

Decision Statements

3.1 Objectives

1. To convert specification into C programs (Specification → Flowchart → Program).
2. To learn the usage of decision statements.

Time-span: 1 lab day (2 hrs.)

3.2 Problems

1. (a) The absolute value of a real number x is defined as

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{otherwise} \end{cases}$$

Write a C program that computes the absolute value of a given number.

(b) The Manhattan distance between two points (x_1, y_1) and (x_2, y_2) is defined as $|x_1 - x_2| + |y_1 - y_2|$. Write a C program that calculates the Manhattan distance.

(c) Write a C program that decides whether the point P_1 is closer to the point P_2 or P_3 based on the Manhattan distance. Here, $P_1:(x_1, y_1)$, $P_2:(x_2, y_2)$, and $P_3:(x_3, y_3)$. [Algorithm and Flowchart Required.]

2. (a) In this problem you are going to build a robot control system. The robot R2D2 (give your own name for the robot) can only move forward, backward, left and right. It also has a laser gun to shoot at the enemy. R2D2 is controlled by a human from a control centre using a keyboard. Your task is to write a program which the human will use to control R2D2. The chip on the robot receives commands from the control

centre and directs it to perform desired action (movement or fire laser). The robot is programmed to move forward, backward, left and right on the 'w', 's', 'a' and 'd' respectively. It shoots the laser gun if the human presses the 'l' key.

Write a program that will display the five actions (four for movement and one for firing) available to the human and ask for him/her to choose one from them. Based on the choice made, a relevant message should be printed. This will allow the human to verify if the program is working properly.

(b) Another fine day, the control software was used by an intruder. The failure was attributed to bad engineering (the lack of intrusion prevention measures). To prevent unauthorized access, the software engineer decided to make the software password protected. The password can only be numeric and three digits in length (no more, no less). Upon running the software, the user is prompted with a message to enter the password. Only when the correct password is entered, user is taken to the menu that you wrote for Part I and II of the problem. Incorporate this feature in your earlier program. [Algorithm and flowchart required]

3. Write a program that determines the day number (1 to 366) in a year from a date (dd-mm-yyyy) that is provided as input data. For example, 1-1-2012 is day 1 and 31-12-2012 is day 366 because 2012 is a leap year. A year is a leap year only if it is divisible by 4. Again, if a year is divisible 100 and not divisible by 400 like 1900 is not a leap year. Your program should take the month, day and year as integers input and print the day number as an integer output.