ITM
IT MUSTAKBIL

Final Examination

Full Name:

Roll No: **Section:**

Introduction to Programming **3 hours**

Problem Solving & Practical Programming Semester 1

Fall (2022)

Instructions:

- You must answer **all** questions. There are **no optional** questions.
- You are responsible for ensuring your answers are clear and unambiguous.
- You must upload your answers in the quiz form uploaded on Google Classroom.
- Write your full name, roll number and section in the boxes at the top of the page.
- **You may use any online / offline notes, handouts, notes or resources except help taken from other students of ITM and their work.**
- This exam affords **zero tolerance** to students found using dishonest or unfair means.

Information:

- The total marks for this paper are 100.
- The number of marks for each question or part question are shown in brackets [ ].
- Students may only be awarded whole number marks.
- There are a total 5 of pages in this paper.
- There are **three sections** in this paper; A) Simple Programs, B) Medium Programs and C) Complex Programs.

C++ Programming Marks
/ 100

systems

Section A

Simple Programs

Examiner Use

1 A hospital wants to use a software solution to keep track of their patients' vital signs i.e., **body temperature, pulse rate, respiration rate (breathing rate) and blood pressure**. You have been tasked with finding a method to store these signs repeatedly for each patient.

You decide to create an object to store this information.

a) Write a program in which you define a class / structure to store the vital signs. **[1]**

b) Create an instance (i.e., object) in the main function of the same program using your class definition, and store the following values in it:

a. Body Temperature: 97
b. Pulse Rate: 80
c. Respiration Rate: 65
d. Blood Pressure: 100

[1]

2 Write a program in which you take two integer numbers as inputs from the user, and output their average.

Any variables used must be dynamically allocated. **[2]**

3 Write a function named *'decorateH1()'* which takes a string of any length as its argument and decorates it with *'####'* lines above and below it. Your function should automatically determine the number of *'#'* printed in the lines above and below the text and should match the length of the string. **[2]**

4 Write a program containing a user login portal.

The portal should prompt the user for a *'username'* and *'password'*. If the correct credentials (i.e., *'username' = 'admin'* and *'password' = 'Pass123'*) are added, the portal should output *'Welcome Admin!'*, otherwise the portal should output *'Access denied!'* and prompt the user with *'Press any key to continue …'*.

Following an *'Access denied!'* and *'Press any key to continue …'* the screen should be cleared, and the user should be given a fresh start to try again.

The password characters entered by the user should be replaced with asterisks '*' to ensure they are hidden from un-authorized eyes. **[3]**

5 Write a C++ program which takes a numeric input between 1 and 999 from the user and prints the equivalent number in English words. **[6]**

Examiner Use

6 Fatima lives in Pakistan and frequently travels to England, USA and Canada. The time differences between the countries are:

Country	Hours	Minutes
England	-7	0
USA	+4	+30
Canada	+11	0

Thus, if it is 10:15 in Pakistan it will be 14:45 in USA.

Write a C++ program that fulfills the following requirements:

- Allows a user to input the name of the foreign country.
- Allows the user to input the local time in Pakistan in hours (H) and minutes (M).
- Calculates the time in the foreign country using the data from the table.
- Outputs the country and the time in hours and minutes.
- Ensures time normalcy is followed; i.e., the hour is incremented after 60 minutes are completed, and the day is incremented after 24 hours are completed.

[15]

Section B

Medium Programs

Examiner Use

7 You work in the IT department of a solar energy solutions company called Greenergy International. The company's sales teams frequently face difficulties in predicting their clients' energy needs. You are tasked with developing an energy consumption calculator that the sales team can use to easily predict their customer's energy consumption. Your portal should be able to predict consumption for any customer's office.

Write a C++ program to fulfill the following requirements. Your program should:

1. Allow a user to enter the number of rooms / sub- spaces in the total office space.
2. Record room / sub- space labels to describe each office sub-space. E.g., Finance, HR, etc. This will be entered by the user.
3. Iterate through each room / sub-sub-space one by one while displaying it's descriptive label to the program user, and ask the user to enter the total number of each kind of appliance installed in the sub-space (list of all possible appliances given in table 1), as well as the estimated daily usage of the appliance in hours and minutes.
    a. E.g., LED Bulbs -> hours: 5, minutes: 30
4. After obtaining the estimated daily usage of each appliance in step 3, your system should compute the total energy consumed by the room in kilowatt-hours.
    a. You may consult any online resource to find the energy consumed in kilowatt-hours using appliance wattage and usage duration.
5. Your system should output the total energy consumed per room as well as the total energy consumed for the entire house.

Appliance / Device	Power Rating (Watts)
LED Bulb	15
Tube Light	30
Fan	70
Printer	50
Laptop Charger	65
Air Conditioner	1500

[20]

Examiner Use

8 A car rental service charges a minimum fee of $25.00 for renting a car for 1 to 5 hours, and charges an additional $5 per hour for every additional hour after the first 5 hours. The maximum charge per day is $120 exclusive of service tax. The company charges an additional $0.50 per hour as service tax when fares are calculated using the hourly rates. Assume that no car is rented for more than 72 hours at a time. If a car is rented for more than 24 hours, then rental is calculated on a daily rate of $110 (inclusive of service tax) instead of the hourly rate.

Write a program that calculates and prints the rental charges for each of three customers who rented cars from this agency yesterday.

- The user should input the hours for which the car needs to be rented by the customer.
- Your program should print the results in a neat tabular format and should calculate and print the total revenue (including tax) of the day's receipts.

Your outputs should appear in the following format:

Cars	Hours	Charges
1	12	56.00
2	34	117.00
3	48	124.00
TOTAL	94	297.00

[20]

Section C

Complex Programs

Examiner Use

9 Write a function called *'zScore()'* that takes a number array of any size in its arguments and returns an array of the same size containing the z-scores of each element in the array.

The z-score is a numeric indicator that measures how far a number is from the mean (i.e., average) value of all the numbers in the collection.

More information on z-scores may be found using the links below:

- How to Calculate Z-Score: Definition (investopedia.com)
- Z-Score: Definition, Calculation & Interpretation - Simply Psychology

[15]

10 Customers may avail public bus services like Speedo Bus that use a card payment system. There are a total of ten stops in the bus's itinerary from the first station to the last station (inclusive). Customers will have to enter their starting and ending points in the program to calculate their fare. The company requires that all customers clear their payments before boarding the bus. Payments are made using an electronic card payment system that maintains a record of each customer's balance.

Write a C++ program that fulfills the functionality described above using the requirements list below. Your program should:

1) Maintain records of all customers (max = 10). This record should include:
    a. A unique customer ID per customer.
    b. The customer's card balance.
2) Allow customers to make deposits to increase their card balance.
3) Compute the customer's fare using their starting and ending stations. The fare should be computed using the following rules:
    a. The fare for the first 2 stops will be Rs.10 per stop.
    b. Subsequent (additional stops) will be charged at Rs.2 per additional stop.
4) If the fare is less than or equal to the balance of the card, the fare will be deducted and a confirmation message will be displayed along with the remaining balance after deduction. Otherwise, an 'Insufficient balance!' message is displayed on the screen instead.
5) If a customer chooses to travel via the service again within the next 30 mins, they will be allowed to travel an unlimited number of stops with just Rs.5.

[15]

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Examiner Use