Programming Assignment 3

Instructions: *Solve the following problems in C. Some example input and output cases are given for better understanding. Your program is expected to provide correct output on* ***any valid input.*** *Ensure that your input and output formats exactly match the examples. The words 'SAMPLE INPUT: ' and 'SAMPLE OUTPUT: ' in the examples are* ***NOT*** *part of the input and output.*

Note: *Your solutions should not use arrays or loops (they will be allowed from Assignment 4). If they are found in Assignment 3, you will be heavily penalized.*

Problem Set 1

1. Write a program in C to calculate the Electricity bill of a given customer. Units consumed by the user should be taken from the keyboard and display the total amount (accurate to two decimals) to pay to the customer. The charges are as follows.

Units	**Charges/unit**
upto 199	@1.20
200 and above but less than 400	@1.50
400 and above but less than 600	@1.80
600 and above	@2.00

If the bill exceeds Rs. 400 then a surcharge of 15% will be charged. The net amount should be minimum 100/- whether so many units are consumed or not.

SAMPLE INPUT: 400
SAMPLE OUTPUT:

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amount charges: 720.00
surcharge amount: 108.00
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net amount: 828.00

SAMPLE INPUT: 686
SAMPLE OUTPUT:
amount charges: 1372.00
surcharge amount: 205.80
net amount: 1577.80

SAMPLE INPUT: 52
SAMPLE OUTPUT:
amount charges: 62.40
surcharge amount: 0.00
net amount: 100.00

2. Write a C program that asks the user to enter a positive integer n less than or equal to 7. According to the number it gives sum of the first n terms of the series $1^4+2^4+4^4+7^4+11^4+$ ....

SAMPLE INPUT: 4
SAMPLE OUTPUT: 2674

SAMPLE INPUT: 5
SAMPLE OUTPUT: 17315

SAMPLE INPUT: 8
SAMPLE OUTPUT: INVALID INPUT

3. Read any 4 digit number from the keyboard. Print the number whose digits are in the reverse order to that of the input number, and also print the absolute difference between the new and the input numbers. For example, if the number entered is 1234, then your code should print 4321 and 3087.

SAMPLE INPUT: 123
SAMPLE OUTPUT: Please enter a 4 digit number

SAMPLE INPUT: 1234
SAMPLE OUTPUT: 4321,3087

SAMPLE INPUT: 4321
SAMPLE OUTPUT: 1234,3087

SAMPLE INPUT: 5678
SAMPLE OUTPUT: 8765,3087

4. Write a program to compute and print the taxi fare based on the following chart. Total number of Kilometers traveled, and the weather condition outside (‘Y’ if raining, and ‘N’ if not raining (both without quotes)), will be input by the user. If it is rainy outside then add 2 rupees extra per KM.

First 0 -12 KM: Rs. 100/-
Next 4 KM: Rs. 8 per KM
Next 4 KM: Rs. 6 per KM
Above 20 KM: Rs. 5 per KM

SAMPLE INPUT: 10,Y
SAMPLE OUTPUT: 120

SAMPLE INPUT: 15,N
SAMPLE OUTPUT: 124

SAMPLE INPUT: 15,Y
SAMPLE OUTPUT: 154

5. Acceleration due to gravity for a satellite revolving around a central object of mass M and radius R is given by

g = (G*M)/((R+D)^2)

Where
G is Newton’s Gravitational Constant
M is mass of the central object around which the satellite is revolving
R is the radius of the central object
D is the distance of the satellite from the central object

Calculate the values of g’s for a satellite moving 250 km from earth and a satellite moving 50 km from moon, given that
Mass of the earth = 5.972×10^{18} kg
Radius of the earth = 6361 km
Mass of the moon = $7.35 \text{ x } 10^{8}$ kg
Radius of the moon = 1737 km
Assume the value of Newton’s constant G as 6.67408×10^{-11} m3 ·kg−1 ·s−2
This code has no input, only output. Output the values g1,g2 where g1 is of the satellite revolving around the earth, and g2 is of the satellite revolving around the moon. Both the values need to be accurate up to 6 decimal places.

INPUT: (NONE)
OUTPUT: g1,g2 (accurate upto 6 decimal places)

Problem Set 2

1. Write a program to check if a given number is odd without division or mod operator. (Division or using MOD will lead to straight zero).

   SAMPLE INPUT: 23
   SAMPLE OUTPUT: ODD

   SAMPLE INPUT: 54
   SAMPLE OUTPUT: EVEN

2. Read about Babylonian method to find the square root of a given number. Write a program to implement this method till it converges (that is, value stops changing) or at most 5 steps. Print the square root obtained through Babylonian Method and error difference [difference between Square Root through Babylonian Method AND Square Root computed through sqrt()]. Precision is up to 4 decimal places.

   SAMPLE INPUT: 25
   SAMPLE OUTPUT: 5.0000 0.0000

   SAMPLE INPUT: 34
   SAMPLE OUTPUT: 5.8310 0.0000

   SAMPLE INPUT: -25
   SAMPLE OUTPUT: NO REAL SOLUTION

3. Read about Golden Ratio (= **1.618033**). Following is an algorithm to compute the golden ratio from a given number.
   (i) Divide your number by 1.
   (ii) Add 1
   (iii) Go to Step (i)

Write a program to print the computed Golden ratio and the error difference between the given Golden ratio AND the computed Golden ratio (up to 5 iterations). (Precision is upto 6 decimal places)

   SAMPLE INPUT: 2
   SAMPLE OUTPUT: 1.615385 0.002648

   SAMPLE INPUT: 34
   SAMPLE OUTPUT: 1.601156 0.016877

   SAMPLE INPUT: -5

SAMPLE OUTPUT: 1.590909 0.027124

4. Given coordinates of the center of a sphere **(x, y, z)** and its radius **r**. Write a program to check whether a point **(px, py, pz)** lies inside, outside or on the sphere. The input format is x, y, x, r, px, py, pz.

    SAMPLE INPUT: -1, 3, 0, 10, 2, 1, 2
    SAMPLE OUTPUT: INSIDE THE SPHERE

    SAMPLE INPUT: 4, 3, -1, 3, 2, 1, 2
    SAMPLE OUTPUT: OUTSIDE THE SPHERE

    SAMPLE INPUT: -1, -1, -1, 2, -1, -1, 1
    SAMPLE OUTPUT: ON THE SPHERE

5. Write a program to find the sum of the digits of a number until the number is a single digit **without loop**. (For example, 525 -> 12 -> 3 (answer)). Using Loops will lead to zero marks.

    SAMPLE INPUT: 342
    SAMPLE OUTPUT: 9

    SAMPLE INPUT: 23786
    SAMPLE OUTPUT: 8

Problem Set 3

1. Given a positive integer (1<=n<=9999), find how many times the digit 3 appears in the number.

   SAMPLE INPUT: 3453
   SAMPLE OUTPUT: 2

   SAMPLE INPUT: 94
   SAMPLE OUTPUT: 0

2. A chessboard has coordinates (1,1) to (8,8). A bishop is placed in one of the squares (m,n). Assuming the board to be empty, find the number of possible moves it can make on the board.

   SAMPLE INPUT: 1, 1
   SAMPLE OUTPUT: 7

   SAMPLE INPUT: 3, 1
   SAMPLE OUTPUT: 7

   SAMPLE INPUT: 5, 7
   SAMPLE OUTPUT: 9

3. Let A and B be two complex numbers. Write a program to add, subtract, multiply and divide them. Input contains the real and imaginary parts of the two numbers followed by the operation to be performed: R1, I1, R2, I2, Op. Op can be A, S, M or D for the above operations. The output should be the real and imaginary parts of the results of the operation, accurate to two decimal places.

   SAMPLE INPUT: 3.0, -2.0, 4.5, 3.33333, M
   SAMPLE OUTPUT: 20.17, 1.00

4. Given a number X, unset the highest bit or the most significant bit (in binary representation) of the input number and output the resulting number.

   SAMPLE INPUT: 12
   SAMPLE OUTPUT: 4

   SAMPLE INPUT: 10
   SAMPLE OUTPUT: 2

5. Given a circle with center (0,0) and a point (x,y) on its circumference, output two other

points (x1, y1) and (x2, y2) on circle so that all three points form an equilateral triangle. Also output the area of the equilateral triangle (accurate to 4 decimal places). The output format should be x1, y1, x2, y2, area.

SAMPLE INPUT: 0, 4
SAMPLE OUTPUT: -3.46, -2, 3.46, -2, 20.7600