The Open University of Sri Lanka
Faculty of Engineering Technology
BSE Honours Degree Programme

Department	: Electrical and Computer Engineering
Level	: 3
Name of the Examination	: Final Examination
Course Title and - Code	: Software Engineering Concepts and Programming – EEX3467
Academic Year	: 2023/24
Date	: 22/08/2024
Time	: 9.30am – 12.30pm
Duration	: 3 hrs.

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **four (4)** questions in **five (5)** 06 pages.
3. Answer all **four (4)** questions. Each question carries equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
6. Write answers in clear and concise format appropriately in points/bullet form.
7. This is a Closed Book Test (CBT).
8. Involvement in any activity that is considered as an exam offense will lead to punishment.
9. Use blue or black ink pen to answer the questions.
10. Clearly state your index number in your answer script on every page.

QUESTION 1

Read the following **description** of the *FitnessPro Gym Membership Payment Calculation System* and answer the parts of QUESTION 1.

The 'FitnessPro Gym' offers memberships to two types of members: Regular and Premium. Each member is required to pay their monthly membership fee by the end of each month. The calculation of the monthly fee involves several components based on the type of membership. For Regular members, the monthly fee is calculated as the sum of a base fee Rs. 1000 and the product of an hourly rate, and the number of hours worked. If a Regular member works more than 30 hours in a month, a 10% discount is applied to the total fee. For Premium members, the monthly fee includes an additional Rs. 2000 premium fees on top of the base fee Rs. 1000 and the product of the hourly rate and the number of hours worked. A 15% discount is applied to the total fee if the Premium member works more than 30 hours. There are no additional discounts or late fees considered in this calculation.

a) Draw a flow chart for the algorithm based on the description. (10 marks)

b) The following C program calculates the monthly fee for members based on their type and usage. Each blank in the code is labeled with a Roman numeral (i, ii, iii, etc.). In your answer script, provide only the correct value or statement that should go in each blank, clearly indicating the corresponding Roman numeral. Do not write your answers on the question paper; ensure they are included in your answer script as instructed. (15 marks)

```
#include <stdio.h>
int main() {
   char membership_type;
   int base_fee = 1000,  premium_additional_fee = 2000;
   float regular_discount_rate = 0.10;
   float premium_discount_rate = 0.15;
   float rate_per_hour, number_of_hours, monthly_payment = _____(i)_____;

   printf("Enter Membership Type (R for Regular, P for Premium): ");
   scanf(" %c", _____(ii)_____);
   printf("Enter Rate per hour: ");
   scanf("%f ",_____(iii)_____ );
```

```
    printf("Enter Number of Hours worked: ");
    scanf("%f", &number_of_hours);

    switch (_____(iv)_____) {
        case 'R':
            monthly_payment = base_fee + (rate_per_hour * number_of_hours);
            if (_____(v)_____> 30) {
                monthly_payment *= (1 - _____(vi)_____);
            }
            printf("Your monthly payment: %.2f\n", _____(vii)_____);
            _____(viii)_____;
        case 'P':
            monthly_payment = base_fee + (rate_per_hour * number_of_hours) + ____(ix)_____;
            if (_____(x)_____ > 30) {
                monthly_payment *= (1 - _____(xi)_____);
            }
            printf("Your monthly payment: %.2f\n", _____(xii)_____);
            _____(xiii)_____;
        _____(xiv)_____:
            printf("Error: Please enter a valid membership type (R or P)!\n");
    }

    return _____(xv)_____;
}
```

QUESTION 2

Read the following **description** of the *Online Healthcare Management System* and answer the parts of QUESTION 2.

In an Online Healthcare Management System, various users such as patients, doctors, pharmacists, nurses, and administrators can create their accounts and log in to the system securely. Patients can book appointments, which involves viewing available time slots. They can also request prescription refills as part of viewing their medical history. Additionally, patients can communicate with healthcare providers. Doctors can manage patient records, which includes viewing past appointments. They can prescribe medications, which involves creating new prescriptions. Doctors can also schedule appointments. Pharmacists can access prescription details, which include viewing prescribed medications. They manage medication inventory and process prescription refills. Nurses can update patient records, which includes adding notes to the medical history. They also assist doctors with patient care. Nurses manage schedules, coordinate with doctors and manage patient appointments. Administrators monitor system activities, which include viewing logs and usage statistics. They handle user inquiries or issues, which involve managing user accounts. Administrators also manage healthcare provider schedules. The system ensures a secure and efficient platform for managing healthcare activities, maintaining the confidentiality and integrity of patient information.

a) Identify the actors in the above *Online Healthcare Management System* scenario. (5 marks)

b) Draw a comprehensive Use Case diagram based on the above scenario, incorporating the underlying concepts of include and extend relationships. (12 marks)

c) Suggest and describe three (3) non-functional requirements for this system. (3 marks)

d) Discuss one (1) platitude, one (1) omission, and one (1) ambiguity in the requirements provided in the description. (3 marks)

e) Propose a way to enhance the security measures for the Online Healthcare Management System, ensuring compliance with healthcare regulations. (2 marks)

QUESTION 3

a) List the stages of the software development life cycle (SDLC) and state one document generated as output during each stage. (5 marks)

b) List different Agile methodologies. And for each methodology, mention two key practices associated with it. (6 marks)

c)
Assume you are assigned to test a subscription fee calculator for a digital service. The pricing rules are as follows:

- For ages 5-12, the subscription fee is $50.
- For ages 13-19, the subscription fee is $100.
- For ages 20-40, the subscription fee is $150.
- For ages 41 and above, the subscription fee is $200.

The User Interface (UI) will be as follows (Figure Q3): When a user inputs their age and clicks on the "Calculate Subscription Fee" button, the subscription fee amount will be displayed.

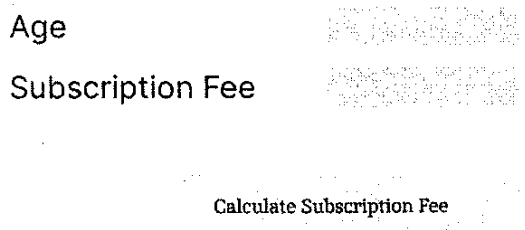

Figure Q3: UI for Subscription fee calculation process

(i) Do the Equivalent Partitioning for input values of age. (5 marks)

(ii) Do the Boundary Analysis for input values of age. (9 marks)

QUESTION 4

The following procedure outlines a pseudocode routine for an algorithm that calculates the total sum and average of valid integers within a specified range from an input array.

```
PROCEDURE CALCULATE_TOTAL_AND_AVERAGE (Array of integers: Numbers)

CONSTANT MINIMUM = 1;
CONSTANT MAXIMUM = 100;
INTEGER index = 0;
INTEGER total_valid = 0;
INTEGER sum = 0;
INTEGER count = LENGTH(Numbers);
REAL average;

DO WHILE index < count
   IF Numbers[index] >= MINIMUM AND Numbers[index] <= MAXIMUM THEN
      total_valid = total_valid + 1;
      sum = sum + Numbers[index];
   ENDIF
   index = index + 1;
END DO

IF total_valid > 0 THEN
   average = sum / total_valid;
   PRINT "Total sum of valid numbers is: ", sum;
   PRINT "Average of valid numbers is: ", average;
ELSE
   PRINT "No valid inputs.";
ENDIF

END PROCEDURE
```

a) Draw a flow chart for the procedure given above. (5 marks)

b) Draw a control flow graph for the procedure given above. (5 marks)

c) Find the Cyclomatic Complexity of the resultant flow graph in Q4.(b). (3 marks)

d) Implement the above pseudocode using standard C syntax. Your code should prompt the user to input the number of elements for an array and then read and store these elements from user input. Include comments to explain key sections and ensure the code adheres to the pseudocode. Your implementation must be correct, well-organized, and follow good programming practices. Make sure to handle input validation and edge cases appropriately. (12 marks)