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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4301: Object Oriented Programming

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Assume that you are asked to develop a part of a program which stores the information of a hospital which follows the following scenarios. You can add necessary member functions and variables which are not mentioned explicitly in the scenarios. 25

In a hospital there are a number of doctors and admitted patients. Each admitted patient receives care from one doctor. On the other hand one doctor can give care to multiple patients. Assume that **MAX_NO_OF_DOCTOR** in any hospital can be 100 and each doctor can serve **at most** 20 patients.

Create **Hospital**, **Doctor** and **Patient** class which serves the above requirements. Each of the classes has a member variable called **name [**e.g. the member variable **name** of **Hospital** class will store the name of the hospital**].** Each patient has a member variable called **patientId.** It stores unique Id for patient, no two patient can have same patientId.

Write a **public** member function of **Hospital** following prototype **bool admit(Patient p, int DoctorIndex);** it assigns the Patient object p under that doctor of the hospital identified by **DoctorIndex**. The **admit** function will check whether the Doctor is valid (whether DoctorIndex is present in the hospital) and if valid whether he/she can give care to another patient or not (**remember** !!! there is a limit on highest number of patients, one doctor can give care to at any moment). If fails to assign the patient **admit** function will return **false** otherwise it returns **true**.

Write a **public** member function of **Hospital** following prototype **bool discharge(int patientId);** it discharges (removes) the Patient object p identified by unique **patientId** from the assigned doctor (assigned by admit function) of the hospital. (Thus that doctor can give care to one new patient now). If patient is not found then discharge function will return **false** otherwise it returns **true.**

Write a **public** member function of **Hospital** following prototype **void showStatus(void);** it will print hospital name with total count of patients and doctors present as well as all the doctors information with their assigned patients**. Sample output** is in the following for a hospital "IUT Medical Center" which has 2 doctors and 4 patients currently.

```
IUT Medical Center
Total Admitted Patient: 4
Total Doctor: 2
-----
Dr. X has following patients:
Mr. A
Mr. B
Mrs. C
-----
Dr. Y has following patients:
Mr. D
```

2 a) Create a class called **Rectangle**. The class has floating point attributes length and width, each of which defaults to 1.0. It has member functions that calculate the **area** and **perimeter** of the rectangle. It has set and get functions for both length and width. It should be noted that, class should give necessary protection so that none can set the length and width of the rectangle smaller than 0.0 and larger than 20.0. 10

b) Create a more sophisticated rectangle class than the one in question 2(a), which stores the Cartesian coordinates of the four corners of the rectangle. The constructor calls a set function that accepts four sets of coordinates. Verify that each of these coordinates falls into the first quadrant and none of the x or y coordinates is larger than 20.0. Also verify that the supplied coordinates in fact creates a rectangle. If the length and width are same for the rectangle, then it is a Square. Create a function which checks whether the rectangle is a square or not. 15

Hint: Distance between two points is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

3. a) Write short notes on 10
   i. Function Overloading
   ii. Encapsulation
   iii. Polymorphism
   iv. Inheritance

b) Create a class called "**myString**" with appropriate constructor (s). The class has a member of char pointer which points to the memory containing a sequence of characters. However, you have to overload the necessary operators for **myString** class to tackle the following expressions: 15

```
s1=s1 + s2 ;
s1= "iut" + s2;
s1 += s2;
if( ! s1) cout<<"Empty string";
cout << s1[2];
cout << s1;
```

Where s1 and s2 are objects of the myString class.

4. a) Consider a book shopkeeper has total of 100 different books to sell. You have to develop a software to manage his business in c++. 20

Shopkeeper can enter into the system by providing his username and password (default username is "admin" and password is "123"). However, Shopkeeper can change the username or password later on.
Shopkeeper can update inventory and check reports. For each Book the following information should be stored: book id, book name, author, quantity, unit price.
Now implement a system that manages the bookshop by shopkeeper which has the following basic functionalities:
1. Shopkeeper can use this system to update the inventory after selling a book.
2. When the numbers of any book in stock is below 10, a warning message will be shown displaying the book name and author name.
3. Shopkeeper can update the inventory after the delivery of goods. (new copies of existing books are delivered)
4. The total income can be calculated based on the unit price and quantity of books that he sold.
Hints:
You may need multiple classes to implement the whole system.
NB: Don't make any attribute public for any class.

b) What is pass by reference? Explain with necessary examples. 5