

IDC101 (Introduction to Computation) :
Lab session 3 / 4**General Instruction :**

For each problem given here, first decide your algorithm. That is, first decide how you will solve the problem on paper. Only after this, you should start writing your program.

Here's the checklist :

- a) Read the problem carefully. Decide the inputs required.
- b) Decide your step-by-step algorithm. That is, decide how you will solve your problem step-by-step.
- c) Now, write your program following your algorithm.

A sample algorithm is given for problem 1 and 5.

1. Write a program which will take time as input in 24 hour format. Your program should convert it into 12 hour format and write the answer as *HH.MM* AM or *HH.MM* PM (For example, 1720 hrs should output 5.20 PM).

Brief sample algorithm :

Input will be hours (`integer`) and minutes (`integer`) in 24 hour format. Read hours and minutes separately using two input statements.

Convert hours using modulo operator; `hours%12` .
Minutes can be kept as it is.

Write the output in desired form.

2. Ask the user to input an integer number. Your output should report if the number is divisible by 2 and/or 3. Use the modulo operator to do this problem.

3. Modify the `day.py` given to you as sample program. The modified program should report correct output for all possible inputs. First think about all possible inputs a user can give; negative numbers, numbers greater than 24, alphabets etc. Meaningful output should result only if input numbers lie in the range 0 to 24. For any other input, your program should report a error message such as ;

Your input values are invalid. Input values should lie in range 0 – 24.

4. Write a program which will take the value of x and y as input from the user and compute the value of u given by the following equation.

$$u = \frac{(\sqrt{x} + y)^{1/3}}{x - y}, \quad x > 0, \quad x \neq y.$$

Note that your program should be capable of checking if the input is valid. In this case, the conditions that $x > 0$ and $x \neq y$ should be checked. The output should show the given input values as well as the computed value of u . If the input does not satisfy the conditions, your program should output the input values and a meaningful error message.

5. The input to this program should be three numbers, real or integers. Write a program that will give the maximum of the three numbers as output. The program should correctly handle positive and negative numbers. The output should also include the input numbers, apart from the result.

Brief sample algorithm :

Read three real numbers : x , y , z .

Let x_{\max} be the variable that will hold the largest number.

To begin, assume x to be the largest number. Then, set $x_{\max} = x$.

Compare x and y . If y is greater than x , then set $x_{\max} = y$. If not, do nothing.

Compare y and z . If z is greater than y , set $x_{\max} = z$. If not, do nothing.

Compare x and z . If z is greater than x , set $x_{\max}=z$. If not, do nothing.

Write the output as x_{\max} .

6. Copy the program you wrote for problem 5 in to a different file. Then, modify this program to give the minimum of three numbers as output. The program should correctly handle positive and negative numbers.

7. This is a classic problem. Write a program that will take year as input and output should tell us if it is a leap year or not. First, figure out the conditions for leap year. The year should be divisible by 4 but there are some exceptions. If a year is divisible by 4 and 100, then it is not leap year. But if it is divisible by 400, it is leap year. For example, 1900 is not a leap year but 2000 is a leap year.

8. Write a program for temperature scale conversion. The user will give two input values; (i) Temperature as real number and (ii) a character (F or C) indicating if the units are Fahrenheit or Celsius. Your program should take both these inputs and convert the temperature from F to C or C to F , depending on the input. As usual, your output should first write the input values and then the computed result. Format your answer to display only 2 decimal places.

9. In a factory, employees are paid Rs. 300 as standard salary for every hour of work. If they had worked for more than 45 hours per week, then the salary is 1.5 times the standard salary for every hour beyond 45 hours of work. Write a program to compute the salary given hours of work per week as input.

10. Write a program to read two words. For example, banana and mango. Write a program to do the following ; (i) Determine the number of letters in each word. Use python command `len(myword)` to find length. (ii) Use boolean operators `>` and `<` to write the two words in alphabetical order.

NOTE: Let us take two words, `word1` and `word2`. In python language, if `word1 > word2`, then `word1` is alphabetically ahead of `word2` (as in a dictionary). You can compare strings just the way you compare numbers. Try few simple cases in python's interactive mode and then write this program. Try with various words of your choice.

11. Some useful information for you. Auto charges in Pune are as follows.

First 1.5 km : Rs 18.00

For every subsequent km : Rs 12.31

Night fare (11 PM to 5 AM) : 25 % extra.

Using this data, write a program to compute the cost for a ride given the distance of travel and duration of travel as input. The answer should display only two digits after decimal. Take care of all possible inputs.

12. An additional complication. In problem 11, what should be done if the ride starts at 10:50 PM and ends at 11:30 PM. Assume that the cost should be prorated as per the part distance travelled before 11 PM and after 11 PM. Assume constant speed (of your choice) for the auto. Note that you will need additional input information. Decide what additional information you need and take it as input. Now, rewrite your program for problem 11 resolving this complication.

13. Consider the quadratic equation $ax^2 + bx + c = 0$. Write a program to determine if the solutions will be real and equal, real and unequal, complex. Find the solutions as well. Before you write your program, (i) decide what inputs your program should take and (ii) decide how the results will be displayed.

14. A train reaches Pune station at 11:45 PM. If the train is delayed by x minutes, what is arrival time of train ? The result should be in 12-hour time format. For example, if the delay is 20 minutes, the answer must be 00:05 AM. Try your program with different inputs ranging from 20 minutes to 800 minutes.