Programming Assignment 2

Instructions: *Solve the following problems in C. Some sample input and output cases are given for better understanding. Your program is expected to provide correct output on any valid input.*

Problem Set 1

1. Write a C program that calculates the total interest income on a given amount in a period of 10 years. Show the results (upto 2 decimal places) for simple interest, compounded interest when the compounding is done annually, semi-annually, quarterly, monthly and daily (assuming 365 days in a year). Assume that the interest rate is 3.5% per year.

   SAMPLE INPUT: 500000.00
   SAMPLE OUTPUT:
   Simple Interest for 10 years: 175000.00
   Compound Interest for 10 years annually: 205299.38
   Compound Interest for 10 years semi-annually: 207389.10
   Compound Interest for 10 years quarterly: 208454.42
   Compound Interest for 10 years monthly: 209172.41
   Compound Interest for 10 years daily: 209521.87

   SAMPLE INPUT: 700000.00
   SAMPLE OUTPUT:
   Simple Interest for 10 years: 245000.00
   Compound Interest for 10 years annually: 287419.13
   Compound Interest for 10 years semi-annually: 290344.74
   Compound Interest for 10 years quarterly: 291836.19
   Compound Interest for 10 years monthly: 292841.38
   Compound Interest for 10 years daily: 293330.62

2. Write a C program that accepts 4 real numbers from the keyboard and prints out the difference (using 4-decimal places) of the maximum and minimum values of these numbers.

SAMPLE INPUT: -1.5 2 7.5 11.2
SAMPLE OUTPUT: 12.7000

SAMPLE INPUT: -2 3 7 2
SAMPLE OUTPUT: 9.0000

3. Write a C program that accepts (from the keyboard) a positive integer less than 1000 and prints out the sum of the digits of this number.

SAMPLE INPUT: -4
SAMPLE OUTPUT: Entered number is out of range

SAMPLE INPUT: 546
SAMPLE OUTPUT: Sum of the digits of 546 is 15

4. A decimal number between 0 and 32 exclusive can be expressed in binary system as $x_4x_3x_2x_1x_0$, where x_i's are either zero or one. Write a C program that accepts (from the terminal) a decimal number in the above range and prints out the equivalent binary representation.

SAMPLE INPUT: -5
SAMPLE OUTPUT: Entered number is out of range

SAMPLE INPUT: 21
SAMPLE OUTPUT: Binary equivalent of decimal number 21 is 10101

5. A positive decimal fraction can be expressed in binary system as $0.x_1x_2x_3x_4\cdots$, where x_i's are either zero or one. Write a C program that accepts (from the keyboard) a positive decimal fraction a $(0 < a < 1)$ and prints out the first four bits of the equivalent binary representation.

SAMPLE INPUT: 0.875
SAMPLE OUTPUT: Binary equivalent of 0.875000 is 0.1110

SAMPLE INPUT: -0.1
SAMPLE OUTPUT: Entered number is not a +ve decimal fraction less than 1

SAMPLE INPUT: 0.525
SAMPLE OUTPUT: Binary equivalent of 0.525000 is 0.1000

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Problem Set 2

1. For an experiment on human behaviour towards integers, we decide to perform a task. The idea is to enter a stream of integers. In the end, we would like to find out
   a. how many numbers were entered
   b. Average of entered values (upto 2 decimal places).
   c. How many were odd numbers?
   d. Largest Number
   e. Smallest Number

   Write a C program to automate this experiment. There can be a minimum of 2 inputs and a maximum of 5 inputs (including the stopping point -999 to indicate there are no more inputs after this).

   SAMPLE INPUT: 1 3 5 -999
   SAMPLE OUTPUT: 3, 3.00, 3, 5, 1

   SAMPLE INPUT: 2 3 6 5 -999
   SAMPLE OUTPUT: 4, 4.00, 2, 6, 2

   SAMPLE INPUT: 4 29 3 17 92
   SAMPLE OUTPUT: INVALID INPUT

2. You aim to design a navigation system. For now, you want to develop a mini module which tells whether the required location is on your left or right. To implement a coarse version, imagine the street as a line which passes through its start point (x1, y1) and terminal point (x2, y2). Visualize the location as a point (x3, y3) in the coordinate system. Your direction of movement is towards the terminal point. Write a program which tells whether the location is on the left or right of the line, or on the line.
   INPUT FORMAT: x1, y1, x2, y2, x3, y3

   SAMPLE INPUT: 2, 1, 6, 8, 7, 5
   SAMPLE OUTPUT: RIGHT

   SAMPLE INPUT: 2, 1, 6, 8, -1, 5
   SAMPLE OUTPUT: LEFT

   SAMPLE INPUT: 2, 2, 8, 8, 4, 4
   SAMPLE OUTPUT: ON STREET

3. Given a date in DD, MM, YYYY format, write a program which prints the number of days left for next Feb 29. If it is an invalid date, print INVALID.

   SAMPLE INPUT: 27, 2, 2020
   SAMPLE OUTPUT: 2

   SAMPLE INPUT: 29, 13, 2020
   SAMPLE OUTPUT: INVALID

4. Recently, the government of India has introduced an optional tax slab which is given in Table 1. The new tax slab does not provide any exemptions.

Table 1: Optional New Income Tax Slab	
Total Income	Income Tax Rate
Upto 2.5 L	NIL
Above 2.5 L to 5L	5% of (total income - 2.5 L)
Above 5 L to 7.5 L	10% of (total income - 5 L)
Above 7.5 L to 10 L	15% of (total income - 7.5 L)
Above 10 L to 12.5 L	20% of (total income - 10 L)
Above 12.5 to 15 L	25% of (total income - 12.5 L)
Above 15 L	30% of (total income - 15 L)

Old Income Tax slab is as given in Table 2.

Table 2: Old Income Tax Slabs	
Total Income	Income Tax Rate
Upto 2.5 L	NIL
Above 2.5 L to 5L	5% of (total income - 2.5 L)
Above 5 L to 10 L	20% of (total income - 5 L)
Above 10 L	30% of (total income - 10 L)

The old Tax slab provides you some exemptions which include House Rent Allowance (upto 1L) and savings (upto 1.5 L). That is, this much amount is subtracted from the gross salary before calculating tax. In both of the slabs, a surcharge of 4% is applied on the top of the iteratively calculated income tax.

Given inputs (a) Gross Salary per Annum (b) House Rent Paid and (c) Savings Amount,

write a program which advises the user about the right tax slab to go for (i.e. Minimized Income Tax). Also output the "Difference" (upto 2 decimal places) in the amount between old and new Income tax. If both slabs lead to the same amount, then print 'ANY' and difference as 0.

For more clarifications, Google and understand.

SAMPLE INPUT: 1200000, 90000, 125000
SAMPLE OUTPUT: OLD, 5720.00

SAMPLE INPUT: 600000, 0, 0
SAMPLE OUTPUT: NEW, 10400.00

SAMPLE INPUT: 150000, 20000, 10000
SAMPLE OUTPUT: NO TAX, 0.00

SAMPLE INPUT: 2000000, 100000, 150000
SAMPLE OUTPUT: ANY, 0.00

5. Write a program to perform 2's complement using Bitwise operators. '~' yields one's complement. '&' and '|' is used for bitwise AND and OR operations respectively. Input is an integer in the decimal number system. The output has to be printed in the hexadecimal number system.

SAMPLE INPUT: 5
SAMPLE OUTPUT: fffffffb

SAMPLE INPUT: 10
SAMPLE OUTPUT: fffffff6

SAMPLE INPUT: -2334
SAMPLE OUTPUT: 91e

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Problem Set 3

1. Write a program for finding the roots (real or imaginary) of a quadratic equation, given *a, b* and *c*. Assume *a* is non-zero. Print both the roots, separated by a comma, as real numbers with exactly one decimal place, in descending order. If imaginary roots, then print the roots in the order of x+iy, x-iy.

SAMPLE INPUT: 1, -5, 6
SAMPLE OUTPUT: 3.0, 2.0

SAMPLE INPUT: 1, 5, 18.5
SAMPLE OUTPUT: -2.5+i3.5, -2.5-i3.5

2. Read four coordinates x1, y1, x2, y2, x3, y3, x4, y4 and verify whether (x4 , y4) is inside or outside the triangle formed by the other three points Δ123. Print YES if the point is inside the triangle and NO otherwise. Make sure that your program works well for all directions (like horizontal, vertical etc.) of the sides of the triangle. (Print YES, even if the fourth point is on the sides of the triangle).

SAMPLE INPUT: 0, 0, 5, 0, 3, 4, 3, 1
SAMPLE OUTPUT: YES

SAMPLE INPUT: 0, 0, 5, 0, 3, 4, 5, 7
SAMPLE OUTPUT: NO

3. Given two dates as (dd mm yyyy, dd mm yyyy), find the number of days elapsed between the two (including the two days). Note that the first day can be before or after or same as the second day. Assume all months have 30 days.

SAMPLE INPUT: 22 5 2008, 5 6 2008
SAMPLE OUTPUT: 14

SAMPLE INPUT: 29 11 2020, 30 12 2018
SAMPLE OUTPUT: 690

4. Read four real numbers corresponding to two points (x1, y1), (x2, y2) and print the distance between them. Print the output as a real number with exactly one decimal place.

SAMPLE INPUT: 0, 0, 1, 0
SAMPLE OUTPUT: 1.0

SAMPLE INPUT: 1.2, -5.3, 7.8, 4.4
SAMPLE OUTPUT: 11.7

5. Given end points of two line segments (x1, y1), (x2, y2), and (x3, y3), (x4, y4), verify whether these two line segments intersect or not. Print YES, if they intersect, NO if they do not intersect. (Note that these are finite line segments, and not infinite lines).

SAMPLE INPUT: 0, 0, 1, 1, 2, 2, 2, 0
SAMPLE OUTPUT: NO

SAMPLE INPUT: -1, 0, 1, 0, 0, -1, 0, 1
SAMPLE OUTPUT: YES