Department of Computer Science and Engineering
Institute of Technical Education & Research, SOA, Deemed to be University

MINOR ASSIGNMENT-001

UNIX Systems Programming (CSE 3041)

Assignment Objectives:

Familiarization with the general form of a C program, use of redirection to enable the use of files for Input/Output, functions and their uses to write programs with separate modules, the control structures: sequence, selections and repetition

Instruction to Students (If any):

This assignment is designed to give practice with C program to solve different kinds of problem using the basic C construct, functions and control structure. In this assignment students are required to create their own programs to solve each and every question/problem as per the specification of the given question/problem to meet the basic requirement of Unix systems programming. **Students are required to write the output/ paste the output screen shots onto their laboratory record after each question.**

Programming/ Output Based Questions:

1. Write a program that stores the values `'X'` and `76.1` in separate memory cells. Your program should get the values as data items and display them again for the user when done.

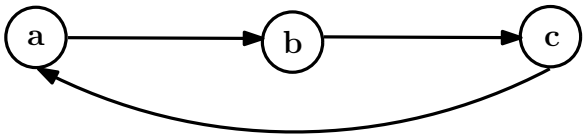
2. Which of the following identifiers are (a) C reserved words, (b) standard identifiers, (c) conventionally used as constant macro names, (d) other valid identifiers, and (e) invalid identifiers?

```
void        MAX_ENTRIES    return      printf    "char"
xyz123      time           part#2      G          Sue's
#insert     this_is_a_long_one         double     __hello_
```

3. Write an assignment statement that might be used to implement the following equation in C.

$$q = \frac{KA(T_1 - T_2)}{L}$$

4. Write a program to that makes the following exchanges without using temporary variable;



The arrows indicate that b is assume the value of a, c the value of b and so on. Your program must take input a, b and c from a data file **`mydata.txt`** and sends program output to output file **`myoutput.txt`** using input-output redirection.

5. Write a program that calculates mileage reimbursement for a salesperson at a rate of $0.35 per mile. Your program should interact with the user in this manner:

```
MILEAGE REIMBURSEMENT CALCULATOR
Enter beginning odometer reading=> 13505.2
Enter ending odometer reading=> 13810.6
You traveled 305.4 miles. At $0.35 per mile,
your reimbursement is $106.89.
```

6. Write the **`#define`** preprocessor directive and declarations for a program that has a constant macro for **`PI`** (3.14159) and variables **`radius`**, **`area`**, and **`circumf`** declared as **`double`** , variable **`num_circ`** as an **`int`** , and variable **`circ_name`** as a **char** .

7. Write a program that reads the $radius$, $length$ of a cylinder from the user and computes the $area$ as well as $volume$ using the following formulas:

$$area = radius * radius * \Pi$$

$$volume = area * length$$

Your program must use the `#define Directive for creating constant macros`

Sample Run:

```
Enter the radius and length of a cylinder: 5.5 12
The area is 95.0331
The volume is 1140.4
```

8. If you have $\mathbf{N}$ eggs, then you have $\mathbf{N/12}$ dozen eggs, with $\mathbf{N\%12}$ eggs left over. Write a program that asks the user how many eggs she has and then tells the user how many dozen eggs she has and how many extra eggs are left over. A gross of eggs is equal to 144 eggs. Extend your program so that it will tell the user how many gross, how many dozen, and how many left over eggs she has.

```
For example;
   if the user says that she has 1342 eggs
   then your program would respond with:
   Your number of eggs is 9 gross, 3 dozen, and 10.
```

9. Metro City Planners proposes that a community conserve its water supply by replacing all the communitys toilets with low-flush models that use only 2 liters per flush. Assume that there is about 1 toilet for every 3 persons, that existing toilets use an average of 15 liters per flush, that a toilet is flushed on average 14 times per day, and that the cost to install each new toilet is $150. Write a program that would estimate the magnitude (liters/day) and cost of the water saved based on the communitys population.

10. Write a program that takes the length and width of a rectangular yard and the length and width of a rectangular house situated in the yard. Your program should compute the time required to cut the grass at the rate of two square feet a second.

11. The Pythagorean theorem states that the sum of the squares of the sides of a right triangle is equal to the square of the hypotenuse. For example, if two sides of a right triangle have lengths of 3 and 4, then the hypotenuse must have a length of 5. Together the integers 3, 4, and 5 form a *Pythagorean triple*. There are an infinite number of such triples. Given two positive integers, m and n, where $m > n$, a Pythagorean triple can be generated by the following formulas:

$$side1 = m^2 - n^2$$

$$side2 = 2mn$$

$$hypotenuse = m^2 + n^2$$

The triple ($side1 = 3$, $side2 = 4$, $hypotenuse = 5$) is generated by this formula when $m = 2$ and $n = 1$. Write a program that takes values for m and n as input and displays the values of the Pythagorean triple generated by the formulas above. The values of m and n should be provided from an input file through input redirection.

12. Design a program to compute the roots of a quadratic equation $2x^2 - 4x - 2 = 0$ using a function whose prototype is given as **`void compute_root(double, double,double);`**.

13. If we know the lengths of two sides (b and c) of a triangle and the angle between them in degrees (α), we can compute the length of the third side (a) using the formula $a^2 = b^2 + c^2 - 2bccos\alpha$. Write a program to determine the third side of the triangle using the function **`double thirdsidecompute(int, int, int);`**.

14. Write a complete C program using user-defined function that prompts the user for the coordinates of two $3 - D$ points (x_1 , y_1 , z_1) and (x_2 , y_2 , z_2) and displays the distance between them computed using the following formula:

$$distance = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

15. Write a program to take a depth (in kilometers) inside the earth as input data; compute and display the temperature at this depth in degrees Celsius and degrees Fahrenheit. The relevant formulas are

$$Celsius = 10(depth) + 20 \quad \text{(Celsius temperature at depth in km)}$$
$$Fahrenheit = 1.8(Celsius) + 32$$

Include two functions in your program. Function **`celsius_at_depth`** should compute and return the Celsius temperature at a depth measured in kilometers. Function **`fahrenheit`** should convert a Celsius temperature to Fahrenheit.

16. The ratio between successive speeds of a six-speed gearbox (assuming that the gears are evenly spaced to allow for whole teeth) is

$$\sqrt[5]{M/m}$$

where M is the maximum speed in revolutions per minute and m is the mini- mum speed. Write a function **`speeds_ratio`** that calculates this ratio for any maximum and minimum speeds. Write a main function that prompts for maximum and minimum speeds (rpm), calls **`speeds_ratio`** to calculate the ratio, and displays the results in a sentence of the form

```
The ratio between successive speeds of a six-speed gearbox
with maximum speed _______ rpm and minimum speed _______
rpm is ____________.
```

17. Write a program in C that prompts the user to enter an integer and determines whether it is divisible by 5 and 6, whether it is divisible by 5 or 6, and whether it is divisible by 5 or 6, but not both.

Sample Run

```
Enter an integer: 10
Is 10 divisible by 5 and 6? False
Is 10 divisible by 5 or 6? True
Is 10 divisible by 5 or 6, but not both? True
```

18. Write a program in C to input a string message and number N to display it N times in the following manner. Use a while loop. E.g. Let the string message be **`Hello`** and N be 10. (*Use i % 10 and i % 100 to determine when to use st, nd, rd, or th for printing the ith Hello*).

Sample Run

```
Enter a message :Hello
1st Hello
2nd Hello
3rd Hello
4th Hello
5th Hello
6th Hello
7th Hello
8th Hello
9th Hello
10th Hello
```

19. Design a C program to display the following pattern;

```
A B C D E F G F E D C B A
A B C D E F   F E D C B A
A B C D E       E D C B A
A B C D           D C B A
A B C               C B A
A B                   B A
A                       A
```

20. The natural logarithm can be approximated by the following series.

$$\frac{x-1}{x}+\frac{1}{2}\left(\frac{x-1}{x}\right)^2+\frac{1}{2}\left(\frac{x-1}{x}\right)^3+\frac{1}{2}\left(\frac{x-1}{x}\right)^4+\ldots$$

If x is input through the keyboard, write a program to calculate the sum of first nine terms of this series.

21. Write a menu driven program which has following options:

    1. Factorial of a number.
    2. Prime or not
    3. Odd or even
    4. Exit

    Implement each option using a function subprogram. Use input-validation loop and program should terminate only when option 4 is selected.

22. Write a program to process a collection of scores obtained by students of a class of certain strength . Your program should count and print the number of students with Grade A (80 and higher), Grade B(65-79), Grade C(40-64) and Grade F(39 and below) . Ensure that the entered scores must remain in between 0 and 100(inclusive). Test your program on the following data:

```
-23 567 65 12 89 32 17 45 41 58 60 78 82 88 19 22
70 88 41 89 78 79 72 68 74 59 75 81 44 59 -23 -12
```

    (a) Read the same input from a file and use endfile controlled loop to implement the above program. Include codes to neglect rest of the line if faulty input is received during data entry.

    (b) Modify your program to display the average marks (a real number) for the subject at the end of the run.

23. A certain grade of steel is graded according to the following conditions:

    i Hardness must be greater than 50

    ii Carbon content must be less than 0.7

    iii Tensile strength must be greater than 5600

    The grades are as follows:

    - Grade is 10 if all three conditions are met
    - Grade is 9 if conditions (i) and (ii) are met
    - Grade is 8 if conditions (ii) and (iii) are met
    - Grade is 7 if conditions (i) and (iii) are met
    - Grade is 6 if only one condition is met
    - Grade is 5 if none of the conditions are met

    Write a program, which will require the user to give values of hardness, carbon content and tensile strength of the steel under consideration and output the grade of the steel.

24. Create two separate C files (i.e **`swap.c`** and **`main.c`**) to swap two numbers using call by value. The partial code snippet for both the files are given below. Complete the code and run to get the desired output.

Listing 1: swap.c

```
void  swap(int x, int y )
{
Write your swap logic here
printf("swap appears in function: a=%d, b=%d\n",a,b);
}
```

Listing 2: main.c

```
#include<stdio.h>
int main()
{
int a=10, b=20;
printf("Before swap in main a=%d, b=%d\n",a,b);
swap(___,___);
printf("after swap in main a=%d, b=%d\n",a,b);
return 0;
}
```

25. Assuming **x** is 15.0 and **y** is 25.0 , what are the values of the following conditions?

```
x!=y
x<x
x>=y-x
x==y+x-y
```

26. Write C statements to carry out the following steps.

    (a) If **item** is nonzero, then multiply **product** by **item** and save the result in **product** ; otherwise, skip the multiplication. In either case, print the value of **product**.

    (b) Store the absolute difference of **x** and **y** in **y** , where the absolute difference is **(x - y)** or **(y - x)**, whichever is positive. Do not use the **abs** or **fabs** function in your solution.

    (c) If **x** is 0 , add 1 to **zero_count**. If **x** is negative, add **x** to **minus_sum**. If **x** is greater than 0 , add **x** to **plus_sum**.

27. Implement the following decision table using a multiple-alternative if statement. Assume that the wind speed is given as an integer.

Wind Speed (mph)	**Category**
below 25	not a strong wind
2538	strong wind
3954	gale
5572	whole gale
above 72	hurricane

28. Write a program that reports the contents of a compressed-gas cylinder based on the first letter of the cylinders color. The program input is a character rep- resenting the observed color of the cylinder: 'Y' or 'y' for yellow, 'O' or 'o' for orange, and so on. Cylinder colors and associated contents are as follows:

orange	ammonia
brown	carbon monoxide
yellow	hydrogen
green	oxygen

Your program should respond to input of a letter other than the first letters of the given colors with the message, **Contents unknown**.

29. Write a program that determines the day number (1 to 366) in a year for a date that is provided as input data. As an example, January 1, 1994, is day 1. December 31, 1993, is day 365. December 31, 1996, is day 366, since 1996 is a leap year. A year is a leap year if it is divisible by four, except that any year divisible by 100 is a leap year only if it is divisible by 400. Your program should accept the month, day, and year as integers. Include a function leap that returns 1 if called with a leap year, 0 otherwise.

30. An integer n is divisible by 9 if the sum of its digits is divisible by 9. Develop a program to display each digit, starting with the rightmost digit. Your program should also determine whether or not the number is divisible by 9. Test it on the following numbers:
    n = 154368
    n = 621594
    n = 123456
    Hint: Use the % operator to get each digit; then use / to remove that digit. So 154368 % 10 gives 8 and 154368 / 10 gives 15436. The next digit extracted should be 6, then 3 and so on.

31. Write a C program to convert a decimal number into its equivalent binary number.