ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2021-2022**

DURATION: 3 HOURS **FULL MARKS: 100**

CSE 4271: Computer Programming

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

Answer **all 6 (six)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

1. a) Define operator and operand with an example expression. What are the different types of operators in C? Explain four unary operators with examples. 2 + 1 + 4 (CO1) (PO1)

   b) Consider two 8-bit unsigned integer variables, `a = 31` and `b = 32`. Determine the output of each of the following nine bitwise operations: 10 (CO1) (PO1)

   ```
   a & b,  a | b,  a ^ b,  a >> 1,  b >> 1,  a << 1,  b << 1,  ~a,  ~b
   ```

   Show the calculation of each of the operations using the binary representation of `a` and `b`.

   c) Write down the differences between the following operators: 3 × 2 (CO1) (PO1)

   i. `&` and `&&`

   ii. `=` and `==`

   iii. `~` and `!`

2. a) Suppose you need to calculate the electricity bill of a customer. The customer ID, name, and unit consumed by the user will be taken as input. The charges are shown in Table 1.

Table 1: Electricity Bill Rate for Question 2.a)

Unit	Charge/Unit (USD)
Upto 99	0.90
100 to 299	1.20
300 to 600	1.70
More than 600	2.20

If the bill exceeds USD 400, then a surcharge of 12% will be added. The minimum bill should be USD 90.

i. Design an algorithm to solve the above mentioned problem. Also, draw the flowchart for this algorithm. 3 + 3 (CO2) (PO2)

ii. Write a C program for the algorithm you designed in Question 2.a)i. 5 (CO2) (PO1)

b) Write the syntax for a `switch` conditional statement in C. Write a C program to create a menu driven calculator that performs basic arithmetic operations (addition, subtraction, multiplication, and division) using switch case. The calculator should take input of two integers and an operator from the user and perform the operation according to the operator. Your program should also check for invalid input. 6 (CO1) (PO1)

3. Suppose 10 of your friends created a programming group and you want to store the information of the members. You want to store two information: name of a member and the number of problems solved by the member.

a) What is the difference between a structure and a union? Write the syntax to create a structure and a union. 2 + 2 (CO1) (PO1)

b) Write the C code fragment to create a structure named `groupMembers` to store the information of the programming group described above. Calculate the memory space required for your created structure. 3 + 2 (CO1) (PO1)

c) Write a C program to take input of the information about all the members and print a list containing names of the members with their number of solved problems. Also, find the member who had solved the highest number of problems. 8 + 5 (CO2) (PO1)

4. a) What is the syntax for creating a user-defined function in C language? Write a C program to add two numbers by calling a function named `addition`. The prototype of the function is as follows: 1 + 4 (CO1) (PO1)

```
int addition(int a, int b);
```

b) An argument may be passed to a function in one of the two ways, 'pass by value' and 'pass by reference'. Explain these two. 7 (CO1) (PO1)

Now, consider the program shown in Code Snippet 1:

```
1  void swap(int firstVariable, int secondVariable)
2  {
3    int tempVariable;
4    tempVariable = firstVariable;
5    firstVariable = secondVariable;
6    secondVariable = tempVariable;
7  }
8
9  int main(void)
10 {
11   int a = 40, b = 20;
12   printf("before swap: value of a: %d , value of b: %d\n", a, b);
13   swap(a, b);
14   printf("after swap: value of a: %d, value of b: %d\n", a, b);
15   return 0;
16 }
```

Code Snippet 1: C Program for Question 4.b)

What will be the output of the code? Is this `swap(int, int)` function using 'pass by value' or 'pass by reference' for its arguments?

c) Convert the code in Question 4.b) so that it uses the other type of passing of arguments. What will be the output of the converted code? 5 (CO1) (PO1)

5. a) What is a pointer in C? Write the syntax for declaring a pointer. Write the syntax of four functions related to dynamic memory allocation in C. 4 (CO1) (PO1)

b) Consider the memory representation in Figure 1 for the variables in Code Snippet 2: 4 (CO1) (PO1)

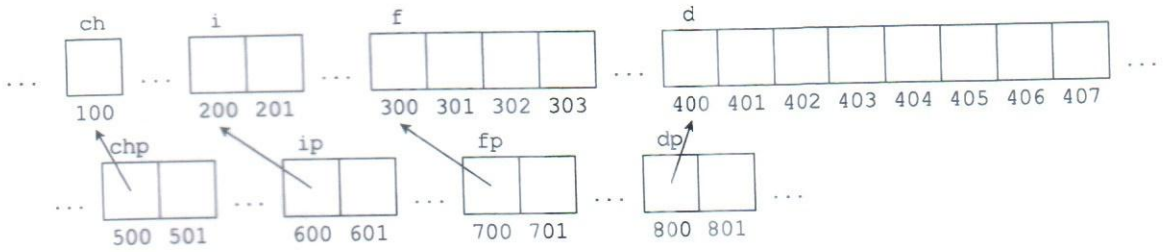

Figure 1: Partial Memory Representation for Question 5.b)

```c
#include <stdio.h>

int main()
{
  char ch = 'a', *chp;
  int i = 10, *ip;
  float f = 12.34, *fp;
  double d = 12.3456, *dp;
  // ... operations related to Figure 1 took place here

  printf("value of ch: %c\n", *chp);
  printf("value of i: %d\n", *ip);
  printf("value of f: %f\n", *fp);
  printf("value of d: %lf\n", *dp);

  printf("Address of ch:  %ld, and address of chp: %ld", chp, &chp);
  printf("Address of i:  %ld, and address of ip: %ld", ip, &ip);
  printf("Address of f:  %ld, and address of fp: %ld", fp, &fp);
  printf("Address of d:  %ld, and address of dp: %ld", dp, &dp);

  return 0;
}
```

Code Snippet 2: C Program for Question 5.b)

What will be the output of the code?

c) Write a C program to open a file named "samplefile.txt" and write the following contents: 4 (CO1) (PO1)

```
Hello everybody
Hello again!!!!
```

Also, write the code to read the contents of the same file.

6. a) Why do we need to use a loop in programming? How many types of loops do we have in C programming? Write the syntax for each of them. 5 (CO1) (PO1)

b) Consider the following two statements in the C program given in Code Snippet 3: 4 (CO1) (PO1)

```c
int arr[4][3]={{1,2,3},{2,3,4},{3,4,5},{4,5,6}};
char division[8][15] =  {"Barisal", "Chittagong", "Dhaka", "Khulna",
   "Mymensingh", "Dhaka", "Rajshahi", "Rangpur"};
```

Code Snippet 3: Code Statements for Question 6.b)

Draw the memory representation of these two arrays with the values.