Theory Assignment - 2

1. Write a program in C that takes as input a set of numbers and calculates the mean, variance and standard deviation. (variance is defined as $\Sigma [(xi - x)^2]/n - 1$, where xi =i th number in the set, x is the mean and n=cardinality of the set ; standard deviation is the square root of variance).

```c
#include <stdio.h>
#include <math.h>

int main(){
    int n; // Number of elements
    int xi; // current element
    float x = 0.0; // Mean
    float variance; // Variance
    float sd; // Standard Deviation
    float sum = 0.0; // Temp Variable

    printf("Number of elements to be entered : ");
    scanf("%d", &n);

    int arr1[n];

    for (int i = 0; i < n; i++)
    {
        printf("Enter number : ");
        scanf("%d", &arr1[i]);

        xi = arr1[i];
        x = x+xi;
    }

    x = x/n; // Mean Calculated

    for (int i = 0; i < n; i++)
    {
        xi = arr1[i];
        sum += pow(xi-x,2);
    }

    variance = sum/(n-1); // Variance Calculated
    sd = pow(variance, 0.5); // Standard Deviation Calculated

    printf("\nMean = %f\nVariance = %f\nStandard Deviation = %f", x, variance, sd);

    return 0;
}
```

Output :-

```
Number of elements to be entered : 5
Enter number : 1
Enter number : 2
Enter number : 3
Enter number : 4
Enter number : 5

Mean = 3.000000
Variance = 2.500000
Standard Deviation = 1.581139
```

2. Amicable numbers are found in pairs. A given pair of numbers is Amicable if the sum of the proper divisors (not including itself) of one number is equal to the other number and vice – versa.
For example 220 & 284 are amicable numbers First we find the proper divisors of 220: 220:1, 2, 4, 5, 10, 11, 20, 22, 44, 55, 110
1+ 2 + 4 + 5 + 10 + 11 + 20 + 22 + 44 + 55 + 110 = 284 Now, 284: 1, 2, 4, 71, 142 1 + 2 + 4 + 71 + 142 = 220
Write a C program to check that the input pair of numbers is amicable.

```c
#include <stdio.h>


int main(){
    int num1, num2;
    int sum1=0, sum2=0;

    printf("Enter two numbers : ");
    scanf("%d %d", &num1, &num2);

    for (int i = 1; i < num1; i++)
    {
        if(num1%i==0){
            sum1+=i;
        }
    }

    for (int i = 1; i < num2; i++)
    {
        if(num2%i==0){
            sum2+=i;
        }
    }

    if(num1 == sum2 && num2 == sum1){
        printf("\nBoth the numbers are amicable numbers.\n");
    }
    else{
        printf("\nNo, both the numbers are not amicable numbers.\n");
    }

    return 0;
}
```

Output :-

```
Enter two numbers : 220 284
Both the numbers are amicable numbers.
```

3. Write a C program to accept the basic salary of an employee from the user. Calculate the gross salary on the following basis:

Basic	HRA	DA
1 - 4000	10%	50%
4001 - 8000	20%	60%
8001 - 12000	25%	70%
12000 and above	30%	80%

```c
#include <stdio.h>

int main(){
    int basicSalary;

    printf("Enter basic salary : ");
    scanf("%d", &basicSalary);

    float hra, da;

    if(basicSalary>=1 && basicSalary<=4000){
        hra = basicSalary*0.1;
        da = basicSalary*0.5;
    }
    else if(basicSalary>=4001 && basicSalary<=8000){
        hra = basicSalary*0.2;
        da = basicSalary*0.60;
    }
    else if(basicSalary>=8001 && basicSalary<=12000){
        hra = basicSalary*0.25;
        da = basicSalary*0.70;
    }
    else if(basicSalary>12000){
        hra = basicSalary*0.3;
        da = basicSalary*0.80;
    }

    printf("Gross salary = %.2f", basicSalary+hra+da);
    return 0;
}
```

Output :-

```
Enter basic salary : 5000
Gross salary = 9000.00
```

4. An Electricity board charges the following rates for use of electricity.
For the First 200 units: Rs 1 per unit,
For the next 100 units: Rs 1.5 per unit
Beyond 300 units: Rs 2 Per unit.
Write a C Program to read no of unit consumed and print out total charge amount.

```c
#include <stdio.h>


int main(){
    float sumAmount = 0;
    int unit = 0, unitCopy;
    int unitIncreased = 0;

    printf("\nEnter unit of electricity used : ");
    scanf("%d", &unit);

    unitCopy = unit;

    if(unit > 300){
        unitIncreased = unit-300;
        sumAmount += unitIncreased*2;
        unit = unit-unitIncreased;
    }
    if(unit>=201 && unit <= 300){
        unitIncreased = unit-200;
        sumAmount += unitIncreased*1.5;
        unit = unit-unitIncreased;
    }
    if(unit<=200){
        sumAmount += unit*1;
    }

    printf("\nTotal Unit : %d\nTotal bill amount = %.2f", unitCopy, sumAmount);
    return 0;
}
```

Output :-

```
Enter unit of electricity used : 304

Total Unit : 304
Total bill amount = 358.00
```

5. Write a C program that reads a positive integer n and then prints the following pattern

```
*********
_********
__*******
___******
____*****
_____****
______***
_______**
________*
```

where n is the number of lines.

```c
#include <stdio.h>

int main(){
    int n = 9;

    for (int i = 0; i < n; i++)
    {
        for (int j = 0; j < i; j++)
        {
            printf("  ");
        }

        for (int k = 0; k < n-i; k++)
        {
            printf("* ");
        }

        printf("\n");
        printf("\n");

    }

    return 0;
}
```

Output :-

```
* * * * * * * * *

  * * * * * * * *

    * * * * * * *

      * * * * * *

        * * * * *

          * * * *

            * * *

              * *

                *
```