***Homework Problems 8***

1. Why is it better to get random numbers from the Random class than to get them from the famous book, *10,000 Random Numbers Arranged in Ascending Order*?
2. Give a statement that displays a random integer between 10 and 100 (inclusive). Assume r is a reference to a Random object.
3. Suppose s1 and s2 point to String objects. Give the statement that displays ASCENDING if the s2 strings follows the s1 string lexicographically.
4. Write a statement that reads in one double value using kb, where kb is a reference variable to a Scanner object.
5. Give the statement that converts the string "1.23456" to a double value and assigns the result to a double variable.
6. Compile the program in C8h6.java to confirm it compiles correctly. Remove the import statement and re-compile. What happens? Now compile without the import statement but use the fully-qualified name for Random (java.util.Random) in the program. What happens?
7. What is displayed by the program below? Run it to check your answer.

class C8h7

{

public static void main(String[] args)

{

String s1, s2, s3, s4;

s1 = "hello";

s2 = "hello";

if (s1 == s2)

System.out.println("s1 == s2");

s3 = new String("hello");

s4 = new String("hello");

if (s3 == s4)

System.out.println("s3 == s4");

}

}

From this example, can you conclude that the construction of the strings that occurs as a result of

s1 = "hello";

s2 = "hello";

is the exactly the same as the construction of strings that occurs as a result of

s3 = new String("hello"):

s4 = new String("hello")

1. What are the possible values assigned to x by

x = (r.nextInt(5) + r.nextInt(5))/2;

where x is type int and r is a reference to a Random object. Write a program that executes the statement above 1,000,000 times and counts the number of times each integer between 0 and 4 (inclusive) is assigned to x. Your program should display the final counts. Use a switch statement (see homework program 7 in Chapter 4). Based on your results, does it appear that 0, 1, 2, 3, and 4 are equally likely?

1. Same as homework problem 8 but for the following statement:

x = (int)(5.0 \* r.nextGaussian());

1. The following code demonstrates the auto-boxing and unboxing between Integer and int:

Integer i;

int j;

i = 5; // 5 is auto-boxed in an Integer object

j = i; // int in i is auto-unboxed and assigned to j

But does auto-boxing and unboxing work between Object and int? Is the following code legal:

Object obj;

int j;

obj = 5; // is 5 auto-boxed?

obj = new Integer(5);

j = obj; // is the integer in the obj object auto-unboxed?

Run a test program to check your answer.

1. Write a program that reads in a string from the keyboard, and then determines and displays the number of occurrences of vowels (a, A, e, E, i, I, o, O, u, and U).
2. Write a program that displays hello repeatedly as long as the user enters 0 after each display. Entering any non-zero integer terminates the program. Sample session:

hello

enter non-zero integer to stop

0

hello

enter non-zero integer to stop

0

hello

enter non-zero integer to stop

1 program terminates at this point

This program naturally calls for a loop with the following structure:

display "hello"

prompt for number

read number

if number is not zero, exit loop.

Notice the loop has a **trailing exit test** (i.e., the exit test is at the bottom of the loop). Because the while loop has a leading exit test, implement the loop you need for this problem using a do-while loop (it has a trailing exit test). Its form is

do

*statement*

while (*true/false expression*);

where the embedded statement can be either a simple statement or a compound statement (i.e., a sequence of statements enclosed with braces). The exit occurs at the bottom of the loop if the true/false expression is false.

1. If a variable is declared within a do-while loop, does its scope (i.e., where it can be used) extend to the true/false expression. For example, is the following loop legal:

do

{

int i = 1;

System.out.println(i);  
 i++;

} while (i <= 5);

Run a test program to check your answer.

1. Write a program that reads in an integer by executing the nextInt method in a Scanner object. What happens if you enter a non-integer rather than an integer when nextInt executes? Try entering "hello", 3.5 and 3.0. What happens if you enter an integer that is too big, such as 999999999999999?
2. Write a program that displays 30 random integers between 10 and 15 inclusive.
3. Write a program that prompts for and reads in a double number and then determines and displays its square root. Your program should do this repeatedly until the user enters a negative number. Use Math.sqrt to compute square roots. Use the class name C8h16 for your program. The output your program creates should look like that in the following sample session:

Enter double

9.0

Square root of 9.0 = 3.0

Enter double

100.0

Square root of 100.0 = 10.0

Enter double

-3.0 program terminates at this point

After you have tested your program, create a file named C8h16.txt with a text editor. The file should contain the data 9.0, 100.0, and -3.0 (do *not* include the commas). Then run your program by entering

java C8h16 < C8h16.txt

The angle bracket here **redirects** input so that it is from the specified file rather than the keyboard.

1. What happens if you pass a negative number to Math.sqrt? Run a test program to find out.
2. Write a program than prompts for and reads in the radius of a circle and then displays its area. Use the constant Math.PI in the Math class for π.
3. Is the following a legal statement:

i = r1 + r2;

where i is an int variable and r1 and r2 are Integer reference variables that point to Integer objects? Run a test program to check your answer.

1. Write a program in which main passes f references to two Integer objects. f should return the sum of the two integers in the Integer objects. Its return type should be int. main should display the value returned by f.
2. Write a program that prompts the user for an integer. Your program should read in the integer and display POSITIVE, NEGATIVE, or ZERO, according to the value of the number. The output your program creates should look like that in the following sample session:

Enter integer

3

3 is positive program terminates at this point

1. Suppose two packages java.a and java.b each have an XXX class. If you want to use both XXX classes in your program, how would you do it? Would you use import statements?
2. Do the wrapper classes have constructors with no parameters. For example, is the following code legal:

Integer i = new Integer();

Run a test program to check your answer.

1. Can a String object be concatenated to a StringBuffer object. For example, if sb points to a Stringbuffer object, is the following statement legal:

System.out.println(sb + "xyz");

Run a test program to check your answer.

1. Can a StringBuffer object be cast to a String. For example, if s and sb have type String and StringBuffer, respectively, is the following statement legal:

s = (String)sb;

Run a test program to check your answer.

1. Write a program that prompts for an integer, reads in an integer with nextInt, prompts for a string and reads in a string with nextLine, in that order. Your program should then display the integer and the string on separate lines, in that order. *Hint*: When your program reads in the integer, it consumes only the integer, not the end-of-line marker at the end of the current input line. If nextLine is then executed, it returns the empty string terminated by the end-of-line marker. It does not read in the next line.
2. Write a program that displays the current time and date. Use the Date class. Consult a Java class reference to determine how to use Date.
3. Incorporate the following code in a program and execute:

System.out.println(Integer.toBinaryString(257));

It displays 257 in binary. Do you now see why the following code assigns 1 to b?

int i = 257;

byte b = (byte)i;

1. Suppose r1 and r2 have type Integer. Do r1 and r2 point to the same object if the following statements are executed?

r1 = 5;

r2 = 5;

Do r1 and r2 point to the same object if the following statements are executed?

r1 = new Integer(10);

r2 = new Integer(10);

Run a test program to check your answers.

1. Write a Graph class that has methods countIt and graphIt. countIt should use five counters (c0, c1, c2, c3, and c4) to count the number of 0’s, 1’s, 2’s, 3’s, and 4’s it is passed. Use a switch statement to determine which counter to increment (see homework problem 7 in Chapter 4). graphIt should display the final counts in the form of a bar graph, with one bar for each count. Each bar should consist of a horizontal line of consecutive asterisks. If the largest count is greater than 50, scale the size of the bars so that the largest bar has 50 asterisks.   
     
   Write a program that uses your Graph class. It should generate 1,000,000 random integers all of which are 0, 1, 2, 3, or 4. For each integer, your program should call countIt in a Graph object. After all the integers have been counted, your program should call graphIt.
2. Write a program that estimates the probability of getting three heads when three coins are tossed. Let 0 represent tails, 1 heads. Simulate the tossing of a coin by generating a random integer equal to 0 or 1. To toss three coins, generate three random integers. A sum of 3 indicates three heads has occurred. Toss three coins 1,000,000 times. Determine the fraction of times the outcome is three heads. This fraction approximates the theoretical probability of getting three heads when tossing three coins.
3. Write a program in which you read a line from the keyboard, and then display the line with its characters reversed. Display both the original and the reversed strings.
4. Write a program that reads in two strings from a single line entered from the keyboard. Use the next method in the Scanner class. Convert the strings to type int using Integer.parseInt. Add the two values and display the sum. Enter 20 30 when your run the program.
5. Write a program that prompts for and reads in an integer number, displays hello that number of times, and then terminates. Sample session:

Enter integer

2

hello

hello

1. Same as homework problem 34 except that the program should repeat after displaying hello the requested number of times. The program should stop only when the user enters a non-positive integer. Sample session:

Enter integer

2

hello

hello

Enter integer

1

hello

Enter integer

0 program terminates at this point

1. Write a program that plays the game Nim with the user of the program. The program and the user alternate turns, picking up one, two, or three straws on each turn. The program goes first. The player to pick up the last straw loses. Your program should start by generating and displaying a random integer (which represents the number of straws) between 10 and 20 inclusive. If this number is 1 more than a multiple of 4, add 1. For example, if the random integer is 20, then start with 20 straws. But if the random integer is 17 (which is 1 more than a multiple of 4), start with 18. On a user’s turn, your program should prompt for, read in, and process the user’s input (which should 1, 2, or 3—the number of straws to pick up). On the program’s turn, it should determine its move by generating a random number between 1 and 3. At the end of each game, your program should display

Do you want to play another game?

It should then read in the user’s yes/no response, and proceed accordingly. Use a do-while loop to control the repetition of games (see homework problems 12 and 13). If either a user’s move or the program's move is greater than the number of straws, then all the remaining straws should be picked up, resulting in a loss. For example, if there are 2 straws left, and the user's move is 3, the remaining 2 straws should be picked up, causing the user to lose.

1. Same as homework problem 36 with this change in the program’s strategy. If the number of straws is 1 more than a multiple of 4, it should pick up 1 straw. Otherwise, it should pick up the number of straws that leaves 1 more than a multiple of 4. For example, if the number of straws is 12, 11, or 10, your program should pick up 3, 2, or 1, respectively, leaving 9 straws (which is 1 more than 2×4).
2. Write a program that simulates the dropping of a one-inch needle on a paper that has two horizontal lines two inches apart. The lower part of the needle can land anywhere between the two lines. The angle of the needle with respect to the horizontal lines can be any value between 0 and π (which is the radian equivalent of 180 degrees). Your program should simulate the dropping of the needle 1,000,000 times. It should count how many drops resulted in the needle touching or crossing the top horizontal line. It should then divide this count *into* the number of drops and display the result. Does the result displayed by your program approximate some well-know constant?
3. What does the next method in the Scanner class return each time it is called if the input is

bye, goodbye , all done

Now try this experiment: Before calling next, execute

kb.delimiter(",");

where kb is the reference to the Scanner object. For the same keyboard input, what does next return? Repeat your experiment, but execute before calling next

kb.delimiter("");

1. Write a program that reads in a string and displays the number e's in the string. Test with the word "Tennessee".
2. Write a program that reads in a string and displays all its characters except the vowels a, e, i, o, and u. Test your

program with the word "international".

1. Write a program that reads in a string and an integer. Your program should display the character in the string whose index is given by the integer entered. Test by entering the string "This is a test" and 8.
2. Write a program that reads in a string and displays True if any two adjacent characters are the same, and False otherwise. Test by entering "hello". Test also with "characters".
3. Write a program that generates a string of 10,000 numbers, either 0 or 1 randomly generated. Your program should determine the largest run of consecutive 1’s and the largest run of consecutive 0’s. Display the number of 1’s in the largest run of 1’s and the number of 0’s in the largest run of 0’s.
4. Write a program that generates a random integer between 1 and 100. Use

number = r.nextInt(100) + 1;

where r is a Random object. Then execute a loop up to six times. Each time through the loop, prompt the user to enter a guess for the number. If the user guesses the number, immediately break out of the loop and display "You Win". Otherwise display either "Your Guess is too high" or "Your guess is too low". If the users does not guess the number after six tries, your loop terminates. In that case, display "You lose".

1. What is displayed when the following program is executed:

class C8h46

{

public static void main(String[] args)

{

String s = "A\nB";

int i = 0;

while (i < s.length())

{

System.out.print(s.charAt(i));

i++;

}

}

}

Modify the program so that with the given string (i.e., do *not* modify the s string) it displays the following four characters:

A\nB

*Hint*: In the loop, check if the current character is the newline. If it is, display the two characters \ and n instead of the new line character.

1. Write a program that reads in a string from the keyboard. Your program should display the string with each group of three characters on a separate line. For example, if the input string is

AB DEFG

Then your program should display

AB

DEF

G