

(3)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION
DURATION: 2 HOURS

WINTER SEMESTER, 2023-2024
FULL MARKS: 120

CSE 4107: Structured Programming I

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer all 4 (four) questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

1. a) For IUT admission, the information of applicants is stored in a CSV (Comma Separated Values) file named "applicants.csv".
- Each row in the file contains the following fields: (ApplicantID,Score,Name).
 - Students name does not contain any spaces and at most 100 characters long.
 - ApplicantID is a unique positive integer less than 9001.
 - There are at most 9000 applicants, and the input file is not sorted.

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(CO3)
(PO2)

Write a C program to perform the following tasks:

- Read applicant information from the file "applicants.csv".
- Filter out only the eligible applicants (those with a score of 93.5 or more).
- Sort the eligible applicants based on ApplicantID in ascending order.
- Write the eligible applicants to a new CSV file named "eligible.csv", maintaining the same format

A sample input-output file is given in Table 1.

Table 1: Sample input-output for Question 1.a)

applicants.csv	eligible.csv
850,94.0,Alice	101,96.2,Charlie
1450,89.5,Bob	850,94.0,Alice
101,96.2,Charlie	
203,65.3,Eve	

- b) A magic square is a square grid of numbers in which the sum of each row, each column, and the main diagonals is the same. A sample 3×3 magic square is provided in Table 2, where the row-wise, column-wise and diagonal sum is 15.

10
(CO3)
(PO2)

Table 2: A 3×3 magic square

8	1	6
3	5	7
4	9	2

Write a user-defined function that takes a square matrix (as a 2D array) and its dimension as parameters and the function should return 1 if the matrix is magic square, and 0 otherwise.

2. a) A bus company operates two types of buses: Premium and Economy.

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(CO3)
(PO2)

- In a Premium bus, each row contains 3 seats.
- In an Economy bus, each row contains 4 seats.
- Each seat is labeled using a combination of the row letter (A, B, C, ...) and a column number (starting from 1).

For example: The seat numbers of the first row of an economy bus will be A1, A2, A3, and A4, and the seat numbers for the third row of a premium bus will be C1, C2, and C3.

Write a C program that reads the total number of seats and the type of bus and prints the seat layout. The program should print an error message if total seats can not be divided evenly among all the rows. A sample input output is given in Table 3

Table 3: Sample input-output for Question 2.a)

Input	Output
Total number of seats: 12	A1 A2 A3 B1 B2 B3
Type of bus (1: Economy, 2: Premium): 2	C1 C2 C3 D1 D2 D3
Total number of seats: 11	Invalid input
Type of bus (1: Economy, 2: Premium): 2	

b) You are planning to print a message on a poster. The printing company charges only for printing uppercase letters, and the cost for each letter varies. The cost of printing each letter is provided in an integer array of size 26 (where the first element is the cost for 'A', the second for 'B', etc.).

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(CO3)
(PO2)

- Write a user-defined function called *calculateCost* that takes a string and the cost array as arguments and returns an integer indicating the total cost (i.e., the sum of the costs of all the letters in each string).
- Write a C program that reads some strings (each maximum 50 characters) from the user, calculates the cost of each string using the function *calculateCost*, and then prints the string along with its cost, sorted based on the total cost in ascending order.

Input: The first line of the input contains 26 numbers indicating the cost of each letter, next line contains a single integer N, indicating the number of strings. Each of the next N line contains a string.

A sample input-output file is given in Table 4

Table 4: Sample input-output for Question 2.b)

Input	Output
3 7 1 5 9 6 4 2 8 3 7 5 1 6 2 9 4 8 7 3 5 2 1 6 9 4 2 IS IT EASY? IT IS NOT.	IT IS NOT. 37 IS IT EASY? 54

3. a) You are tasked with designing a detailed result processing system for a university. The system needs to manage academic information for multiple students across multiple semesters. The following data must be stored:
 Information for each subject:
- Subject Code: Alphanumeric (e.g. "CSE 4107")
 - Subject Title: Alphanumeric (e.g. "Data Structures")
 - Credit: Floating-point value (e.g. 3.0)
 - Obtained Marks: Floating-point value (e.g. 92.50)
- Information for each semester:
- Semester Number: Integer (1 to 8)
 - Number of Subjects: Integer (maximum of 10)
 - Credit: Floating-point value (e.g. 3.0)
 - Subjects: Array of subject structures (maximum size 10)
- Information for each student:
- Student ID: Integer (e.g. 230041215)
 - Student Name: String (alphanumeric)
 - Semester Information: Array of 8 semester structures (fixed for 8 semesters)
 - Current CGPA: Floating-point value
- Complete the following tasks:
- Define the necessary struct types to represent the above information and declare an array to store data for 100 students.
 - Write a function `findAPlusSubjects(Student student, int semesterNumber)`, which receives a student object and semester number as arguments and prints the subject code for all subjects where the student obtained an A+ grade for the specified semester. A student is considered to have received an A+ in a subject if (obtained marks / credit) ≥ 80 .
- b) Explain the concepts of unions and bit-fields in C. Write a C program that uses a union containing a char variable, and a structure with bit-fields representing the individual bits of a byte. The program should take a character as input and print the binary representation of its ASCII value by accessing each bit through the bit-field structure.
4. a) You have access to a folder in the Student Information System (SIS), where each student's photo is stored. The type of each image file is "jpg" and the student ID is used as the file name (example: 230041119.jpg).
 You are planning to replace the pictures of the next 10 students (based on ID numbers) with your own picture.
 For example: If your ID is 230041119, you will overwrite the pictures of the following students: 230041120.jpg, 230041121.jpg, ..., 230041129.jpg. Each of these files will be replaced with a copy of your own picture. [You may assume there will be always at least 10 students after your student ID.]
 Write a C program that will do this job for you.

5 + 10
(CO3)
(PO2)

5 + 10
(CO1)
(PO1)

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(CO3)
(PO2)

b) A sample C code snippet is shown in Code Snippet 1.

```
1 #include<stdio.h>
2 void f1(char *str){
3     if(*str){
4         //Location #1
5         printf("%c",*str);
6         //Location #2
7     }
8 }
9 int main(){
10     f1("ABC");
11 }
```

Code Snippet 1: A recursive C program for Question 4.b

Determine the output of this code if you add this recursive call $f1(str+1)$:

- Only in location #1
- Only in location #2
- In both location #1 and #2