

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**WINTER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4107: Structured Programming I**

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

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Write down the output of the following code:

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```
#include<stdio.h>
void change_value(int *q){
    int *p[] = {q+3, q+2, q+1, q};
    int **db_p = p;
    *(*p - 1) = (*p[0])++;
    *p[2] = db_p - p;
    **(p+3) = **db_p + 5;
    return;
}
int main(){
    int arr[5] = {10, 20, 30, 40};
    int i;
    change_value(arr);
    for(i = 0; i < 4; i++){
        printf("%d ", arr[i]);
    }
    return 0;
}
```

Figure 1: Code for Question 1(a)

- b) Write a program where the main function takes a string as input from the user. It then passes the string to the user-defined function *int myatoi(char \*p)* that converts the string to an integer and returns the value like the library function *int atoi(char \*str)*. The program then prints the returned value. If the given string starts with a character that is not a number, then the function returns zero. On the other hand, if the given string starts with a number, then the function will take all the consecutive numeric characters for conversion until it reaches the end of the string or a non-numeric character is encountered. Some examples are given below:

12

Enter string: 123 Output: 123	Enter string: abc123 Output: 0	Enter string: 123abc Output: 123	Enter string: 12ab34 Output: 12
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Figure 2: Sample outputs for Question 1(b)

2. a) The people of Wakanda want to send a secret message to the members of Avengers. But they are fearful that the spies of Thanos will intercept their message and read it. So, they have asked you to encrypt their message so that the spies cannot understand it. Now, write a program where a string will be taken as input from the user. Take the 2's complement of the ASCII code of each of the characters in the string and write it in a file.

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- b) Discuss the storage type modifiers auto, register and static.

9

3. a) Write a program where the main function takes an integer as input. It then passes the value to a **recursive** function that prints the binary representation of the number. **Do not use any global variable.** [Hint: the main task of the recursive function will be to divide the given number by 2]

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- b) A square matrix is said to be an upper triangular matrix if all the entries below the main diagonal is zero. Two examples of upper triangular matrices are given below: 12
- |   |   |   |    |   |
|---|---|---|----|---|
| 1 | 3 | 1 | 8  | 4 |
| 0 | 3 | 2 | -2 | 2 |
| 0 | 0 | 7 | 6  | 1 |
| 0 | 0 | 0 | 4  | 2 |
| 0 | 0 | 0 | 0  | 9 |
- |   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 2 | 9 | 1 |
| 0 | 0 | 3 | 2 |
| 0 | 0 | 0 | 7 |

Figure 3: Examples of upper triangular matrices

Write a program that takes an integer  $n$  as input from the user. It then takes a  $n \times n$  matrix as input and checks whether it is a upper-triangular matrix or not.

4. a) You have been assigned the task of developing a grading software to calculate the grades of the students. The software will take the mark  $m$ , ( $0 \leq m \leq 100$ ) obtained by a student as input and then print the grade of the student according to the following table. You have also been instructed to only use switch case in the program. The use of if condition will not be accepted by the clients. 10

Grade	Marks
A	70-100
B	50-69
C	40-49
F	0-39

Figure 4: Table for Question 4(a)

- b) Take an integer  $n$  as input from the user. Now take a  $n \times n$  array as input. Now print the content of the array in a spiral form. An example is given below: 15

```

Enter Size: 4
Enter Array:
1  2  3  4
5  6  7  8
9  10 11 12
13 14 15 16
Output: 1 2 3 4 8 12 16 15 14 13 9 5 6 7 11 10

```

Figure 5: Sample output for Question 4(b)

5. a) Tapos created a program to write down his and some of his friends' quiz, mid semester and semester final marks in a file using binary stream. The information was stored in the following manner: 13  
At first, he wrote an **integer** that contained a Student ID. Next, he wrote 4 **double** values that were the 4 quiz marks of that person. Then he stored 2 more **double** values where the first one was the mid-semester exam marks and the second one was the semester final exam marks. This was followed by a newline **character** to represent the end of the information for that person.  
The information of the next person started immediately after the newline character following the same format.  
Tapos now wants to find the average of the mid-semester exam marks all the people in his file. Help Tapos out by writing a program that will perform this task.
- b) What is programming language? Discuss the three classes of programming language. 6  
c) Differentiate between binary and character stream. List their advantages and disadvantages. 6
6. a) Take two characters as input and perform the three binary bitwise operations on them to create three new characters. Print the number of 1s and 0s in the binary representation of the ASCII code of the new characters. 15  
b) Discuss how the shift operators can be used to perform certain division and multiplication operations with suitable examples. 10
7. You have been assigned the task of organizing the data of each of the departments of IUT. You will need to store the following data:  
For each department you will have to store:
- Name of the department (Maximum 50 characters)
  - Number of B.Sc. Students
  - Information of the BSc students (Maximum 500 students)



- Number of M.Sc. Students
- Information of the M.Sc. students (Maximum 50 students)
- Number of PhD Students
- Information of the PhD students (Maximum 20 students)

Create a structure called *department* that can store all of these data. Since, there are six departments, you will need an array of this structure type. For each student, the following data must be stored:

- Name of the student (Maximum 50 characters)
- Student ID (Maximum 10 characters)
- Current CGPA

These data will be stored in a structure called *student*. Variables of *student* structure will be used within the *department* structure to hold the information of all the B.Sc., M.Sc. and PhD students.

- Create the required structures according to the given specifications and create variables so that all the information can be stored. 7
  - Write a function that will print maximum and minimum CGPA of any student in any department of IUT. 8
  - Write a function that will take the name of a department as input and print the name of all of its students (B.Sc., M.Sc. and PhD) **alphabetically**. 10
8. a) The following codes gives the output '210'. Rewrite the code so that the output is '211'. **Do not change any of the printf() statements.** 7

```
#include<stdio.h>
#define MAX(i, j) i > j ? i : j
int main(){
    printf("%d", MAX(1, 2));
    printf("%d", MAX(1, -1));
    printf("%d", MAX(100 && -1, 0));
    return 0;
}
```

Figure 6: Code for question no. 8(a)

- Write the output of the following code and also rewrite the code so that the output is:  
4 5 6 23 24 99 8

```
#include<stdio.h>
enum colors {blue, orange, purple, cyan, crimson, burgundy};
int main(){
    printf("%d ", blue);
    printf("%d ", orange);
    printf("%d ", purple);
    printf("%d ", cyan);
    printf("%d ", crimson);
    printf("%d ", burgundy);
    return 0;
}
```

Figure 7: Code for Question 8(b)

- Write a code that takes an integer  $n$  as input and determines if  $n$  is a power of 3. [Check if  $n == 3^a$ , where  $a \geq 0$ ]. 10