C under Linux: Exercise 1

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Introduction

Problem 1 Write a c program to display "Hello World" as the output.

Problem 2 Write a c program to print the following using a single printf statement.

```
1   2   3   4   5
6   7   8   9   10
```

Types, Operators, and Expressions

Problem 3 Declare three-integer variables, **nNum1** and **nNum2**, **nProduct**. Assign nNum1 and nNum2 with values 1200 and 56 respectively. Multiply the values of nNum1 and nNum2 and store it in **nProduct** and finally display the result.

Problem 4 Write a c program to convert given number of days to a measure of year, weeks and days. For example, 375 days is equal to 1 year 1 week and 3 days (ignore leap year).

Problem 5 Write a c program, which accepts the radius of the circle and displays the area and circumference of the circle. *(Hint: Area of the circle = Pi * Radius * Radius, Circumference of the circle = 2 * Pi * Radius. Pi = 3.1415)*

Problem 6 Write a c program that prompts for and reads an elapsed time in the format **hh:mm:ss**, and then computes the elapsed time in seconds and output it.
Try your program on the following time:

- 2:5:10
- 5:30:4
- 10:4:30

Problem 7 Write a c program that prompts for and accepts a telephone number in the form **ddd-ddd-dddd**, where d is a digit, and prints it out in the following format: **(ddd) ddd-dddd**.

Problem 8 A c program contains the following declarations and initial assignments:

```
int i = 8, j = 5, k;
float x = 0.005, y = -0.01, z;
char a, b, c = 'c', d = 'd';
```

Determine the value of each of the following assignment expression. Use the values originally assigned for each expression. Evaluate the following manually and then validate your answer by writing a code.

1. $k = (i + j)$
2. $z = -x$

3. $i = j$
4. $k = (x + y)$
5. $k = c$
6. $z = i/j$
7. $a = b = d$
8. $i = j = 1.1$
9. $z = k = x$
10. $k = z = x$
11. $(i\&\&!j)||d$
12. $(i\& \sim j)|d$
13. $i+ = 2$
14. $y- = x$
15. $x* = 2$
16. $i/ = j$
17. $i\% = j$
18. $i+ = (j - 2)$
19. $k = (j == 5)?i : j$
20. $k = (j > 5)i : j$
21. $z = (x >= 0)?x : 0$
22. $z = (y >= 0)?y : 0$
23. $a = (c < d)?c : d$
24. $i- = (j > 0)?j : 0$

problem 9 Write a c program, which accepts two integer values in variable **nNum1** and **nNum2**, add them and store the value in an integer variable **nRes** and finally display result. (Similarly try for subtract, multiply, divide and modulus).

Problem 10 Write a c program, which accepts three integer values and display the highest of the three.

Problem 11 Write a c program, which accepts a character in lowercase, and displays the same character in uppercase. If the entered character in not an alphabet, display an appropriate message.

Problem 12 A c program contains the following declarations and initial assignments:

```
int i = 8, j = 5;
float x = 0.005, y = -0.01;
char c = 'c', d = 'd'
```

Determine the value of each of the following expressions. Use the value initially assigned to the variables for each expression. Evaluate the following manually and then validate your answer by writing code.

1. $(3 * i–2 * j)\%(2 * d–c)$
2. $2 * ((i/5) + (4 * (j–3))\%(i + j–2))$
3. $(i–3 * j)\%(c + 2 * d)/(x - y)$
4. $–(i + j)$
5. $+ + i$
6. $i + +$

7. $--j$
8. $++x$
9. $y--$
10. $i <= j$
11. $c > d$
12. $x >= 0$
13. $x < y$
14. $j! = 6$
15. $c == 99$
16. $5 * (I + j) > `c'$
17. $(2 * x + y) == 0$
18. $2 * x + y == 0$
19. $!(i <= j)$
20. $!(c == 99)$
21. $!(x > 0) * (i > 0)\&\&(j < 5)$
22. $(i > 0)\&\&(j < 5)$
23. $(i > 0)\&\&(j < 5)$
24. $(x > y)\&\&(i > 0)!!(j < 5)$
25. $(x > y)\&\&(i > 0)$

Problem 13 Write a c program, which accepts a temperature in Fahrenheit and displays the centigrade degree equivalent. $C = (5/9) * (F - 32)$;

Problem 14 Write a c program, which accepts a year and display a message stating the year is a leap year or not. Hint: To be a leap year, the year must be divisible by 4 and not divisible by 100. Also, if a year is divisible by 100 and by 400, the year is a leap year.

Problem 15 Write a c program that prompts for and reads a floating-point value. The program prints the whole part on one line and the decimal part on a second line. For example, if the program was given the input 23.45, it would output:
23
0.45

Problem 16 Write a c program that allows the user to enter an integer value and then generates the multiplication table. Format it into 10 columns and 20 lines. Interaction of the program should look like:

```
Enter a Number: 5
5 10 15 20 25 30 35 40 45 50
55 60 65 70 75 80 85 90 95 100
...(up to 20 lines).
```

Problem 17 Write a c program, which accepts a character in a variable and displays a message stating whether the character is a vowel, consonant, number or a special symbol.
Vowel a, e, i, o, u (Both cases)
Consonant Any alphabet which is not a Vowel
Digit 0 to 9
Special Symbol Any Character which is not in the above list

Problem 18 What will be the output of the following code:

```
#include <stdio.h>
int main(void){
    printf("%d", printf("Hello"));
    return 0;
}
```

Problem 19 Suppose that **a** is an unsigned integer whose value is (hexadecimal) 0xa2c3. Write the corresponding bit pattern for this value. Then evaluate each of the following bitwise expressions, first showing the resulting bit pattern and then the equivalent hexadecimal value. Utilize the original value of a in each expression. Assume that **a** is stored in a **16-bit word**.

1. $\sim a$
2. $a\&0x3f06$
3. $a \wedge 0x3f06$
4. $a|0x3f06$
5. $a\& \sim 0x3f06$
6. $a \wedge \sim 0x3f06$
7. $a| \sim 0x3f06$
8. $a >> 3$
9. $a << 3$
10. $a\& \sim a$
11. $a \wedge \sim a$
12. $a| \sim a$
13. $a\& \sim 0x3f06 << 8$
14. $(a\& \sim 0x3f06) << 8$
15. $a\& \sim (0x3f06 << 8)$
16. $a \wedge \sim 0x3f06 << 8$
17. $(a \wedge \sim 0x3f06) << 8$
18. $a \wedge \sim (0x3f06 << 8)$
19. $a| \sim 0x3f06 << 8$
20. $(a| \sim 0x3f06) << 8$
21. $a| \sim (0x3f06 << 8)$

Problem 20 Assume that we have an integer variable with a hexadecimal value 0x3456. Using the bit operator's store 0x5634 to another variable using the previous variable.

Control Flow

Problem 21 Write a c program that accepts an integer value and displays whether it is even or odd number.

Problem 22 Write a c program to find the roots of a quadratic equation. Quadratic Equation is : $ax^2 + bx + c = 0$ The formulae to compute x is:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Problem 23 Write a program, which accepts a string and displays the number of vowel, consonant, digit and special symbol within the string.

Problem 24 Write a program to display the ASCII characters in the screen. The program should halt after displaying 10 characters until the user presses a key.

Problem 25 Write a program, which accepts a string and displays each character in a new line.

Problem 26 Write a program, which accepts a positive integer number and displays the number of digits.

Problem 27 Write a program, which accepts a positive integer number and displays the sum of digits.

Problem 28 Write a program to display the following:

*****
****
***
**
*

Problem 29 Write a program, which accepts a string and displays the length of the string.

Problem 30 Write a program, which accepts a number in binary form (combination of 0's and 1's) in an integer variable and displays the decimal equivalents. Note: The entered number should not be greater than 5 digits.

Problem 31 Write a program, which accepts a number and checks whether the number is prime number of not. Note: A prime number is a number, which is divisible only by one and itself.

Problem 32 Write a program, which displays the following output:

1
121
12321
1234321
123454321

Problem 33 Write a program to generate the Fibonacci numbers up to a given number. (The Fibonacci numbers form an interesting sequence in which each number is equal to the sum of the previous two numbers). In other words, Fi = Fi-1 + Fi-2

Problem 34 Write a program to calculate the factorial of a given number.

Problem 35 Write a program, which accepts an integer value and displays the equivalent binary number, using bit operator.

Array

Problem 36 Write a program that accepts 10-integer number in an array, and displays the sum of the numbers.

Problem 37 Write a program, that accepts a string and checks whether the entered string is a palindrome or not. A palindrome is a word, phrase or sentence that reads the same way either forward or backward. For example, words such as noon, peep and madam are palindromes.

Problem 38 Write a program that accepts 10 integer values and displays the highest and the lowest number.

Problem 39 Write a program to accept a series of number and count the number of positive and negative values.

Problem 40 Write a program to illustrate how user authentication is made before allowing the user to access the secured resources. The program should ask for the user name and then the password. The password that the user enters will not be displayed, instead that character is replaced by '*'.

Problem 41 Program to check whether the given elements in an array is sorted or not. If the elements are sorted in ascending order or descending order, print suitable messages accordingly. Otherwise, print "Array is not sorted".

Problem 42 Write a program to accept 10 numbers in an array and find the sum of negative, positive numbers and the average of all numbers. Also finds the elements above and below the average.

Problem 43 Write a program, which accepts a matrix of 3 rows and 3 columns and checks whether the entered matrix is an identity matrix or not. Note: An identity matrix is the one whose diagonal elements are 1 and other elements are 0.

Structure

Problem 44 Declare a structure Book, with elements name, pages and price. Write a program to accept data in the structure variable and finally display the data.

Problem 45 Declare a structure with elements of type character array capable of storing 20 characters, and an integer variable. Write a program to display the size of the structure.

Problem 46 Declare a structure Date, which will store three integer quantity dd, mm and yy. Declare one more structure Person, with elements Name of type character array, Date of Birth of type **struct Date**, Address of type character array. Write the main() function to test the structure.

Problem 47 Store Students name and birth-date within a structure. Use bit-fields for the birth-date.

Union

Problem 48 Write a c program to evaluate $y = x \text{ ^} n$. The value of x can be an integer value or a float value. Hint: Use union to store either an int or a float

Problem 49 Find the representation of a float number say 10.65, using union in hexadecimal format.

Function

Problem 50 Assume i is an integer variable with an initial value of 10. Determine the value of each of the following expressions. Use the value initially assigned to the variables for each expression. Evaluate the following manually and then validate your answer by writing code. (a) printf(“(b) printf(“(c) printf(“(d) printf(“(e) printf(“(f) printf(“(g) printf(“

Problem 51 What is the output of the following code:

```
#include<stdio.h>

void swap(); /* blank parentheses in function declaration
denotes that there can be any number of parameters, to be
specified when defining the function
*/

int main(void){
    int ni = 10;
    int nj = 20;
    printf("\nBefore Calling swap function:\n");
    printf("i = %d,\t j = %d", ni, nj);
    swap(ni, nj);
    printf("\nAfter Calling swap function:\n");
```

```
    printf("i = %d,\t j = %d", ni, nj);
    return(0);
}

void swap(int na, int nb){
    int temp;
    temp = na;
    na = nb;
    nb = temp;
}
```

Problem 52 Write a function 'Product()' which accepts a float and an integer value and returns the product of the two. Write the main() function to test the code.

Problem 53 Write a function, to return the factorial of a given number using recursion.

Problem 54 Write a program to generate the following series:
1 + 1 / 1! + 2 / 2! + ... + n / n!.
! denotes factorial.
Use function to calculate function.

Problem 55 Write a function that prints the following:

```
/*****************************************************
*       This is a neat comment put in a box         *
*                                                   *
*****************************************************/
```

Problem 56 Declare a global variable of type int in a C source file and write a function declaration Display() in a header file and the definition of this function in another C source file, which will display the value of the global variable declared in the C source file. Write the main() function in another C source file to test the code. Note: In total 3 files are required, 1 header file, 1 source file containing the Display() function definition and another C source file containing the main() function.

Problem 57 What will be the output of the following code:

```
#include<stdio.h>
void Display(){
    static int i = 0;
    i +=10;
    printf("\nValue of i is %d", i);
}

int main(void){
    Display();
    Display();
    Display();
    return(0);
}
```

Evaluate the following manually and then validate your answer by writing the code.

Problem 58 What type of error will occur in the following code:

```
#include<stdio.h>
void Display();
```

```
int main(void){
    Display();
    return 0;
}
```

Evaluate the following manually and then validate your answer by writing the code

Problem 59 In a program, x, y and z have values 1.1, 2.2 and 3.3 respectively. The statement PRN3(x,y,z); should cause the line: x has a value 1.1 y has a value 2.2 and z has a value 3.3 to be printed. Write the macro definition for PRN3().

Problem 60 What will be output of the following code:

```
#include <stdio.h>

int i = 100;
int main(void){
    int i = 50;
    printf(\Value of i is %d", i);
    return 0;
}
```

Problem 61 What will be the output:

```
#include <stdio.h>
int main(void){
    printf(\Never Ending ???");
    main();
    return(0);
}
```

Problem 62 Write a program, to accept five numbers and display the average of the five numbers. Note: Array is not to be used.

Problem 63 Write a c program to demonstrate the use of the conditional inclusion #if

Problem 64 Write a program, which accepts an integer value from the user. If the number entered is the combination of 0's and 1's display a message "In Binary Form", else display "Not In Binary form".

Problem 65 Write a program to find the sum of each row and each column in a matrix. Also, sum of all elements of a matrix.

Pointer

Problem 66 Write a program, which declares an integer variable with an initial value of 10 and a pointer to an integer, assign the pointer to the address of the integer variable and display the value of the integer variable with the help of the pointer.

Problem 67 Write a program to demonstrate the use of realloc function by declaring a character pointer variable, allocate 5 bytes of memory to it using the malloc function. Display the address of the first element of the block. Now use the realloc function to allocate 20 bytes of memory, and display the address of the first element of the block.

Problem 68 What will be the output of the following code:

```
#include<stdio.h>
int main (void){
    char*p = "World";
    char c;
    c = ++*p++;
    printf("\n%c", c);
    printf("%c", *p);
    return(0);
}
```

Problem 69 What will be the output of the following code:

```
#include<stdio.h>
int main(void){
    int* p = (int*) 500;
    *p = 20;
    printf(\%d", *p);
    return(0);
}
```

Problem 70 What will be the output of the following code:

```
#include<stdio.h>
int main(void){
    int nArr[] = {1,2,3,4,5};
    int* p = &nArr[0];
    int* q = &nArr[4];

    printf("%d", (q-p));
    return(0);
}
```

Problem 71 Write your own version of strlen function.

Problem 72 Write your own version of strcpy function.

Problem 73 Write your own version of strncpy function.

Problem 74 Write a function that counts the number of occurrences of a character within a given string.

Problem 75 Write a function that will accept a string and an integer value. Depending on the integer value, the function should change the case of the string. Assume that, if 1 is passed as the second argument, the string should be converted to uppercase, else the string should be converted to lowercase.

Problem 76 Write a program that will store a specified number of elements of type int. The number of elements to be stored is to be provided by the user.

Problem 77 Write a function that will delete every occurrence of a char within a given string.

Problem 78 Write a function, which will accept two char arrays. The function should reverse the characters in the first character array and store it in the second character array.

Problem 79 Write a function, which will accept a string, a start position and count as parameters. The function should return the characters starting from the start position. The number of characters to be extracted will be specified in the count parameter. If the count parameter is negative, the string should be extracted in the right to left direction. **Example:**

```
Mid(\Park", 2, 2) should return \ar"
Mid(\Park", 4, -4) should return \kraP"
```

Mid is the function name.

Problem 80 A program contains the following declarations and initial assignments:

```
char* p[2][3]={\abc", \defg", \hi", \jklmno",\pqrstuvw",\xyz"};
```

Determine the value of each of the following assignment expression. Use the values originally assigned for each expression. Evaluate the following manually and then validate your answer by writing a code.

Expression	Equivalent Expression	Value
**p		
**p[1]		
**(p[1]+2)		
((p+1)+1)[7]		
(*(*(p+1)+1))[7]		
*(p[1][2] + 2)		

Problem 81 Write a function, which will accept two variables of integer type and will interchange the values in the variable.

Problem 82 Declare a character array with initial value of 'Tafila', write a program to generate the following output: Tafila
afila
fila
ila
la
a

Problem 83 What will be the output of the following code:

```
#include<stdio.h>
#include<malloc.h>
#include<string.h>

char* pC = (char*) malloc(6 * sizeof(char));

void Assign(){
    strcpy(pC, \Hello");
}

int main(void){
    int nCount;
    Assign();
    printf(\String is :%s", pC);
    free(pC);
    return(0);
}
```

Problem 84 Write a program to accept values in a 1-D array of N elements & split it into 2 halves. Use pointers to store the elements. The program should work as:

```
Enter 10 elements:
1
```

```
2
3
4
5
6
7
8
9
10

First Half:
1   2   3   4   5
Second Half
6   7   8   9   10
```

Problem 85 Write a function for sorting the elements in an integer array. Write the main() function to test the sort function.

Problem 86 Write a program, which accepts a matrix of specified number of columns and fixed no of rows. (Assume that the number of rows is 3.)

Problem 87 Write a program, which accepts a matrix of specified number of rows and 3 columns.

Problem 88 Write a program, which will accept a row size from the user and then will accept the column size for each row. Declare a pointer-to-pointer variable and then allocate memory for this and then accept data within the allocated memory. Finally display the value in a matrix form. The array created may have different column sizes for each row. This type of array is called Gagged array. Note: Usage of array should not be made. There will be only one pointer-to-pointer variable and some counter variables for the loop.
The program execution should be as:

```
Enter Row Size: 3
Enter Column Size of Row 1: 1
Enter Column Size of Row 2: 2
Enter Column Size of Row 3: 3
Enter Elements for Row 1:
1
Enter Elements for Row 2:
2
3
Enter Elements for Row 3:
4
5
6
Values Entered are:
1
2   3
4   5   6
```

Problem 89 Write a function, which will allocate memory depending on the size of string entered by the user. Hint: Write a user defined function. Within this function, create an array of size 100 bytes, store a string value within this array, depending on the size of the string, allocate memory, copy the string in the new memory location and then return the address of the new memory block.

Problem 90 Write a program with functions Sum, Subtract and Process. The Process function should take 2 integer values and a function name (either Sum or Subtract) as parameter and call the function. Write the main function to test the Process function.

Problem 91 Which line will generate error and why:

```
#include<stdio.h>
int main(void){
    int i = 100;                /*Line 1*/
    const int* p = &i;          /*Line 2*/
    p++;                        /*Line 3*/
    (*p)++;                     /*Line 4*/
    return(0);                  /*Line 5*/
}
```

Problem 92 Write a program, which accepts 3 integer values, indicating month, day and year, and then display the corresponding day of the week. For example, suppose we were to enter date 08 23 2002; this would produce the output Friday, August 23, 2002.

Problem 93 Write a program to demonstrate matrix multiplication. For a matrix to multiply, first check whether the number of columns of the first matrix is same as the number of rows of the second matrix or not. If they are not equal, the matrix cannot be multiplied. The formula to multiply is:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} * \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} = \begin{bmatrix} 1a+2d+3g & 1b+2e+3h & 1c+2f+3i \\ 4a+5d+6g & 4b+5e+6h & 4c+5f+6i \\ 7a+8d+9g & 7b+8e+9h & 7c+8f+9i \end{bmatrix}$$

Problem 94 Write a program that reads several different names and addresses, rearranges the names into alphabetical order, and then writes out the data in an alphabetical list.

Problem 95 Declare a structure Student with members student name, class, marks obtained in physics, marks obtained in chemistry, marks obtained in mathematics, total marks and percentage. Write a function to read the student name, class, marks obtained in physics, marks obtained in chemistry and the marks obtained in mathematics. Write another function to calculate the total marks and percentage. Write the main() function to test the functions.

Problem 96 Write a program, which stores the name, address, account number and balance amount of 5 persons within an array of structure. Write a function, which will search for a particular person and will display the details of that person. The function should return an integer value if the search is successful else 0 should be returned stating the failure of the search.

File Handling

Problem 97 Write a c program, which accepts a string from the keyboard, stores it in a character array and then writes the string into a file.

Problem 98 Write a c program, which will read the contents of the file, created in **Problem 97**.

Problem 99 Declare a structure with members name and ID. Assign some data or accept some data from the user and finally write the data into a text file. Write a function for storing the data into the file. The function should accept 2 parameters, first being the file name and the second being the pointer to the structure, which points to the data stored.

Problem 100 To the program in **Problem 99**, add a function, which will read the contents from the file and display them on the screen. The function should accept the file name as the parameter.

Problem 101 To the program in **Problem 99**, add a function, which will read a particular record from the file. The function will accept the filename and the record position from the user.

Problem 102 To the program in **Problem 99**, add a function, which will modify the available record in the file. The file name and the name of the person will be passed as parameters to the function. The function should ask for confirmation before changing the record. The user will enter the new value to be stored.

Variable Number of Arguments

Problem 103 Write a function, which is capable of accepting variable number of integer arguments, and will display the average of them.

Command Line Arguments

Problem 104 Write a program to add, subtract, multiply or divide two numbers, the option will be provided by the user as a command line argument. Also if the user passes an arguments as "/?", a message should be displayed which will specify the purpose of the program. The parameter to be passed are:

Parameter Value	Meaning
A or a	Add
S or s	Subtract
M or m	Multiply
D or d	Divide
/?	Specify the working of the program

Problem 105 Rewrite the program in **Problem 104**, so that the two numbers and the symbol are also passed as command line argument. The program will be called as:

```
Arithmetic 20 * 50
```

where "Arithmetic" is the filename and 20, * and 50 are the three arguments Note: The first argument is the filename in the array. Command line arguments are passed as strings to the program.

Interrupts

Problem 106 Write a c program that will switch ON the caps lock on the keyboard. Hint: The address where the status is stored is 0x417.

Problem 107 Write a c program that will invoke the post process routine, so that the system reboots. Hint: The address for the post routine is 0xffff0000

Problem 108 Write a c program that will display the amount of RAM in your system. Hint: The address where this is stored is 0x413

Problem 109 Write a c program that will change the background color of the screen to blue. Hint: Data displayed in the screen is stored in 0xb8000000, to store one character, 2 bytes are required, one bytes stores the data and the other stores the attribute.

Problem 110 Write a c program that will change the uppercase characters to lowercase characters.

Problem 111 Write a c program that will print all the uppercase characters in lowercase when a print command is issued. Hint: Printer routine address is 0x17.

Problem 112 Write a c program that traps the Ctrl + Alt + Del keys so that the system is not rebooted when used by the user.
Hint:
Port Address for Keyboard 0x60
Scan Code of Del Key is 83
Port Address for Port Controller 0x20.

problem 113 Write a program, which disables the 's' key in the keyboard. Hint: Use the inportb and outportb function. Scan code for 's' is 31.

I/O Port Programming

Problem 114 Write a c program, which will demonstrate the data communication through serial port.