Programming Fundamentals

Lecture # 13

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Problem 1

- Write a program that prompts the user to input a number. The program should then output the number and a message saying whether the number is positive, negative, or zero.

Problem 2

- Write a program that prompts the user to input three numbers. The program should then output the numbers in ascending order.

Problem 3

- In a right triangle, the square of the length of one side (hypotenuse) is equal to the sum of the squares of the lengths of the other two sides. Write a program that prompts the user to enter the lengths of three sides of a triangle and then outputs a message indicating whether the triangle is a right triangle

Problem 4

The roots of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ are given by the following formula:

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

In this formula, the term $b^2 - 4ac$ is called the **discriminant**. If $b^2 - 4ac = 0$, then the equation has a single (repeated) root. If $b^2 - 4ac > 0$, the equation has two real roots. If $b^2 - 4ac < 0$, the equation has two complex roots. Write a program that prompts the user to input the value of a (the coefficient of x^2), b (the coefficient of x), and c (the constant term) and outputs the type of roots of the equation. Furthermore, if $b^2 - 4ac \geq 0$, the program should output the roots of the quadratic equation. (*Hint:* Use the function `pow` from the header file `cmath` to calculate the square root. Chapter 3 explains how the function `pow` is used.)

Problem 5

Write a program that mimics a calculator. The program should take as input two integers and the operation to be performed. It should then output the numbers, the operator, and the result. (For division, if the denominator is zero, output an appropriate message.) Some sample outputs follow:

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3 + 4 = 7
13 * 5 = 65
```

Problem 6

Example 2.5: A company insures its drivers in the following cases:

- If the driver is married.
- If the driver is unmarried, male & above 30 years of age.
- If the driver is unmarried, female & above 25 years of age.

In all other cases the driver is not insured. If the marital status, sex and age of the driver are the inputs, write a program to determine whether the driver is to be insured or not.

Problem 7

Example 2.6: Write a program to calculate the salary as per the following table:

Gender	Years of Service	Qualifications	Salary
Male	>= 10	Post-Graduate	15000
	>= 10	Graduate	10000
	< 10	Post-Graduate	10000
	< 10	Graduate	7000
Female	>= 10	Post-Graduate	12000
	>= 10	Graduate	9000
	< 10	Post-Graduate	10000
	< 10	Graduate	6000

Problem 8

If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit he made or loss he incurred.

Problem 9

Write a program to check whether a triangle is valid or not, when the three angles of the triangle are entered through the keyboard. A triangle is valid if the sum of all the three angles is equal to 180 degrees.

Problem 10

- Find the absolute value of a number entered through keyboard

Problem 11

- Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all three points fall on one straight line. [Hint: points lie on same line if slope of (point 1 & point 2) and slope of (point2 & point 3) are equal. We can find slope (m) of point 1 and point 2 using formula:
- m = (y2 – y1) / (x2 – x1)

An Insurance company follows following rules to calculate premium.

(1) If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city and is a male then the premium is Rs. 4 per thousand and his policy amount cannot exceed Rs. 2 lakhs.

(2) If a person satisfies all the above conditions except that the sex is female then the premium is Rs. 3 per thousand and her policy amount cannot exceed Rs. 1 lakh.

(3) If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then the premium is Rs. 6 per thousand and his policy cannot exceed Rs. 10,000.

(4) In all other cases the person is not insured.

Write a program to output whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

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.

Problem 14

A library charges a fine for every book returned late. For first 5 days the fine is 50 paise, for 6-10 days fine is one rupee and above 10 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a program to accept the number of days the member is late to return the book and display the fine or the appropriate message.

Problem 15

If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is valid or not. The triangle is valid if the sum of two sides is greater than the largest of the three sides.

Problem 16

- Any year is entered through keyboard, write a program to determine whether the year is leap or not. [Hint: A leap year is a year divisible by 400. If year is divisible by 4 then it must not be divisible by 100.]

Problem 17

- If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is isosceles, equilateral, scalene or right angled triangle [Hint: isosceles triangle has two equal sides, equilateral triangle has all equal sides, scalene triangle has all sides of different length, right angled triangle can be identified using Pythagorean theorem]

Problem 18

In a company, worker efficiency is determined on the basis of the time required for a worker to complete a particular job. If the time taken by the worker is between 2 – 3 hours, then the worker is said to be highly efficient. If the time required by the worker is between 3 – 4 hours, then the worker is ordered to improve speed. If the time taken is between 4 – 5 hours, the worker is given training to improve his speed, and if the time taken by the worker is more than 5 hours, then the worker has to leave the company. If the time taken by the worker is input through the keyboard, find the efficiency of the worker.

Problem 19

A university has the following rules for a student to qualify for a degree with A as the main subject and B as the subsidiary subject:

(a) He should get 55 percent or more in A and 45 percent or more in B.

(b) If he gets than 55 percent in A he should get 55 percent or more in B. However, he should get at least 45 percent in A.

(c) If he gets less than 45 percent in B and 65 percent or more in A he is allowed to reappear in an examination in B to qualify.

(d) In all other cases he is declared to have failed.

Write a program to receive marks in A and B and Output whether the student has passed, failed or is allowed to reappear in B.