment called

"Orion Blue Book-Audio". This guide lists both a wholesale and a retail value for most audio gear.

Orion Research Corporation
1315 Main Avenue Suite 230
Durango CO 81301 USA
303-247-8855

<http://www.bluebook.com>

Last I knew a guide costs \$169. Each Nov, a new book is printed.

After June, the old book is discounted. If you need a single quote from the Orion Blue Book, send a polite request to:

al@giclab.scn.rain.com

and you may get a quote back by e-mail.

20.8 Do people really hear those differences?

Who knows? They sure think that they do.

20.9 Why do people disagree on what is the best sound?

There are at least three different measures of what is "Perfect

Sound". All three have advocates, and all three are right, in their own way. In general, whether they admit it or not, most listeners fit into one of these three preference groups:

1. It must sound like live music. These people know

what voices sound like in person, they know what instruments sound like without any amplification, and they have heard orchestras perform unaided by sound systems. They want to accurately reproduce that sound.

2. It must sound like the recording engineer wanted it

to sound. The recording engineer listened with extremely good equipment to the sound coming out of the microphones, and mixed them together for what he, at that time, felt was artistically correct. It may not have been the same as live, but it was exactly what

he

wanted. In the extreme, people like John Fogerty used to audition his final recording mix in his truck to see how it would sound through a common, lousy stereo.

used

see

good

3. It must give me the most pleasure. No matter how or bad live sounds, no matter what the recording engineer intended, if buy some equipment will give me more listening pleasure then it must be the best.

that

music

the

possibilities.

With these three perspectives, it is clear that no one system will satisfy everyone. Add to that confusion the variable

everyone likes a different kind of sound, has heard live under different conditions, and has a different idea of what the engineer intended. There is an enormous range of

things

to

(in

Another set of reasons is that people look for different to be right. Some want strong bass; others want male voices sound like male voices; others want violins to sound like violins. Systems rarely do everything equally well. Speakers (in particular) are compromises. Look for the speaker where the designer had your priority first. You are perfectly right to select speakers based on YOUR personal taste.

would

Confounding the situation further, we all say the greatest things about the stuff we already bought. To do otherwise be to admit that we are either stupid or deaf.

reconstruct

Still another reason is that most people haven't heard enough variations. Until you hear a system that can truly the three-dimensional accuracy of a stereo image accurately,

you

may never realize that it is possible. Some excellent recordings contain enough information that with a good enough system, you can hear up-down, in-out, and left-right distinctions very clearly. However, we will never experience this until we are fortunate enough to hear such a fine

recording

on a very good system.

Finally, some of us really can't hear much difference. We aren't deaf, but we don't have a well trained ear, don't know exactly what to listen for, and may even have slight hearing deficiencies, such as bad sensitivity to high frequencies

which

comes with older age, or hearing damage from listening to

loud

sounds (machinery, rock concerts, etc).

20.10 How do I contact the manufacturer of XXXXX? How do I get repair service on XXXXX? How do I get replacement parts?

Some magazines publish lists of contact phone numbers for the manufacturers of equipment. In the US, Consumer Reports has a small listing in each issue and a more comprehensive listing in their March issue. Also, Audio Magazine has an exhaustive listing in their October "Equipment Directory". In Europe,

look

in "What HiFi?".

You can find many addresses by reading ads in hifi magazines. You can also find out by asking at your friendly local hifi shop, especially if you've built up a relationship with them.

There is a book called the "Electronics Industry Telephone Directory". It comes out yearly and is available in some libraries. Many reps from parts distributors pass them out

for

free. If you want a copy and are willing to pay for it, call Harris Publishing, 800-888-5900 or 216-425-9000.

The directory of the Electronic Industries Association is similarly useful. You can reach the EIA at 202-457-4900.

A good source for parts and service is often the

manufacturer's

repair center. The best way to locate one near you is to look at the literature which came with your equipment when it was new. Failing that, see the ideas mentioned above in 19.10.

COPYRIGHT NOTICE

The information contained here is collectively copyrighted by the authors. The right to reproduce this is hereby given, provided it is copied intact, with the text of sections 1 through 8, inclusive. However, the authors explicitly prohibit selling this document, any of its parts, or any document which contains parts of this document.

--

Bob Neidorff; Texas Instruments		Internet: neidorff@ti.com
50 Phillippe Cote St.		Voice : (US) 603-222-8541
Manchester, NH 03101 USA		

Note: Texas Instruments has openings for Analog and Mixed Signal Design Engineers in Manchester, New Hampshire. If interested, please send resume in confidence to address above.

[Part1](#) - [Part2](#) - [Part3](#) - [Part4](#) - [Part5](#) - [Part6](#) - [Part7](#) - [Part8](#) - [Part9](#) - [Part10](#) - [Part11](#) - [Part12](#) - [Part13](#)



[Current Top-Rated FAQs](#)

[Not finding the answers you need? Submit your question for others to see.](#)

Are you an expert in this area? Share your knowledge and earn expert points by giving answers or rating people's questions and answers! This section of FAQS.ORG is not sanctioned in any way by FAQ authors or maintainers.

Questions strongly related to this FAQ:

- [Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only. reply to...](#) by Tom (7/26/2003)
- [How to get sound when my error is "Error creating DirectSound buffer. Error Code 80070057...."](#) by David (7/26/2003)
- [How does a logarithmic amplification circuit look like? And how do I design one to amplify...](#) by Kathy (8/17/2003)
- [Hi, I've got a fairly old \(1980's\) Sansui amp that's very noisy on startup. The noise is...](#) by Charlie (8/18/2003)

Questions somewhat related to this FAQ:

- [how to record the audio over existing vide-audio track in moviemaker program? example: I...](#) by pedja (8/14/2003)

Other questions awaiting answers:

- [4027 questions](#) related to other FAQs
- [665 general questions](#)
- [1043 answered questions](#)

[[Usenet FAQs](#) | [Search](#) | [Web FAQs](#) | [Documents](#) | [RFC Index](#)]

Send corrections/additions to the FAQ Maintainer:
neidorff@ti.com

Last Update October 03 2003 @ 00:11 AM

Your question will be published for anyone to respond to and rate. Your question will not be displayed immediately. If you'd like to rate the responses or benefit from positive ratings, please create a new account or login into an existing account below. Your question should be complete enough so that it can stand on its own - don't leave out the subject matter. Do not ask for answers via email. FAQS.ORG reserves the right to edit your question as to improve its clarity.

Your name or nickname:	
If you'd like to create a new account or access your existing account, put in your password here:	
Is your question related to this FAQ?	<input type="radio"/> Yes <input type="radio"/> Somewhat <input type="radio"/> No
Your question:	

[Check spelling](#)



...use 8 ohm speakers on 6 ohm amp the equipment is for...

[Internet RFC Index](#)

[Usenet FAQ Index](#)

[Other FAQs](#)

[Documents](#)

Search

► [Search FAQs](#)

[[Home](#) | [FAQ-Related Q&As](#) | [General Q&As](#) | [Answered Questions](#)]

Question by Tom

Submitted on 7/26/2003

Related FAQ: [FAQ: rec.audio.* Retail 2/99 \(part 9 of 13\)](#)

Rating: ★★☆☆

Rate this question:

VOTE

Can I use 8 ohm speakers on 6 ohm amp the equipment is for domestic use only.
reply to twh.hol@ntlworld.com

Your answer will be published for anyone to see and rate. Your answer will not be displayed immediately. If you'd like to get expert points and benefit from positive ratings, please create a new account or login into an existing account below.

Your name or
nickname:

If you'd like to create a new account or access your existing account, put in your password here:

Your answer:

Check spelling

FAQS.ORG reserves the right to edit your answer as to improve its clarity. By submitting your answer you authorize FAQS.ORG to publish your answer on the WWW without any restrictions. You agree to hold harmless and indemnify FAQS.ORG against any claims, costs, or damages resulting from publishing your answer.

FAQS.ORG makes no guarantees as to the accuracy of the posts. Each post is the personal opinion of the poster. These posts are not intended to substitute for medical, tax, legal, investment, accounting, or other professional advice. FAQS.ORG does not endorse any opinion or any product or service mentioned mentioned in these posts.

<< [Back to: FAQ: rec.audio.* Retail 2/99 \(part 9 of 13\)](#)

© 2003 FAQS.ORG. All rights reserved.



Questions and Answers Related to FAQs

[Internet
RFC Index](#)

[Usenet
FAQ Index](#)

[Other
FAQs](#)

[Documents](#)

Search

► [Search
FAQs](#)

[[Home](#) | [FAQ-Related Q&As](#) | [General Q&As](#) | [Answered Questions](#)]

Pages: 1, [2](#), [3](#), [4](#), [5](#), [6](#), [7](#), [8](#), [9](#), [10](#), [11](#), [12](#), [13](#), [14](#), [15](#), [16](#), [17](#), [18](#), [19](#), [20](#)

Give a good answer - get expert points!

Top experts: chimama, Pete, Jenn, John Nowakowski, tiki, yyy, David Cary, squirrel.

Question / Answer	Rating	Date	FAQ link
I have a samoyed/border collie/blue heeler mixed female, (looks like a pure samoyed). On... by lazycane	★★★★★	9/8/03	rec.pets.dogs: Samoyeds Breed-FAQ
► They are, exactly as you suspected, dewclaws. Rear dewclaws are not common on Samoyeds,... by Deb	★★★★★	9/28/03	
When Dependants of F1 visa holder is refused a visa, can the f1 holder petition the Ins? by Nation	★★★★★	9/13/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
How do you get wiring to new ceiling fan from wall switch controlling wall outlet? by Joe	★★★★★	9/9/03	Electrical Wiring FAQ [Part 1/2]
When heating glass in a flame, the flame appears yellow/orange when it is hot enough to... by Ashlie	★★★★★	9/6/03	Sci.chem FAQ - Part 1 of 7

My check engine light comes on periodically in my 2001 chrysler 300m. I have been advised... by Sonya	★★★★★	9/5/03	rec.autos.makers.chrysler FAQ, Part 1/6
Does Kool-Aid still make the flavor root beer? I am desperate to find a noncarbonated... by Jeannee	★★★★★	8/28/03	Kool-Aid FAQ v7.0
My black lab is 9 months old and has not yet gone into heat. What is the typical age for... by Michelle	★★★★★	8/25/03	rec.pets.dogs: Labrador Retrievers Breed-FAQ
Is there a test that can be given like a blood test or what have you to determine if a... by Erica's mom	★★★★★	8/24/03	Bipolar Disorder FAQ v 1.1 (1 of 4)
Why is that some ink markers are water soluble while some are not? What are the components... by chemmy	★★★★★	8/19/03	Sci.chem FAQ - Part 1 of 7
All four of my grandparents were born in Ireland. If I get Irish citizenship, will my... by trish	★★★★★	8/16/03	Irish FAQ: Glossary [10/10]
What are the side effects of testicular sperm extraction? Can it be frozen and howmuch... by Mark	★★★★★	8/15/03	Infertility FAQ (part 1/4)
I just took a serum pregnancy test and my results came back inconclusive. What does this... by Angie	★★★★★	8/14/03	misc.kids FAQ on Pre-Pregnancy and Pregnancy Tests
What breed of dog is Buck? I need photos please by chitwn2112	★★★★★	8/16/03	Married... With Children FAQ [alt.tv.mwc]

How do you unlock doors with a paper clip? by Elle	★★★★★	8/21/03	misc.kids FAQ on Babyproofing - General Ideas
My computer gives message "remote procedure call(rpc) service terminated unexpectedly",... by mike	★★★★★	8/13/03	VIRUS-L/ comp.virus Frequently Asked Questions (FAQ) v2.00
My brother (from Oregon) bought my old car (with expired registration and insurance). He... by Scared&Confused	★★★★★	8/17/03	FAQ: California Driving (and Surviving)
Are there any foods that should be avoided which might null the condition and conversely... by Eliza3930	★★★★★	8/12/03	Rosacea Frequently Asked Questions v1.15
If my dog took a bite out of a toad, will she get sick? by Mitchman	★★★★★	8/13/03	rec.pets.dogs: Canine Medical Information [Part 2/2] FAQ
a small company with 3 departments recently began networking by installing peer-to-peer... by janaki	★★★★★	9/29/03	Client/Server Frequently Asked Questions
Hallo, grüße Sie ich habe soeben ein Kettenmail erhalten, worin versprochen wird, das Sie... by Roswitha Weyrauch	★★★★★	9/18/03	alt.spam FAQ or "Figuring out fake E-Mail & Posts". Rev 20030901 - spamfaq.txt (1/1)

May I change my B2 visa for any other student visa if I am in USA and if I have the I-94... by andrea	★★★★★	8/7/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
What does load, line and slave mean? I have a X-10 dimmer switch that has red(slave),... by jason	★★★★★	8/6/03	Electrical Wiring FAQ [Part 1/2]
what are the pros/cons of pro gun/ gun control? i am doing a report on pro guns & i need... by school person	★★★★★	9/25/03	talk.politics.guns Official Pro-Gun FAQ 1/2
Does anyone know how to get rid of pigmentation without going to a dermatologist? by susie	★★★★★	8/4/03	Psoriasis Newsgroup FAQ v. 2.2
My wife and I are looking for another dog at some local rescues. While looking we ran... by CRF	★★★★★	8/4/03	rec.pets.dogs: Australian Shepherds Breed-FAQ
I really don't have a question. I would rather use this forum for a service. I'm an... by BC Tewari	★★★★★	9/15/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
93 Grand Voyager that stalls in hot weather - help!. Will sail along on the street/freeway... by JRAC	★★★★★	9/25/03	rec.autos.makers.chrysler FAQ, Part 1/6
My dog teddy makes a bark into an err do your dogs do that by hi	★★★★★	9/9/03	rec.pets.dogs: Shih Tzus Breed-FAQ

What is the ozone layer? by Ila	★★★★★	9/3/03	Ozone Depletion FAQ Part I: Introduction to the Ozone Layer
How much do cockapoos range from? by pj	★★★★★	8/23/03	rec.pets.dogs: Cockapoos Mixed-Breed-FAQ
How does an Anti Virus Program recognize the Virus? What is Virus fingerprints? by Aryan	★★★★★	8/23/03	Computer Virus FAQ for New Users
▶ A computer virus is simply a set of computer instructions or computer code that was... by PrashantK	★★★★☆	9/12/03	
My chihuahua has a nippy biting problem... not vicious, just annoying... constant nipping... by Kerry	★★★★★	8/21/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ If she's a puppy, you've got a much better chance of breaking her of this. Both of mine... by chimama	★★★★☆	8/21/03	
What is the acceptable minimum distance between the wall and pool table? by Mike	★★★★★	7/30/03	Pool & Billiards Frequently Asked Questions
Is there a way to create a copper chloride solution? I only need a small amount for a... by cockroach	★★★★★	7/20/03	rec. pyrotechnics FAQ

► Find some copper wire (speaker wire, or other type with multiple thin strands is best).... by Kudos	★★★★★	8/9/03	
Has anyone ever heard of doing knee replacement surgery for dogs? I have a Lab/Dane/Rot... by mrst	★★★★★	7/30/03	rec.pets.dogs: Canine Medical Information [Part 2/2] FAQ
How much are rottweiler dogs? by Rachel	★★★★★	8/17/03	rec.pets.dogs: Rottweilers Breed-FAQ
Help! My dog's toe nails are long . I tried cutting them but she and I both yelp with... by carol	★★★★★	7/23/03	rec.pets.dogs: English Cocker Spaniels Breed-FAQ
► If the nails are bleeding after you cut them, then you cut them too short. Have your vet... by Jenny	★★★★★	8/26/03	
I want to see conan but im scared of him @:() ... by Diego	★★★★★	9/1/03	Conan O'Brien Faq, v.3.1
What does the Queensryche logo mean? And Why is it called "tri-ryche?" by John	★★★★★	7/27/03	MUSIC: Queensryche FAQ
Where can I find information on installing a 220 volt/50 amp circuit breaker to be used... by John Krysinski	★★★★★	7/27/03	Electrical Wiring FAQ [Part 1/2]
Why do I automatically log on when I open hotmail? How can I change it to where I have to... by shadawg1@hotmail.com	★★★★★	7/27/03	Accessing the Internet by E-mail FAQ

I did diagnostic engine codes check. on my 1988 Plymouth Sundance. I got code 21 for... by Roy	★★★★★	7/27/03	rec.autos.makers.chrysler FAQ, Part 1/6
Is second hand smoke addictive? by ohsocool	★★★★★	8/11/03	alt.smokers FAQ (1/2)
How is it transmitted? Is it contagious? by mightycpa	★★★★★	7/25/03	Rosacea Frequently Asked Questions v1.15
Where can I obtain single valent Mumps and Measles vaccines - - thimerosal free - - to... by JT	★★★★★	7/21/03	misc.kids FAQ on Childhood Vaccinations, Part 4/4
Does anybody know the name of the brunette girl (the one who was kissing all over Justin)... by x MiSz DiTz x	★★★★★	7/20/03	alt.supermodels frequently asked questions (FAQ)
Can you tell me all the e-mail address for males named Kenny? by nelle	★★★★★	7/22/03	FAQ: How to find people's E-mail addresses
Where can I find some source code (or algorithms) to downscaling the JPEG at DCT domain? by AOE	★★★★★	9/19/03	JPEG image compression FAQ, part 1/2
▶ Hi there, Well please go though the book on Mark Nelson to get a fair good idea about the... by BeanZ.	N/A	9/21/03	

I have a male, 1 year old, and he is VERY mean to other people..will he grow out of this?... by kim	★★★★★	9/9/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ I don't think fixing will make that much of a difference, although I personally recommend... by Chimama	★★★★★	9/9/03	
▶ I have a male he is very sensitive. But when people come over the only way he will except... by patti	N/A	9/16/03	
I would like to know why and when house wiring in the U.S went from 2 wire duplex outlets... by Larry	★★★★★	7/18/03	Electrical Wiring FAQ [Part 1/2]
How do you stop dogs from digging. Ours loves to dig and actually got lost because he dug... by Diamond	★★★★★	8/27/03	rec.pets.dogs: Labrador Retrievers Breed-FAQ
What are the chemical contents of coffee itself? In other words, after you prepare the... by David	★★★★★	7/17/03	Coffee and Caffeine's Frequently Asked Questions
Where can i find lowilla face soap and who is the manufacturer? by Erin	★★★★★	7/9/03	misc.kids FAQ on Eczema Part 1/2
▶ Lowila soap is manufactured by Westwood-Squibb Pharmaceuticals in Princeton, NJ. It can... by fmpezzolla	★★★★★	7/19/03	
Can i post C++ questions here? by meena	★★★★★	8/3/03	C++ FAQ (part 1 of 10)

Why did the majority of the Australian population of Australia turn against support of the... by bored	★★★★★	7/15/03	soc.history.war.vietnam FAQ: Australian Involvement (1/3)
Do they make the classic sega game "rampart" for for the computer now? by Pyro	★★★★★	7/14/03	rec.games.video.arcade Frequently Asked Questions
In which province exists highest number of ethnic minority by sucker	★★★★★	8/27/03	China - The Internet Travel Guide (FAQ) (part 2/3)
I want to write a program in 8086 assembly language that accepts two floating point... by Rafat	★★★★★	8/24/03	x86 Assembly Language FAQ - General Part 1/3
What kind of sequencer/drum machine do TMBG use? by XedX	★★★★★	7/15/03	FAQs about FAQs
Is there any computer code available to convert a non linear programming problem into a... by krishnan	★★★★★	7/12/03	Nonlinear Programming FAQ
In the post-war occupation of Japan how many allied military personal died due to hostile... by kappy	★★★★★	6/30/03	[soc.history.war.world- war-ii] Frequently Asked Questions
▶ to my knowledge and from what ive gathered on historical sites most post war deaths were... by squirrel	★★★★★	7/10/03	

<p>► I spoke with a retired colonel who had been instrumental in the rebuilding of japan. He... by What</p>	<p>★★★★★</p>	<p>7/12/03</p>	
<p>Evaluate the impact the Vietnam war had on Australia in terms of their international... by MizzT</p>	<p>★★★★★</p>	<p>7/10/03</p>	<p>soc.history. war.vietnam FAQ: Australian Involvement (1/3)</p>
<p>I am a Ji visa holder, in what kind of circumstance, I can be exempted by the 2 years... by JI holder</p>	<p>★★★★★</p>	<p>7/9/03</p>	<p>Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)</p>
<p>What are the role (function) of the following ingredients in chocolate making. Sugar,... by Kums</p>	<p>★★★★★</p>	<p>8/18/03</p>	<p>Chocolate Frequently Asked Questions (FAQ)</p>
<p>Can a tourist get a driver's license? I live in Orlando, FL and I want to know how to get... by JNadia</p>	<p>★★★★★</p>	<p>7/8/03</p>	<p>Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)</p>
<p>Is there any difference between gas at a Shell or Chevron station to the gas at a corner... by r2a2</p>	<p>★★★★★</p>	<p>7/6/03</p>	<p>Gasoline FAQ - Part 4 of 4</p>
<p>Is MYA hair real? by latasha</p>	<p>★★★★★</p>	<p>8/13/03</p>	<p>[alt.fan.lynne-russell] Frequently Asked Questions</p>

What are the golden retrievers habits, history, and origin? by JColive	★★★★★	7/8/03	rec.pets.dogs: Golden Retrievers Breed-FAQ
Where can I find one of those fold and carry chairs that people take to soccer games that... by Cher	★★★★★	9/3/03	Clothing for Big Folks: U. S. (FAQ)
▶ Wal mart and most sporting or department stores carry them. They are everywhere in... by Milo	N/A	9/28/03	
How long does it take for a pup to come old enough to breed? by max	★★★★★	9/6/03	rec.pets.dogs: Jack Russell Terriers Breed-FAQ
▶ 2 years by dog man	N/A	9/26/03	
My longhair dachshund, Rudy, is obsessed with staring at the walls. Every now and then... by Fran	★★★★★	7/2/03	rec.pets.dogs: Behavior: Understanding and Modifying FAQ
my question is can I write to "mail daemon"? I have recived some things sent to me from... by shar	★★★★★	8/22/03	Email Addressing FAQ (How to use user +box@host addresses)
What song is playing in Episode 19 when Carter sits with his dead gramma? by jaicee	★★★★★	8/29/03	ER FAQ 5.00, Section 7: The Music Of "ER" (7/8)
▶ I looked high and low, it is called "the saddest song I've got" by Annie Lennox. I found... by Brie	★★★★★	8/29/03	

► Hey, there if you go to this site you will find loads of songs to do with ER from all the... by Forevercarby	N/A	9/3/03	
What is a 4 conductor 22 guage wire? by Al	★★★★★	7/7/03	Electrical Wiring FAQ [Part 1/2]
If I want to watch certain sites streaming video, it gives me a message that say I don't... by Simon Yoo	★★★★★	8/13/03	comp.mail. mime meta-FAQ: Help for MIME problems
What is the price range for a French Bulldog puppy? by Pat	★★★★★	8/1/03	rec.pets.dogs: French Bulldogs Breed-FAQ
► fifteen hundred dollars by paula	★★★☆☆	8/7/03	
how can i find email addresses in Germany? by achille	★★★★★	8/22/03	FAQ: How to find people's E-mail addresses
Why do they call themselves The Bee Gee's by Lacey	★★★★★	8/10/03	Bee Gees Frequently Asked Questions (FAQ), Part 3/4
My puppy is about 5-6 weeks old. When he is sleeping he "shivers" or shakes somewhat. I... by K-K	★★★★★	7/18/03	rec.pets.dogs: Chihuahuas Breed-FAQ
► He's likely dreaming. Chihuahuas shake for many reasons. They're cold, they're excited,... by chimama	★★★★★	7/22/03	

<p>► CORRECTION !!!!!!!!!!!!!!!! If he DOES NOT STOP when you wake him. Also don't be... by chimama</p>	<p>★★★★☆</p>	<p>7/28/03</p>	
<p>I have a \$10.00 1934 Series A Federal Reserve Note with a C seal on it says Bank of... by vlynn</p>	<p>★★★★☆</p>	<p>8/28/03</p>	<p>Paper Money Collecting FAQ</p>
<p>► Hi..nothing unusal about the motto it was placed on those two type of notes not until the... by Pete</p>	<p>N/A</p>	<p>8/28/03</p>	
<p>Does Stevie have any children?? by Amanda</p>	<p>★★★★☆</p>	<p>7/15/03</p>	<p>rec.music.artists.stevie-nicks FAQ (v 2.5)</p>
<p>What are some network security issues by Ro</p>	<p>★★★★☆</p>	<p>8/5/03</p>	<p>Cryptography FAQ (10/10: References)</p>
<p>How can i find a cheap english bulldog within a month, it is going to be a surprise? by Tai</p>	<p>★★★★☆</p>	<p>7/26/03</p>	<p>rec.pets.dogs:Bulldogs Breed-FAQ</p>
<p>► If you buy it cheap now...its going to cost a whole lot of money down the road!!!! by michelle</p>	<p>★★★☆☆</p>	<p>8/8/03</p>	
<p>What is Bipolar 2 Disorder? by cher</p>	<p>★★★★☆</p>	<p>7/23/03</p>	<p>Bipolar Disorder FAQ v 1.1 (1 of 4)</p>
<p>► WHAT EXACTLY IS BIPOLAR 1 ? by BLUE EYES</p>	<p>★★★☆☆</p>	<p>7/30/03</p>	
<p>► "Bipolar 1" commonly refers to an illness characterized by intense periods of extreme... by yyy</p>	<p>★★★★☆</p>	<p>8/1/03</p>	

▶ bipolar one is diagnosed when a manic episode is experienced, regardless of presence of... by m	★★★★★	8/17/03	
▶ Bipolar 2 is a disease that is hereditary and effects more people than you think. A person... by Bipolar 2 and living	★★★★★	9/15/03	
What, if anything, should I do when my computer tells me I have the Trojan horse?? by LM	★★★★★	8/12/03	Computer Virus FAQ for New Users
▶ i am stuck with trojan i don't know what to use monica_ds@msn.com by monica d sexton	N/A	9/26/03	
▶ LM, I don't understand how your question came to be. A computer, by itself, doesn't know... by Mikey	★★★★★	9/28/03	
How can I embed Images into an standalone perl/Tk executable? Right now the executable... by Steve	★★★★★	8/11/03	comp.lang.perl.tk FAQ part0 of 5
▶ Use the data attribute of the images to get the base64 encoded image data, like this... by Pete Barnett	★★★★★	8/20/03	
▶ Note that the site has managed to strip out all the backslashes from the code; notably... by Pete Barnett	N/A	8/20/03	
I wonder if someone can tell me where I can get some information about the architecture of... by hoang tung ngoc	★★★★★	7/30/03	8051 microcontroller FAQ

how do I open a mim file? by BALLEN	★★★★★	9/7/03	comp.mail. mime meta- FAQ: Help for MIME problems
What is nonlinear cryptography? by antony5	★★★★★	7/7/03	Cryptography FAQ (10/10: References)
I have just had my 3rd miscarriage in the space of 1 year, I have noticed that my... by Emily	★★★★★	8/19/03	misc.kids FAQ on Miscarriage, Part 1/3
▶ i am not sure if this helps at all but they say an average women has 9 miscarriages in her... by karmakrystal	N/A	9/11/03	
Hi, I'm trying to run vim 6.2 under Cygwin 1.3.22. I get an error indicating that... by thermal	★★★★★	7/27/03	vi editor FAQ (Frequently Asked Question List), Part 1/2
My cat is 2 years old and he has a parasite on his ears and under his arms they look... by carol	★★★★★	7/27/03	rec.pets.*: Fleas, Ticks, and Your Pet FAQ
I'm interested in playing the uilleann bagpipes, however I have no idea where to start... by David Albrigh from Columbus Oh	★★★★★	7/31/03	rec.music. makers. bagpipe Frequently Asked Questions (FAQ), Part2/2

Can a pure breed have puppies with a non pure breed then breed with a pure breed like it's... by rotti	★★★★★	8/16/03	rec.pets.dogs: Doberman Breed-FAQ
▶ or if the dog you're breeding it to has a different breed and the other is the same as... by atomicrenegade	N/A	9/5/03	
Does anyone know where I can find the piano score to Mellon Collie and the Infinite... by Bex	★★★★★	8/12/03	Smashing Pumpkins FAQ v4.6, part 1
▶ the moonsongs site. http://www.blamonetwork.com/sp/moonsongs/scores/mcis_jh_1.jpg ... by rowena	N/A	9/21/03	
Is it true that B.J Honicutt and Trapper despised each other in real life by Gibbo	★★★★★	7/21/03	M*A*S*H FAQ
Enya-related artists Twinflame Twinflame is an extremely talented duo who offer an... by Cosmict	★★★★★	7/22/03	Enya-related artists
i have a 1992 chrysler lebaron convertible, i bought it used and i can't figure out how to... by hndrsn6	★★★★★	8/25/03	rec.autos.makers.chrysler FAQ, Part 1/6
▶ Check out www.alldata.com for any recalls concerning the rear windows. I have a '91 and... by Murphy	★★★★★	9/18/03	
I heard that shaving your Chow dog's hair can result in a heat regulating problem. That... by sevin	★★★★★	6/29/03	rec.pets.dogs: Chow Chow Breed-FAQ

▶ I have owned Chows. When I shaved them they developed dry skin and hot spots. I wouldn't... by tiki	★★★★★	7/7/03	
▶ I currently live in Canada, but used to live in Florida. At the time had two Chows. I... by Merlin	★★★★☆	7/19/03	
How can I find the narrated version "original version" to by, because the one I had is no... by Beezyboo21	★★★★★	7/13/03	BLADE RUNNER Frequently Asked Questions (FAQ)
where can i find the lyrics of the Jamie foxx show theme song? by LaShawn	★★★★★	7/26/03	LIST: MOVIE TRIVIA: in-jokes, cameos, signatures
Dear Mr, May I have this faq via my mail, please? by Ngoie guy	★★★★★	8/6/03	Accessing the Internet by E-mail FAQ
▶ Instructions on how to obtain web documents can be found in FAQ http://www.faqs.org/faqs/i... by SZS	N/A	8/28/03	
hi, I'm having problems making audio cd copies with my new cd writer plextor 482448A. The... by newbie	★★★★★	7/23/03	[comp.publish.cdrom] CD-Recordable FAQ, Part 1/4
How do you make sippin syrup? by MattGame	★★★★★	7/20/03	Rap Dictionary (part 2 of 4)
▶ we sipp syrurppp ... 2ozhenny / 1shotsyrum (codiene fiends) by jrokka	★☆☆☆☆	8/2/03	

▶ go to the weed house buy a duece and powe it up in some sprite and then get some styrofoam... by sippin purple sprite remix	★★★★★	8/21/03	
▶ just go hit a up a friend house for some prescription cough syrup. I has codeine in it. ... by howell	★★★★★	8/21/03	
▶ mix up some sprite and liquid morphine, codine, tuss, or any cough syrup that has a kick.... by DJ Screw (RIP)	★★★★★	9/16/03	
my cat died recently and i was with her then. What i want to know is how do animals die?... by fa	★★★★★	9/18/03	rec.pets.cats: Medical Information FAQ
▶ ON September 12, 2001 , My cat "Fosters" had to be put to sleep because I could not afford... by garyc	N/A	9/27/03	
I'm not an aol user but I do use AIM and I was wondering if their is a way that I can look... by jay	★★★★★	7/8/03	alt.aol-sucks FAQ Part 1/3 - Censorship
I'm looking for information (specifications) on the ABI Voyager Elite MALDI-TOF. by MassCharge	★★★★★	7/7/03	Mass Spectrometry Internet Resources FAQ
Where did the name Paris come from??? by chook`	★★★★★	8/5/03	[rec.travel.europe] Paris Transport FAQ
▶ Paris was the son of the king of Troy. He fell in love with Helen and brought her back to... by Spartacus	N/A	9/13/03	

What causes SIDS? by Brandon	★★★★★	9/4/03	Sudden Infant Death Syndrome (SIDS) misc. kids FAQ
▶ it just rapidly happens it is no ones fault! by HANNAH	☆☆☆☆	9/19/03	
I was wondering if certain states have laws about piercing the belly button at certain... by julie	★★★★★	7/1/03	rec.arts. bodyart: Piercing FAQ 9A--Resource List
I have a 3 prong receptacle that supplies power if I plug in a 3 prong plugged appliance... by inquisitor	★★★★★	7/1/03	Electrical Wiring FAQ [Part 1/2]
How to read the instructions from the /proc file system during the execution of the... by dippan	★★★★★	7/1/03	comp.unix.aix Frequently Asked Questions (Part 1 of 5)
How to find someone from 1977, not knowing their 'Married name' or where they are now,... by James York	★★★★★	7/10/03	FAQ: How to find people's E-mail addresses
What is the default TCP port for SSL Connections by mammy	★★★★★	7/3/03	[SSL-Talk List FAQ] Secure Sockets Layer Discussion List FAQ v1.1.1
what is or would be a typical Tibetan monk diet? what veggies? is there milk? goat?... by lee	★★★★★	7/9/03	talk.politics.tibet: FAQ [1/1]

what is the difference between a client/server and a peer-to-peer server? by moggy	★★★★★	9/27/03	Client/Server Frequently Asked Questions
why Australia became involved in the Vietnam conflict. by ravinesh	★★★★★	8/10/03	soc.history.war.vietnam FAQ: Australian Involvement (1/3)
▶ The lure of free beer was what got the Aussies into the game. by Kornholio	★★★★★	9/21/03	
my yorkie just had an emergency csection and both of her pups died. She is having a touch... by Desie Conway	★★★★★	8/16/03	rec.pets.dogs: Yorkshire Terriers Breed-FAQ
my dog is not eating well, is sometimes shaky and has a lot of mucus secreting from her... by fee fee	★★★★★	7/6/03	rec.pets.dogs: Canine Medical Information [Part 2/2] FAQ
can I block with more than one creature? by arkee	★★★★★	7/3/03	Magic: The Gathering Rules FAQ, v3.06 (index)
▶ Yes, you may block a creature with as many of your creatures as you want. Just make sure... by squirrel and mini	★★★★★	7/9/03	
I have a spunky male Dachshund, he is now a year and a half old. I was wondering should I... by annie	★★★★★	7/29/03	rec.pets.dogs: Dachshund Breed-FAQ

► Dachshund are such great little dogs! Do the little guy a favor, though, and do get him... by Lost Feather	N/A	9/10/03	
what causes SIDS? by scoobydoo	★★★★★	8/12/03	Sudden Infant Death Syndrome (SIDS) misc. kids FAQ
how do i find the amount of caffeine in substances? by leanna	★★★★★	9/26/03	Coffee and Caffeine's Frequently Asked Questions
Where was Gilligans Island filmed? by Carmon	★★★★★	9/10/03	Gilligan's Island FAQ: Episode Guide
► Fanning Islands by Gary T.	★★★☆☆	9/24/03	
► nowhere by britto	N/A	9/29/03	
how many puppies can a chi have? and how long can the pregnancy take? / by ray	★★★★★	9/22/03	rec.pets.dogs: Chihuahuas Breed-FAQ
too simple - I know about "gauge" and that a high number means lesser thickness, but... by vanna vechian	★★★★★	7/2/03	rec.arts. bodyart: Welcome & Netiquette FAQ
can i marry a girl who is under 18 years of her age but she is Muslim by raj	★★★★★	8/10/03	Islam FAQ (Part 9/15): Islam: Prophethood, Jesus & Trinity

My wife and I are purchasing an AKC Chihuahua that is being flown (with the present owner)... by Duncan	★★★★★	9/9/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ I would be concerned that a puppy is being sold to you when you have never seen it, and... by Chimama	★★★★★	9/10/03	
▶ Chimama is absolutely right. In additon to what she said, Chihuahuas are also a very... by Kristen	N/A	9/21/03	
▶ Those dogs are so freaking ugly. by Blahbee	N/A	10/2/03	
why do schools exist? what should be taught? what is the role teacher and student? how... by doods	★★★★★	9/17/03	Naming Guidelines For uk.*
My son died of SIDS in April, i laid him on his back and did everything the doctors said... by Stormy	★★★★★	7/15/03	Sudden Infant Death Syndrome (SIDS) misc. kids FAQ
▶ my answer is that you did all that you can do to help your son and obviously god was ready... by lotta	N/A	10/2/03	
What is a \$50.00 dollar bill worth that was printed in 1934? by Ruth	★★★★★	7/8/03	Paper Money Collecting FAQ
▶ Hi..need additional info need serial number and condition of your note like how many folds... by Pete	★★★★★	7/11/03	

▶ i have a couple pennies from 1943-1952. Are they worth anything? they have the old "one..." by John	N/A	8/26/03	
Who sang the song "Somewhere Over the Rainbow in Season 8, Episode Title: On the Beach?" by Alice	★★★★★	7/3/03	ER FAQ 5.00, Section 7: The Music Of "ER" (7/8)
▶ That cover of "Over the Rainbow" was performed by Israel "IZ" Kamakawiwo'ole who sadly... by elmpro	★★★★☆	7/21/03	
▶ Israel Kamamawiwo'ole-Somewhere over the Rainbow... This is Mark's song whe he dies on... by FraN=^..^=	N/A	10/1/03	
I need to translate my birth certificate from Spanish to English but, it has been very... by Laura	★★★★★	7/13/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
▶ Laura, I can be of help to you. I speak both English and Spanish and can translate your... by Princess	N/A	8/7/03	
what is a nonimmigrant visa number? i am currently filling out part 3 on an i-485 and i am... by emma	★★★★★	9/1/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
▶ The control number is the visa number. by Ric	★★★★★	9/10/03	
Could a dog develop an allergy to peanut butter. I have two dogs one is scratching all... by Pat	★★★★★	8/20/03	rec.pets.dogs: Canine Allergies FAQ

► It could be the peanut butter. It's not easy determining the cause of dog allergies,... by Jenny	N/A	8/26/03	
what does protection DO? by tentime	★★★★	7/7/03	Magic: The Gathering Rules FAQ, v3.06 (index)
► As latest rules states , protection (meant to be prot . against SOMETHING) means : a... by Jabbattitude	★★★★	8/14/03	
My dog is 6 years old. I got her from the pound when she was two years old. She is part... by KC	★★★★	7/8/03	rec.pets.dogs: Training Your Dog FAQ
► There are two thing I would suggest one would be to crate train your dog. There is no... by Julie	N/A	8/26/03	
well, its like this, i enjoy things like most people in life but I am not into bugs or... by sam	★★★★	8/3/03	talk.origins Welcome FAQ v.1.11
I am a current owner of a PC running a windows ME operating system. Is this system in any... by MASTER18	★★★★	8/16/03	Computer Virus FAQ for New Users
► some anti virus provider, declare that only windows 2000 ang windows XP which not have... by kadek	N/A	9/18/03	
IS crab meat halal? by Amber	★★★★	8/14/03	Islam FAQ (Part 9/15): Islam: Prophethood, Jesus & Trinity

<p>► Many crabs are able to live on land and under water and this, according to muslim friends... by daisy</p>	N/A	8/29/03	
<p>When my father passed I received his Yacht boy 400. I have enjoyed fiddling with it but it... by Craig</p>	★★★★	7/6/03	Welcome to rec.radio.shortwave (Shortwave)
<p>► This isn't exactly it (this is for the newer model) but its close. http://www.agradio.com... by jdd</p>	N/A	8/9/03	
<p>I have just found a virus on my computer that I cannot find any information about,(verifie... by Tina</p>	★★★★	9/6/03	Computer Virus FAQ for New Users
<p>► I have the same virus and I couldn't find any information on that one...I quarantined the... by amish</p>	N/A	9/8/03	
<p>► I had the same problem It's CWS hijack (cool Web Search) Run Ad Ware 6 *free from the web*... by mary Ellis</p>	N/A	9/22/03	
<p>How can windows media player playback ".m2v" bitstreams? If that is not possible, where... by teo</p>	★★★★	7/22/03	MPEG-FAQ: multimedia compression [0/9]
<p>► You need the appropriate MPEG-2 codec from a 3rd party. Microsoft only provides MPEG-1... by joel_corley</p>	★★★☆☆	9/4/03	
<p>when are new trek comics gonna be published? by ray</p>	★★★★	9/9/03	Star Trek Comics Checklist, Part 1/9

When to exercise? Morning or evening? Before food or after food? When to eat after or... by nathanv	★★★★★	7/28/03	diabetes FAQ: bg monitoring (part 2 of 5)
▶ in the evening by junmar gentuya	★★★★☆	8/20/03	
▶ morning is best time to excercise. It gives you energy for the day.If you excercise at... by chris	N/A	9/23/03	
how do I find a person's e-mail address by Makuena	★★★★★	7/31/03	FAQ: How do spammers get people's email addresses ?
333333 333333 3333333 3333333 3333333 3333333 3333333 3333333 ... by 1111111	★★★★★	10/2/03	alt.spam FAQ or "Figuring out fake E-Mail & Posts". Rev 20030901 - spamfaq.txt (1/1)
My friend has found two newborn kittens behind a warehouse. One has died so it is a hard... by beth	★★★★★	7/1/03	rec.pets.cats: Care of Orphaned Kittens FAQ
▶ go to Wal-Mart to the pet dept. and get kitten formule and a baby bottle should next to... by Tammy	★★★★★	7/5/03	
▶ Any pet store has kitten formula the best is powdered so you only mix as much as you need.... by kathy	★★★★★	8/13/03	
▶ I also have found newborn kittens, as I have in the past. I have found that baby formula... by Sarah	★★★★☆	8/20/03	

▶ hi.....um i have neevr been tot his webstie before but this is kinda an emergency. My... by Samantha	N/A	9/25/03	
actually Julius is the name of my boyfriend, and someone e-mailed him saying all negative... by Cherish	★★★★	7/20/03	FAQ: How to find people's E-mail addresses
please give me details of V1 and v2 visa by mian	★★★★	7/25/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
I own a one year old Louisiana Catahoula leopard dog.He is well mannered and has some... by Jamie	★★★★	7/27/03	rec.pets.dogs: Training Your Dog FAQ
▶ Jamie, knowing very little about your situation I can only speculate on a few things. The... by Julie	★★★☆☆	8/26/03	
▶ i have a Louisiana Catahoula leopard dog, hes 6yr old , he will charge at other dogs if... by boo from ks	N/A	9/29/03	
I am writing to ask about Renshaw's College and the American University of London. Are... by puffin	★★★★	6/27/03	alt.education. distance FAQ (part 4 of 4)
▶ Yes Renshaw's is accredited by the British Association of Open and Distance Learning.... by prof. good	N/A	7/9/03	
why does Rs232 follow the voltage level as follows: 0level from +3V to +25V high level... by ashvini	★★★★	7/17/03	8051 microcontroller FAQ

I am looking at buying a Cavoodle, and as they are a newish breed I was wondering if... by india	★★★★★	8/26/03	rec.pets.dogs: Cavalier King Charles Spaniels Breed-FAQ
▶ No one should ever cross breed dogs the pound is filled with cross breed dogs that need... by Brenda	N/A	9/30/03	
▶ I had a cav-a-poo or a cavoodle as some people call them, and she was such a gorgeous dog.... by Violet	N/A	10/2/03	
where can I buy natto in the east bay? Or in vallejo or vacaville by mondil	★★★★★	8/7/03	rec.food.veg World Guide to Vegetarianism - California1
▶ http://www.maruwa.com/onlineShop/fresh/fresh.html by Michelle	N/A	10/2/03	
what can be done for hip displyaca? my dog is only 1 year old. could it be somethig else? by mary	★★★★★	8/23/03	rec.pets.dogs: Great Danes Breed-FAQ
how much are yearly passes to Disney by tania	★★★★★	7/21/03	Disneyland Paris (Euro Disney) Frequently Asked Questions (FAQ)

What was the first PG-13 movie to come out in July 1984? by Mary	★★★★★	7/1/03	rec.arts.movies.past-films Frequently Asked Questions (FAQ)
▶ red dawn by asswipe	★★★★☆	7/15/03	
▶ Red Dawn was the first motion picture released with the PG-13 rating, which had been... by bayshore	★★★★★	8/18/03	
▶ Wow, you didnt get that entire thing from IMDB or anything.... by Josh Man	N/A	9/11/03	
how to create an exponential summation with c++ programming? by leen	★★★★★	8/20/03	LEARN C/C++ TODAY (A list of resources/tutorials)
how do you make real kosher salami like the kind that was made in the previous world war 2... by sam	★★★★★	8/17/03	Rec.Food. Preserving FAQ (v.7.08) Part1
What do the numbers on a golf ball mean and what does the color (black or red) indicate... by David Denyes	★★★★★	8/14/03	rec.sport.golf Golf FAQ
▶ As far as I know the numbers on the golf ball are there for identity reasons. For example... by Ray	N/A	9/13/03	
▶ The numbers can be there simply for identification, or they can indicate compression... by dkopesh	N/A	9/16/03	

What is the latest Virus reported by Keisha	★★★★★	7/8/03	Computer Virus FAQ for New Users
▶ You should visit the following sites to see what the latest known virus is:http://www.cert... by Qbi	★★★☆☆	8/21/03	
How can I get rid of my big fat thighs? by Paula	★★★★★	7/17/03	Big Folks Exercise and Fitness Resources FAQ
▶ stop eating twinkies by tony	★★★☆☆	9/13/03	
▶ Read this: http://sdsd.essortment.com/ridofcellulite_rmcu.htm very practical and... by JenniBigBum	N/A	9/24/03	
Decaf Chocolate. Can chocolate be decaffeinated? If yes, how is it done? by Caffein Intolerant	★★★★★	7/28/03	Chocolate Frequently Asked Questions (FAQ)
▶ I would also like to know if chocolate can be decaffeinated. And if so, WHERE CAN I BUY... by Devrock	★★★★★	8/27/03	
▶ I would also love to find decaffeinated chocolate. Caffeine gives me migraines, but i LOVE... by GAM	★★★★★	8/27/03	
▶ White chocolate. A straight-edge friend of mine swears by it. As for dark or milk... by jon	☆☆☆☆☆	8/30/03	

<p>► I have not been able to have caffeine or any other stimulants for years. I did always love... by Caffeine and Stimulant Intolerant</p>	N/A	9/28/03	
<p>HEY, i just got a new tattoo on saterday and it is now tuesday..i've noticed that its... by k-dub</p>	★★★★★	7/1/03	rec.arts. bodyart: Tattoo FAQ 6/9--Care of new tattoos
<p>► One thing people are misconcepted about is usage of the "goo" or a&d ointments. Your... by Anna McCleskey</p>	★★★★★	7/26/03	
<p>► I just got my tattoo last a month ago and mine did the same thing.I washed it with mild... by chris</p>	N/A	9/23/03	
<p>i'm desperately in need of an old friends e mail address it's been long i saw her and i... by case</p>	★★★★★	9/11/03	FAQ: How to find people's E-mail addresses
<p>How old can you be to get a tattoo with parent consent? by Dani</p>	★★★★★	7/13/03	rec.arts. bodyart: Tattoo FAQ 6/9--Care of new tattoos
<p>► In the Alabama, the law says that anyone under 18 must have parental permission before... by peersurgurl</p>	★★★★★	7/24/03	
<p>► It varries from state to state.... but most require any one under 18 to have parental... by Anna McCleskey</p>	★★★★★	7/26/03	

▶ Here in Kc you have to be at least 16 with parent present but in places that are not... by KCMisses	★★★★★	8/5/03	
▶ in cali... it sucks you have to be 18.. me and my friends want to get tattoos, but we are... by imBADimREALLYbad	N/A	8/13/03	
▶ I was told 16 with consent due to the fact the kid is still growing and this may distort... by Reebee	N/A	9/13/03	
i need to know that borther louie by modern talking song waz in which movie of Robert De... by Qasim	★★★★★	6/30/03	LIST: MOVIE TRIVIA: in-jokes, cameos, signatures
HOW DO I FIND OUT ABOUT EMERGENCY LEAVE FLIGHTS? by JACQUE	★★★★★	7/29/03	Military Space A Travel FAQ
I'M TRYING TO MAKE IN FILEMAKER A TABLE WHICH INCLUDE NUMBERS IN COLUMNS THAT HAVE TO BE... by NANCY	★★★★★	7/28/03	[FAQ] FileMaker Pro - database for Macintosh and Windows
I have a male chihuahua he is 4 months old.When I let him out to go to the bathroom he... by patti	★★★★★	8/31/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ Sometimes they do that. I know, it's disgusting. Doing a sweep of the area beforehand... by chimama	★★★★☆	9/2/03	
▶ Thanks for sharing this with me. My little Chihuahua shocked the heck out of me when she... by Willa	N/A	9/8/03	

▶ My dog did that too! It made me flaming mad as I do feed her well. After her meal, my dog... by daisy	N/A	9/21/03	
I live in Denver, Colorado. I am looking to adopt a male Rottweiler, 3 years old or... by Shannon	★★★★★	7/4/03	rec.pets.dogs: Rottweilers Breed-FAQ
▶ do not adopt without assistance from an rott expert tx by mtnjkt	N/A	9/4/03	
I NOTICE THAT MY DACHSHUND AS WELL AS MY FRIEND'S MINIATURE DACHSHUND TEND TO LICK ALL THE... by JUDY	★★★★★	8/23/03	rec.pets.dogs: Dachshund Breed-FAQ
▶ Because they want to say hi or I love you by Teddy	★★★★★	9/9/03	
HOW DO YOU KNOW WHEN A DOG IS IN HEAT AND WHEN IS THE CORRECT TIME TO BREED? by BRADY	★★★★★	8/24/03	rec.pets.dogs: Breeding Your Dog FAQ
should manx cats bleed from there anus after having babies? by nat	★★★★★	7/18/03	rec.pets.cats: Manx Breed-FAQ
where can we find works in lebanon for whom they have 16 years old and for the people they... by LAYAL	★★★★★	7/13/03	soc.culture. lebanon FAQ, part 1/5
Can Chis be housebroken. My female is 2 years old and still doesn't get the idea that... by PJ	★★★★★	7/12/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ Have you tried training her to use a litter tray? I'm serious. I live in Minnesota where... by chimama	★★★★★	7/14/03	

▶ I agree with chimama on the tray for them. My chi has her "I'm mad at you messes!" As... by Christy	★ ★ ☆ ☆	8/5/03	
▶ chimama is on the right track. It's best to catch the dog in the act, or better, when... by texmexgirl	N/A	10/1/03	
evaluate the impact on the morale of the australian troops as they hear from home about... by chut	★ ★ ★ ★	8/22/03	soc.history.war.vietnam FAQ: Australian Involvement (1/3)
How can a monogamous person learn to accept the relationships of their polyamorous spouse?... by pana	★ ★ ★ ★	7/10/03	alt.polyamory Frequently Asked Questions (FAQ)
▶ it is hard i won't lie to you but you have to ask him/her to be honest and tell you... by dee	★ ★ ☆ ☆	7/16/03	
▶ Do what your heart tells you to do. Be honest to yourself, then all else will fall into... by JACKBOB	★ ★ ☆ ☆	9/16/03	
▶ The key is even more communication (if that's even possible) than standard or mutually... by springdew	N/A	10/2/03	
Does anyone have any info on this tattoo fade a way system called Tat B gone, says they... by Kevin	★ ★ ★ ★	7/9/03	rec.arts.bodyart: Tattoo FAQ 6/9--Care of new tattoos

▶ http://www.faqs.org/faqs/bodyart/tattoo-faq/part7/section-4.html Check this link! It's... by Suzanne	★★★★★	7/23/03	
▶ But the link and the warning that Suzanne wrote in her answer is an old case... ¿? by JUAN	★★★★★	8/15/03	
▶ I've been using the tat-b-gone product for a month. I'd be more impressed with the... by bryan	★★★★★	9/4/03	
▶ Well, I am 3 months into the treatment, and it seems to be working very well for me. I am... by MB	★★★★★	9/12/03	
▶ Tat b gone does NOT work. Don't waste your money. Go to a tattoo artist and get the... by Nona	N/A	9/12/03	
▶ Checked into that FDA thing. Seemed like someting else and way out of date-12-15 years... by Mary Pat	★★★★★	9/15/03	
▶ I am wanting to try some of the Tat B Gone for some roses that I had put on my shoulder in... by Snowe	N/A	9/15/03	
i was wondering how high it is for this breed to develop bloat? can i help prevent bloat?... by keith colovos	★★★★★	7/7/03	rec.pets.dogs: Great Danes Breed-FAQ
is there anyone out there that can give me a recipe for making the fillo/ or phyllo dough?... by billszoo667@aol.com	★★★★★	7/7/03	soc.culture.bulgaria FAQ (monthly posting) (part 0/10)

I have a bet with my brother that Kelly Bundy said in one episode where she was skydiving... by Cuomo	★★★★	7/8/03	Married... With Children FAQ [alt.tv.mwc]
▶ You are right about her quote, but Bud was skydiving with another girl, not Kelly. by SCJ	N/A	8/31/03	
▶ yes kelly does say that. then bud went skydiving with a girl and after bud jumps out he... by chaos	N/A	9/2/03	
my hedgehog is three months old. we have him for a week and he will not eat his food out... by julie	★★★★	7/3/03	Hedgehog FAQ [1/7] - About the Hedgehog FAQ
how do you get rid of a firewall because it is stopping me from getting onto msn witch all... by jos lester	★★★★	9/2/03	Firewalls FAQ
▶ how do I get red of a firewall? by barbara jewell	N/A	9/30/03	
the importance of computer graphics in visualization by reiy	★★★★	8/11/03	Technical Illustration FAQ (v 1.1.1)
when will a cat go into "heat" by chris	★★★★	8/30/03	rec.pets.cats: Getting A Cat FAQ
WHAT IS THE SHELF LIFE OF GASOLINE? by TONY	★★★★	8/18/03	Gasoline FAQ - Part 4 of 4

how do you deal and control hot spots on golden retrievers during the hot summer months? by hunter	★★★★★	7/19/03	rec.pets.dogs: Canine Medical Information [Part 2/2] FAQ
▶ Give them baths in the early AM, when you know they will dry during the day, don't let... by Rick C.	★★★★☆	8/25/03	
how much are the dogs usually? by Cassandra Baker	★★★★★	7/15/03	rec.pets.dogs: Bichon Frise Breed-FAQ
Is there anything you can do to calm a Jack Russell Terrior down so it does not bark all... by wg	★★★★★	7/6/03	rec.pets.dogs: Jack Russell Terriers Breed-FAQ
▶ Yes you can tell him no barking over and over lol we have a neighbor that he sees... by linda	★★★★☆	8/9/03	
▶ my husband and i went out and purchased a nylon muzzle it sounds horrible to do something... by kitty	★★★★★	8/20/03	
▶ i have the same dog no they dont stop barking, buy him a collar that gives him a small... by sue	N/A	9/20/03	
▶ i will not use a shock collar on my dog lol by ljn_314@yahoo.com	N/A	9/21/03	
how do you make a pit bull mate? by blingy	★★★★★	7/6/03	rec.pets.dogs: American Pit Bull Terriers Breed-FAQ, Part 1/3

what is the role of " pizotifen " in migraine. by muhammad sarwar	★★★★★	7/28/03	Natural Migraine Treatment FAQ
show me a pic of what a boston terror and a boxer would look like? by shelly	★★★★★	8/13/03	rec.pets.dogs: Boston Terriers Breed-FAQ
▶ WE HAVE A FULL BRED BOXER AND ARE THINKING ABOUT GETTING A BOSTON TERRIOR AS COMPANY TO... by CHRISSY	N/A	9/7/03	
TRYING TO FIND E MAIL ADDRESS ON A DETRICK HUDSON, WHO IS CURRENTLY STATIONED OVER SEAS IN... by PEBBLESFLINTSTONE@HOTMAIL.COM	★★★★★	8/20/03	FAQ: How to find people's E-mail addresses
HOW COULD I PROTECT MY COMPUTER FROM VIRUS THREATS by DEEP	★★★★★	9/13/03	Computer Virus FAQ for New Users
▶ install an anti-virus software, and never too late updating the newer virus definitions. ... by kadek	★★★★☆	9/18/03	
where can i find a device called squeezeo. it is used to juice berries for jelly by bobbie chapman	★★★★★	7/8/03	Rec.Food. Preserving FAQ (v.7.08) Part1
▶ These folks have it for sale new - www.homesteadhelpers.com/foodprocess01.htm. There are... by Cyndi M	★★★★★	7/30/03	

looking for my granddaughters e-mail address so i can talk to her by donna	★★★★	7/19/03	FAQ: How to find people's E-mail addresses
what is postmodern drama? by amin azimi	★★★★	7/8/03	Alt. Postmodern FAQ
when i open the file .avi in my windows pc i only hear sound but no video. but that the... by access	★★★★	7/6/03	AVI Graphics Format Overview

Pages: 1, [2](#), [3](#), [4](#), [5](#), [6](#), [7](#), [8](#), [9](#), [10](#), [11](#), [12](#), [13](#), [14](#), [15](#), [16](#), [17](#), [18](#), [19](#), [20](#)

© 2003 FAQS.ORG. All rights reserved.



Answered Questions

[Internet RFC Index](#)

[Usenet FAQ Index](#)

[Other FAQs](#)

[Documents](#)

Search

► [Search FAQs](#)

[[Home](#) | [FAQ-Related Q&As](#) | [General Q&As](#) | [Answered Questions](#)]

Pages: 1, [2](#), [3](#), [4](#), [5](#)

Give a good answer - get expert points!

Top experts: chimama, Pete, Jenn, John Nowakowski, tiki, yyy, David Cary, squirrel.

Question / Answer	Rating	Date	FAQ link
I have a samoyed/border collie/blue heeler mixed female, (looks like a pure samoyed). On... by lazycane	★★★★	9/8/03	rec.pets.dogs: Samoyeds Breed-FAQ
► They are, exactly as you suspected, dewclaws. Rear dewclaws are not common on Samoyeds,... by Deb	★★★★	9/28/03	
How does an Anti Virus Program recognize the Virus? What is Virus fingerprints? by Aryan	★★★★	8/23/03	Computer Virus FAQ for New Users
► A computer virus is simply a set of computer instructions or computer code that was... by PrashantK	★★★★☆	9/12/03	

[My chihuahua has a nippy biting problem... not vicious, just annoying... constant nipping...](#)
by Kerry

★★★★★ 8/21/03

[rec.pets.dogs: Chihuahuas Breed-FAQ](#)

▶ [If she's a puppy, you've got a much better chance of breaking her of this. Both of mine...](#) by chimama

★★★★☆ 8/21/03

[Is there a way to create a copper chloride solution? I only need a small amount for a...](#) by cockroach

★★★★★ 7/20/03

[rec. pyrotechnics FAQ](#)

▶ [Find some copper wire \(speaker wire, or other type with multiple thin strands is best\)....](#) by Kudos

★★★★★ 8/9/03

[Help! My dog's toe nails are long . I tried cutting them but she and I both yelp with...](#) by carol

★★★★★ 7/23/03

[rec.pets.dogs: English Cocker Spaniels Breed-FAQ](#)

▶ [If the nails are bleeding after you cut them, then you cut them too short. Have your vet...](#)
by Jenny

★★★★☆ 8/26/03

[Where can I find some source code \(or algorithms\) to downscaling the JPEG at DCT domain?](#) by AOE

★★★★★ 9/19/03

[JPEG image compression FAQ, part 1/2](#)

▶ [Hi there, Well please go though the book on Mark Nelson to get a fair good idea about the...](#) by BeanZ.

N/A 9/21/03

[I have a male, 1 year old, and he is VERY mean to other people..will he grow out of this?... by kim](#)

★★★★★ 9/9/03

[rec.pets.dogs: Chihuahuas Breed-FAQ](#)

▶ [I don't think fixing will make that much of a difference, although I personally recommend... by Chimama](#)

★★★★★ 9/9/03

▶ [I have a male he is very sensitive. But when people come over the only way he will except... by patti](#)

N/A 9/16/03

[Where can i find lowilla face soap and who is the manufacturer? by Erin](#)

★★★★★ 7/9/03

[misc.kids FAQ on Eczema Part 1/2](#)

▶ [Lowila soap is manufactured by Westwood-Squibb Pharmaceuticals in Princeton, NJ. It can... by fmpezzolla](#)

★★★★★ 7/19/03

[In the post-war occupation of Japan how many allied military personal died due to hostile... by kappy](#)

★★★★★ 6/30/03

[\[soc.history. war.world- war- ii\] Frequently Asked Questions](#)

▶ [to my knowledge and from what ive gathered on historical sites most post war deaths were... by squirrel](#)

★★★★★ 7/10/03

▶ [I spoke with a retired colonel who had been instrumental in the rebuilding of japan. He... by What](#)

★★★★★ 7/12/03

[Where can I find one of those fold and carry chairs that people take to soccer games that...](#) by Cher



9/3/03

[Clothing for Big Folks: U.S. \(FAQ\)](#)



[Wal mart and most sporting or department stores carry them. They are everywhere in...](#) by Milo

N/A

9/28/03

[How long does it take for a pup to come old enough to breed?](#) by max



9/6/03

[rec.pets.dogs: Jack Russell Terriers Breed-FAQ](#)



[2 years](#) by dog man

N/A

9/26/03

[What song is playing in Episode 19 when Carter sits with his dead grandma?](#) by jaicee



8/29/03

[ER FAQ 5.00, Section 7: The Music Of "ER" \(7/8\)](#)



[I looked high and low, it is called "the saddest song I've got" by Annie Lennox. I found...](#) by Brie



8/29/03



[Hey, there if you go to this site you will find loads of songs to do with ER from all the...](#) by Forevercarby

N/A

9/3/03

[What is the price range for a French Bulldog puppy?](#) by Pat



8/1/03

[rec.pets.dogs: French Bulldogs Breed-FAQ](#)



[fifteen hundred dollars](#) by paula



8/7/03

[My puppy is about 5-6 weeks old. When he is sleeping he "shivers" or shakes somewhat. I...](#) by K-K



7/18/03

[rec.pets.dogs: Chihuahuas Breed-FAQ](#)

► [He's likely dreaming. Chihuahuas shake for many reasons. They're cold, they're excited,...](#) by chimama



7/22/03

► [CORRECTION !!!!!!!!!!!!!!! If he DOES NOT STOP when you wake him. Also don't be...](#) by chimama



7/28/03

[I have a \\$10.00 1934 Series A Federal Reserve Note with a C seal on it says Bank of...](#) by vlynn



8/28/03

[Paper Money Collecting FAQ](#)

► [Hi..nothing unusual about the motto it was placed on those two type of notes not until the...](#) by Pete

N/A

8/28/03

[How can i find a cheap english bulldog within a month, it is going to be a surprise?](#) by Tai



7/26/03

[rec.pets.dogs: Bulldogs Breed-FAQ](#)

► [If you buy it cheap now... its going to cost a whole lot of money down the road!!!!](#) by michelle



8/8/03

[What is Bipolar 2 Disorder?](#) by cher






7/23/03

[Bipolar Disorder FAQ v 1.1 \(1 of 4\)](#)

► [WHAT EXACTLY IS BIPOLAR 1 ?](#) by BLUE EYES




7/30/03

- ▶ ["Bipolar 1" commonly refers to an illness characterized by intense periods of extreme...](#) by yyy  8/1/03
- ▶ [bipolar one is diagnosed when a manic episode is experienced, regardless of presence of...](#) by m  8/17/03
- ▶ [Bipolar 2 is a disease that is hereditary and effects more people than you think. A person...](#) by Bipolar 2 and living  9/15/03

[What, if anything, should I do when my computer tells me I have the Trojan horse??](#) by LM

 8/12/03


[Computer Virus FAQ for New Users](#)

- ▶ [i am stuck with trojan i don't know what to use monica_ds@msn.com](#) by monica d sexton N/A 9/26/03
- ▶ [LM, I don't understand how your question came to be. A computer, by itself, doesn't know...](#) by Mikey  9/28/03

[How can I embed Images into an standalone perl/Tk executable? Right now the executable...](#) by Steve

 8/11/03

[comp.lang.perl.tk FAQ part0 of 5](#)

- ▶ [Use the data attribute of the images to get the base64 encoded image data, like this...](#) by Pete Barnett  8/20/03
- ▶ [Note that the site has managed to strip out all the backslashes from the code; notably...](#) by Pete Barnett N/A 8/20/03

[I have just had my 3rd miscarriage in the space of 1 year, I have noticed that my...](#)
by Emily



8/19/03

[misc.kids FAQ on Miscarriage, Part 1/3](#)

▶ [i am not sure if this helps at all but they say an average women has 9 miscarriages in her...](#) by karmakrystal

N/A

9/11/03

[Can a pure breed have puppies with a non pure breed then breed with a pure breed like it's...](#) by rotti



8/16/03

[rec.pets.dogs: Doberman Breed-FAQ](#)

▶ [or if the dog you're breeding it to has a different breed and the other is the same as...](#) by atomicrenegade

N/A

9/5/03

[Does anyone know where I can find the piano score to Mellon Collie and the Infinite...](#) by Bex



8/12/03

[Smashing Pumpkins FAQ v4.6, part 1](#)

▶ [the moonsongs site. http://www.blamonetwork.com/sp/moonsongs/scores/mcis_jh_1.jpg ...](#) by rowena

N/A

9/21/03

[i have a 1992 chrysler lebaron convertible, i bought it used and i can't figure out how to...](#) by hndrsn6



8/25/03

[rec.autos.makers.chrysler FAQ, Part 1/6](#)

▶ [Check out www.alldata.com for any recalls concerning the rear windows. I have a '91 and...](#) by Murphy



9/18/03

[I heard that shaving your Chow dog's hair can result in a heat regulating problem. That...](#) by sevin



6/29/03

[rec.pets.dogs: Chow Chow Breed-FAQ](#)

► [I have owned Chows. When I shaved them they developed dry skin and hot spots. I wouldn't...](#) by tiki



7/7/03

► [I currently live in Canada, but used to live in Florida. At the time had two Chows. I...](#) by Merlin



7/19/03

[Dear Mr, May I have this faq via my mail, please?](#) by Ngoie guy



8/6/03

[Accessing the Internet by E-mail FAQ](#)

► [Instructions on how to obtain web documents can be found in FAQ http://www.faqs.org/faqs/i...](#) by szs

N/A

8/28/03

[How do you make sippin syrup?](#) by MattGame



7/20/03

[Rap Dictionary \(part 2 of 4\)](#)

► [we sipp syrurppp ... 2ozhenny / 1shotsyrum \(codiene fiends\)](#) by jrokka



8/2/03

► [go to the weed house buy a duece and powe it up in some sprite and then get some styrofoam...](#) by sippin purple sprite remix



8/21/03

► [just go hit a up a friend house for some prescription cough syrup. I has codeine in it. ...](#) by howell



8/21/03

► [mix up some sprite and liquid morphine, codine, tuss, or any cough syrup that has a kick....](#) by DJ Screw (RIP) ★★★★★ 9/16/03

[my cat died recently and i was with her then. What i want to know is how do animals die?...](#) by fa ★★★★★ 9/18/03

[rec.pets.cats: Medical Information FAQ](#)

► [ON September 12, 2001 , My cat "Fosters" had to be put to sleep because I could not afford...](#) by garyc N/A 9/27/03

[Where did the name Paris come from???](#) by chook` ★★★★★ 8/5/03

[\[rec.travel.europe\] Paris Transport FAQ](#)

► [Paris was the son of the king of Troy. He fell in love with Helen and brought her back to...](#) by Spartacus N/A 9/13/03

[What causes SIDS?](#) by Brandon ★★★★★ 9/4/03

[Sudden Infant Death Syndrome \(SIDS\) misc. kids FAQ](#)

► [it just rapidly happens it is no ones fault!](#) by HANNAH ☆☆☆☆☆ 9/19/03

[why Australia became involved in the Vietnam conflict.](#) by ravinesh ★★★★★ 8/10/03

[soc.history.war.vietnam FAQ: Australian Involvement \(1/3\)](#)

► [The lure of free beer was what got the Aussies into the game.](#) by Kornholio ★★★★★ 9/21/03

can I block with more than one creature? by arkee	★★★★★	7/3/03	Magic: The Gathering Rules FAQ, v3.06 (index)
▶ Yes, you may block a creature with as many of your creatures as you want. Just make sure... by squirrel and mini	★★★★★	7/9/03	
I have a spunky male Dachshund, he is now a year and a half old. I was wondering should I... by annie	★★★★★	7/29/03	rec.pets.dogs: Dachshund Breed-FAQ
▶ Dachshund are such great little dogs! Do the little guy a favor, though, and do get him... by Lost Feather	N/A	9/10/03	
what does y Enc mean & why cant i download jpeg'with this in the header by zeitsev	★★★★★	8/3/03	General
▶ Putting it simply, yENC is a way of compressing posts on Usenet so that they require less... by John Nowakowski	★★★★★	8/4/03	
Where was Gilligans Island filmed? by Carmon	★★★★★	9/10/03	Gilligan's Island FAQ: Episode Guide
▶ Fanning Islands by Gary T.	★★★☆☆	9/24/03	
▶ nowhere by britto	N/A	9/29/03	
what is a motet and what are its characteristics? by clint	★★★★★	9/12/03	General

► [Good question. The development of the motet as a musical form follows the early developme...](#) by John Nowakowski

★★★★★ 9/24/03

[My wife and I are purchasing an AKC Chihuahua that is being flown \(with the present owner\)...](#) by Duncan

★★★★★ 9/9/03

[rec.pets.dogs: Chihuahuas Breed-FAQ](#)

► [I would be concerned that a puppy is being sold to you when you have never seen it, and...](#) by Chimama

★★★★★ 9/10/03

► [Chimama is absolutely right. In additon to what she said, Chihuahuas are also a very...](#) by Kristen

N/A 9/21/03

► [Those dogs are so freaking ugly.](#) by Blahbee

N/A 10/2/03

[My son died of SIDS in April, i laid him on his back and did everything the doctors said...](#) by Stormy

★★★★★ 7/15/03

[Sudden Infant Death Syndrome \(SIDS\) misc. kids FAQ](#)

► [my answer is that you did all that you can do to help your son and obviously god was ready...](#) by lotta

N/A 10/2/03

[What is a \\$50.00 dollar bill worth that was printed in 1934?](#) by Ruth

★★★★★ 7/8/03

[Paper Money Collecting FAQ](#)

► [Hi..need additional info need serial number and condition of your note like how many folds...](#) by Pete

★★★★★ 7/11/03

<p>▶ i have a couple pennies from 1943-1952. Are they worth anything? they have the old "one..." by John</p>	N/A	8/26/03	
<p>Who sang the song "Somewhere Over the Rainbow in Season 8, Episode Title: On the Beach?" by Alice</p>	★★★★★	7/3/03	ER FAQ 5.00, Section 7: The Music Of "ER" (7/8)
<p>▶ That cover of "Over the Rainbow" was performed by Israel "IZ" Kamakawiwo'ole who sadly... by elmpro</p>	★★★★☆	7/21/03	
<p>▶ Israel Kamamawiwo'ole-Somewhere over the Rainbow... This is Mark's song whe he dies on... by FraN=^..^=</p>	N/A	10/1/03	
<p>I need to translate my birth certificate from Spanish to English but, it has been very... by Laura</p>	★★★★★	7/13/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
<p>▶ Laura, I can be of help to you. I speak both English and Spanish and can translate your... by Princess</p>	N/A	8/7/03	
<p>what is a nonimmigrant visa number? i am currently filling out part 3 on an i-485 and i am... by emma</p>	★★★★★	9/1/03	Immigration (USA) FAQ: H visa questions and answers (part 3 of 6)
<p>▶ The control number is the visa number. by Ric</p>	★★★★★	9/10/03	

[Could a dog develop an allergy to peanut butter. I have two dogs one is scratching all...](#) by Pat



8/20/03

[rec.pets.dogs: Canine Allergies FAQ](#)

► [It could be the peanut butter. It's not easy determining the cause of dog allergies,...](#) by Jenny

N/A

8/26/03

[what does protection DO?](#) by tentime



7/7/03

[Magic: The Gathering Rules FAQ, v3.06 \(index\)](#)

► [As latest rules states , protection \(meant to be prot . against SOMETHING \) means : a...](#) by Jabbattitude



8/14/03

[My dog is 6 years old. I got her from the pound when she was two years old. She is part...](#) by KC



7/8/03

[rec.pets.dogs: Training Your Dog FAQ](#)

► [There are two thing I would suggest one would be to crate train your dog. There is no...](#) by Julie

N/A

8/26/03

[I am a current owner of a PC running a windows ME operating system. Is this system in any...](#) by MASTER18



8/16/03

[Computer Virus FAQ for New Users](#)

► [some anti virus provider, declare that only windows 2000 ang windows XP which not have...](#) by kadek

N/A

9/18/03

IS crab meat halal? by Amber	★★★★★	8/14/03	Islam FAQ (Part 9/15): Islam: Prophethood, Jesus & Trinity
▶ Many crabs are able to live on land and under water and this, according to muslim friends... by daisy	N/A	8/29/03	
When my father passed I received his Yacht boy 400. I have enjoyed fiddling with it but it... by Craig	★★★★★	7/6/03	Welcome to rec.radio. shortwave (Shortwave)
▶ This isn't exactly it (this is for the newer model) but its close. http://www.agradio.com... by jdd	N/A	8/9/03	
I have just found a virus on my computer that I cannot find any information about,(verifie... by Tina	★★★★★	9/6/03	Computer Virus FAQ for New Users
▶ I have the same virus and I couldn't find any information on that one...I quarantined the... by amish	N/A	9/8/03	
▶ I had the same problem It's CWS hijack (cool Web Search) Run Ad Ware 6 *free from the web*... by mary Ellis	N/A	9/22/03	
How can windows media player playback ".m2v" bitstreams? If that is not possible, where... by teo	★★★★★	7/22/03	MPEG-FAQ: multimedia compression [0/9]

▶ [You need the appropriate MPEG-2 codec from a 3rd party. Microsoft only provides MPEG-1...](#) by joel_corley

★☆☆☆☆ 9/4/03

[When to exercise? Morning or evening? Before food or after food? When to eat after or...](#) by nathanv

★★★★★ 7/28/03

[diabetes FAQ: bg monitoring \(part 2 of 5\)](#)

▶ [in the evening](#) by junmar gentuya

★★★★☆ 8/20/03

▶ [morning is best time to excercise. It gives you energy for the day.If you excercise at...](#) by chris

N/A 9/23/03

[My friend has found two newborn kittens behind a warehouse. One has died so it is a hard...](#) by beth

★★★★★ 7/1/03

[rec.pets.cats: Care of Orphaned Kittens FAQ](#)

▶ [go to Wal-Mart to the pet dept. and get kitten formule and a baby bottle should next to...](#) by Tammy

★★★★★ 7/5/03

▶ [Any pet store has kitten formula the best is powdered so you only mix as much as you need....](#) by kathy

★★★★★ 8/13/03

▶ [I also have found newborn kittens, as I have in the past. I have found that baby formula...](#) by Sarah

★★★★☆ 8/20/03

▶ [hi.....um i have neevr been tot his webstie before but this is kinda an emergency. My...](#) by Samantha

N/A 9/25/03

[I own a one year old Louisiana Catahoula leopard dog.He is well mannered and has some...](#)
by Jamie



7/27/03

[rec.pets.dogs: Training Your Dog FAQ](#)

▶ [Jamie, knowing very little about your situation I can only speculate on a few things.](#)
[The...](#) by Julie



8/26/03

▶ [i have a Louisiana Catahoula leopard dog, hes 6yr old , he will charge at other dogs if...](#) by boo from ks

N/A

9/29/03

[I am writing to ask about Renshaw's College and the American University of London.](#)
[Are...](#) by puffin



6/27/03

[alt.education. distance FAQ \(part 4 of 4\)](#)

▶ [Yes Renshaw's is accredited by the British Association of Open and Distance Learning....](#) by prof. good

N/A

7/9/03

[I am looking at buying a Cavoodle, and as they are a newish breed I was wondering if...](#) by india



8/26/03

[rec.pets.dogs: Cavalier King Charles Spaniels Breed-FAQ](#)

▶ [No one should ever cross breed dogs the pound is filled with cross breed dogs that need...](#) by Brenda

N/A

9/30/03

▶ [I had a cav-a-poo or a cavoodle as some people call them, and she was such a gorgeous dog....](#) by Violet

N/A

10/2/03

[where can I buy natto in the east bay? Or in vallejo or vacaville](#) by mondil

★★★★ 8/7/03

[rec.food.veg World Guide to Vegetarianism - California1](#)

▶ <http://www.maruwa.com/online/fresh/fresh.html> by Michelle

N/A 10/2/03

[What was Freddie Krueger's mothers name?](#) by Ton

★★★★ 8/29/03 [General](#)

▶ [its Amanda](#) by kim

☆☆☆☆ 9/2/03

▶ [her name was Hilary](#) by fastbrowndog

N/A 9/24/03

[do you have any pictures of the real Hannibal Lecter?](#) by cz21allstar

★★★★ 8/3/03 [General](#)

▶ [no i wish](#) by Clarice Starling

N/A 9/29/03

[What was the first PG-13 movie to come out in July 1984?](#) by Mary

★★★★ 7/1/03

[rec.arts.movies.past-films](#)
[Frequently Asked Questions \(FAQ\)](#)

▶ [red dawn](#) by asswipe

★★★★☆ 7/15/03

▶ [Red Dawn was the first motion picture released with the PG-13 rating, which had been...](#) by bayshore

★★★★ 8/18/03

▶ [Wow, you didnt get that entire thing from IMDB or anything....](#) by Josh Man

N/A 9/11/03

[What do the numbers on a golf ball mean and what does the color \(black or red\) indicate...](#)



8/14/03

[rec.sport.golf
Golf FAQ](#)

by David Denyes

▶ [As far as I know the numbers on the golf ball are there for identity reasons. For example...](#) by Ray

N/A

9/13/03

▶ [The numbers can be there simply for identification, or they can indicate compression...](#) by dkopesh

N/A

9/16/03

[What is the latest Virus reported](#) by Keisha



7/8/03

[Computer
Virus FAQ for
New Users](#)

▶ [You should visit the following sites to see what the latest known virus is:http://www.cert...](#) by Qbi



8/21/03

[How can I get rid of my big fat thighs?](#) by Paula



7/17/03

[Big Folks
Exercise and
Fitness
Resources
FAQ](#)

▶ [stop eating twinkies](#) by tony



9/13/03

▶ [Read this: http://sdsd.essortment.com/ridofcellulite_rmcu.htm very practical and...](#) by JenniBigBum

N/A


9/24/03


[Decaf Chocolate. Can chocolate be decaffeinated? If yes, how is it done?](#) by Caffein Intolerant




7/28/03

[Chocolate
Frequently
Asked
Questions
\(FAQ\)](#)

▶ [I would also like to know if chocolate can be decaffeinated. And if so, WHERE CAN I BUY...](#) by Devrock  8/27/03

▶ [I would also love to find decaffeinated chocolate. Caffeine gives me migraines, but i LOVE...](#) by GAM  8/27/03


▶ [White chocolate. A straight-edge friend of mine swears by it. As for dark or milk...](#) by jon  8/30/03

▶ [I have not been able to have caffeine or any other stimulants for years. I did always love...](#) by Caffeine and Stimulant Intolerant N/A 9/28/03

[HEY, i just got a new tattoo on saterday and it is now tuesday.. i've noticed that its...](#) by k-dub

 7/1/03

[rec.arts.
bodyart:
Tattoo FAQ
6/9--Care of
new tattoos](#)

▶ [One thing people are misconcepted about is usage of the "goo" or a&d ointments. Your...](#) by Anna McCleskey  7/26/03

▶ [I just got my tattoo last a month ago and mine did the same thing.I washed it with mild...](#) by chris N/A 9/23/03

[How old can you be to get a tattoo with parent consent?](#) by Dani

 7/13/03

[rec.arts.
bodyart:
Tattoo FAQ
6/9--Care of
new tattoos](#)

▶ [In the Alabama, the law says that anyone under 18 must have parental permission before...](#) by peersurgurl

★★★★☆ 7/24/03

▶ [It varries from state to state....but most require any one under 18 to have parental...](#) by Anna McCleskey

★★★★☆ 7/26/03

▶ [Here in Kc you have to be at least 16 with parent present but in places that are not...](#) by KCMisses

★★★★☆ 8/5/03

▶ [in cali... it sucks you have to be 18.. me and my friends want to get tattoos, but we are...](#) by imBADimREALLYbad

N/A 8/13/03

▶ [I was told 16 with consent due to the fact the kid is still growing and this may distort...](#) by Reebee

N/A 9/13/03

[I have a male chihuahua he is 4 months old.When I let him out to go to the bathroom he...](#) by patti

★★★★☆ 8/31/03

[rec.pets.dogs: Chihuahuas Breed-FAQ](#)


▶ [Sometimes they do that. I know, it's disgusting. Doing a sweep of the area beforehand...](#) by chimama

★★★★☆ 9/2/03

▶ [Thanks for sharing this with me. My little Chihuahua shocked the heck out of me when she...](#) by Willa

N/A 9/8/03



▶ My dog did that too! It made me flaming mad as I do feed her well. After her meal, my dog... by daisy	N/A	9/21/03	
I live in Denver, Colorado. I am looking to adopt a male Rottweiler, 3 years old or... by Shannon	★★★★★	7/4/03	rec.pets.dogs: Rottweilers Breed-FAQ
▶ do not adopt without assistance from an rott expert tx by mtnjkt	N/A	9/4/03	
I NOTICE THAT MY DACHSHUND AS WELL AS MY FRIEND'S MINIATURE DACHSHUND TEND TO LICK ALL THE... by JUDY	★★★★★	8/23/03	rec.pets.dogs: Dachshund Breed-FAQ
▶ Because they want to say hi or I love you by Teddy	★★★★★	9/9/03	
Is there life on Saturn by Unin	★★★★★	7/28/03	General
▶ id say no t but i like to think yes by mack	★★★★★	10/1/03	
▶ i'dlove to live on another planet at least there would be no grief humans are unpredictabl... by reema	N/A	10/3/03	
Can Chis be housebroken. My female is 2 years old and still doesn't get the idea that... by PJ	★★★★★	7/12/03	rec.pets.dogs: Chihuahuas Breed-FAQ
▶ Have you tried training her to use a litter tray? I'm serious. I live in Minnesota where... by chimama	★★★★★	7/14/03	

- ▶ [I agree with chimama on the tray for them. My chi has her "I'm mad at you messes!" As...](#) by Christy  8/5/03
- ▶ [chimama is on the right track. It's best to catch the dog in the act, or better, when...](#) by texmexgirl N/A 10/1/03

[How can a monogamous person learn to accept the relationships of their polyamorous spouse?...](#) by pana

 7/10/03

[alt.polyamory
Frequently
Asked
Questions
\(FAQ\)](#)

- ▶ [it is hard i won't lie to you but you have to ask him/her to be honest and tell you...](#) by dee  7/16/03
- ▶ [Do what your heart tells you to do. Be honest to yourself, then all else will fall into...](#) by JACKBOB  9/16/03
- ▶ [The key is even more communication \(if that's even possible\) than standard or mutually...](#) by springdew N/A 10/2/03

[I hear there is a Charmed Soundtrack coming out and i'vebeen trying to find out when. ...](#) by eastcoastbob

 9/10/03

[General](#)

- ▶ [Its coming out september 23..whenever u want to find out when a particular DVD or CD is...](#) by Kristen N/A 9/21/03
- ▶ [I need to get the Sound track.](#) by Bre N/A 9/22/03

▶ [Hey there. The Soundtrack came out today. It's fantastic. I got mine this morning.](#) by Alice N/A 9/23/03

[Does anyone have any info on this tattoo fade a way system called Tat B gone, says they...](#) by Kevin

★★★★★ 7/9/03

[rec.arts.
bodyart:
Tattoo FAQ
6/9--Care of
new tattoos](#)

▶ <http://www.faqs.org/faqs/bodyart/tattoo-faq/part7/section-4.html> Check this link! It's... by Suzanne

★★★★★ 7/23/03

