

CODATHON

(Qualifying Round)

Name:

Time: 90 mins

Note: Some questions have an optional bonus version. Bonus version is a more complex version of the original question. You may either attempt the original initial version **OR** the bonus version.

Solving the bonus version would yield you more marks

- 1) An institute XYZ must issue official email IDs for their new joinees. As this would be a very painstaking process if done manually, they seek the help of a student who is proficient in programming to write a program to generate the institute mail IDs of 300 students. However, for the scope of this question, let us solve a simpler problem. Write a program that outputs the institute mail ID of a person given their roll number, first name, middle name and surname.

The roll numbers are of the form 22CHEM-01, 23MECH-05, 24EXTC-07, etc. where the first two digits indicate the year of admission (2022, 2023, ...), the four letters indicate the branch (Chemical, Mechanical, Electronics, etc.) and the last two digits indicate the roll call of the person in the class. The following pattern is followed to generate the mail IDs :-

For 23MECH-07 Pranoy Hridoy Roy, the mail ID is given as 23mechph.roy@xyz.edu.in **[3 Marks]**

- 2) Given any date and month in the year 2025, write a program to find out what day it is or what day it was. **[7 Marks]**

Bonus Version: Solve the following version to get +5 bonus marks i.e total of 12 marks

Given any date, any month and any year, write a program to find out what day it is or what day it was. For the purpose of this question, you may restrict yourself to years between 2001 and 2025 to avoid the confusion of changing the century. **[12 Marks]**

- 3) Create any example of your own that illustrates the use of recursion in a function. **[2 Marks]**
- 4) Say all the 5 letter words in the English language are arranged in alphabetical order in a dictionary. Note that for the sake of this problem, even words that don't make sense such as AAAAA, AEIOU, etc. are considered as words. Given any five letter word, write a program that outputs the rank of the word in the dictionary. The rank of AAAAA is 1, the rank of AAAAB is 2, etc. **[6 Marks]**
- 5) Programming has come a long way as years have progressed. Modern day programming languages come packed with an inventory of in-built functions. We have in-built functions to solve differential equations and in-built functions to solve non-linear equations. What we take for granted is that someone had to program these in-built functions from scratch. Somebody had to write a code for a function as simple as printing something or someone had to write a code for a while loop or a for loop. Thus understanding the contributions of such people and to value it, create your own function that return the sine, cosine and exponents of a given real number. You may use basic syntax of functions, you may use basic loops, conditional statements and you may define variables as programming these from scratch is not possible at this level. You are prohibited from using any in-built functions such as factorial(), exp(), sin(), cos(), etc. **[7 Marks]**

- 6) Find the interest earned by 4 banks (say A B C D) who have lent money to 4 people (say P Q R S). The interests are calculated by simple interest. Following is the data of amounts borrowed by the people from the four banks, time period of return and rate of interest of various banks:

| Bank | Money borrowed by P (in INR) | Money borrowed by Q (in INR) | Money borrowed by R (in INR) | Money borrowed by S (in INR) |
|------|------------------------------|------------------------------|------------------------------|------------------------------|
| A | 51000 | 73000 | 21000 | 19000 |
| B | 56000 | 98000 | 24000 | 27000 |
| C | 93000 | 75000 | 85000 | 20000 |
| D | 10000 | 91000 | 10500 | 23000 |

| Person | Bank A (Time period) in years | Bank B (Time period) in years | Bank C (Time period) in years | Bank D (Time period) in years |
|--------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| P | 1.5 | 1 | 1.5 | 2 |
| Q | 1 | 1.5 | 1 | 2 |
| R | 2.5 | 1 | 2 | 3 |
| S | 3 | 1 | 2 | 1.5 |

| Bank | A | B | C | D |
|------------------|---|---|-----|---|
| % ROI (per year) | 3 | 5 | 2.5 | 4 |

$$\{\text{Interest} = (\text{Principal amount}) * (\text{ROI}/100) * (\text{Time period})\} \quad [6 \text{ Marks}]$$

- 7) Specific heat capacity of a fluid is defined as the amount of energy required to raise the temperature of unit mass of a fluid by 1 degree (in some units, may be 1°C , 1°F , etc.). Knowing the values of specific heat capacities of various fluids is very important for the design of heat transfer equipments such as a shell and tube heat exchanger, jacketed vessels, etc. For engineers involved in the design of these equipments, these values of specific heat capacities must be obtained from literature. However, relatively older books written by American authors use unconventional units and various books report these heat capacities in different units. Write a program that gives the output in the units the user mentions for a given unit in which the user decides to input the value. Following are the units that you might have to deal with : -

{kJ/(kg.K), kcal/(kg. $^{\circ}\text{C}$), Btu/(lb. $^{\circ}\text{F}$)}

1 cal = 4.184 J, 1 kJ=1000 J, 1 kcal= 1000 cal, 1 Btu= 1055.06 J, 1 lb= 0.454 kg ,

T (in K) = T (in $^{\circ}\text{C}$) +273.15, T (in $^{\circ}\text{F}$) = $(9/5)*T$ (in $^{\circ}\text{C}$) + 32, Change in Celsius scale = Change in Kelvin scale , Change in Celsius scale = $1.8*(\text{Change in Fahrenheit scale})$ [3 Marks]

Bonus Version: Solving the following version to get +4 bonus marks i.e. total of 7 marks

Try to write a program for the above mentioned problem with the following catch. Write a program to solve the previous problem without the use of conditional for each and every conversion case. This will help to write a similar program that can be later expanded to involve more units and more quantities than just specific heat capacity. [7 Marks]

- 8) Write a program to find the sum of first n prime numbers [6 Marks]

Use the computer but don't be a bot. Be human, be creative

END