Indian Institute of Information Technology Vadodara

B. Tech (CSE/IT) Semester III (Autumn 2021-22)

Examination: End Semester Examination (Remote Session)

Course ID: CS 201

Course name: Object Oriented Design and Programming

Full Marks: 60

Date: 05.01.2022

Exam Slot: 10:45 – 11:45

**Exam Duration**: 60 minutes

Scan & Upload: 11:45 – 12:00

Instructions

1. **Attempt ALL questions**.

2. Use a Notebook to write the answers to Remote session test.

3. Answer all questions in the same Notebook. Answers should be in Order.

4. Answers should be readable, else they may not be considered for grading.

5. All answered pages should be scanned properly. Please check the scanned copy before submitting.

6. The final PDF uploaded should contain all pages sequentially arranged.

7. The uploaded PDF file should be renamed as **courseid_rollno.pdf**.

8. Late submission is <u>not allowed</u>, and would be penalized during grading.

Q.1. Diagram: Consider the following piece of text

An academic institute is in a process of installing a login-authenticated *Course Registration System* for the various undergraduate programs run by the various departments of the institute. The system is administered by a *course coordinator* who should be a faculty of some department. Before the start of a semester, the faculties of different departments offer various courses that they intend to undertake along with credits, prerequisites, and the (preferred) weekly schedules. At some specified duration, the students of the institute, depending on the credit requirements and interest, register for these courses. After the deadline, the course registration process is ended by the course coordinator, and various reports along with time tables are generated for the semester.
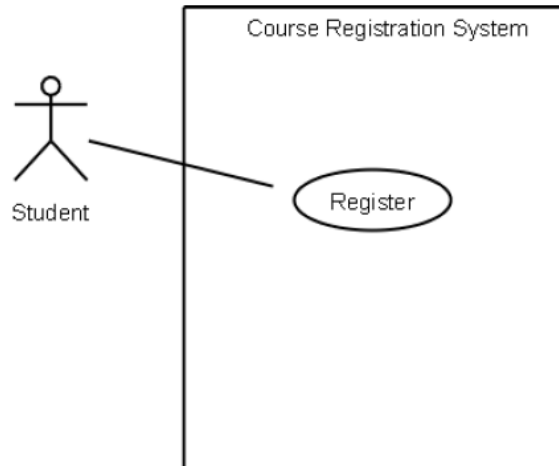
An incomplete use case diagram for the system is given above. Develop the following Documents

   (a) Complete the use case diagram for the above problem text.   **[15 marks]**

   (b) Specify use case documentation for "Register" use case.   **[15 marks]**

Q.2. Programming:

(a) Define a **Question** class, which stores a multiple-choice question having one correct answer. Each question has a complexity (difficulty) level.

Use the **Question** class to define a **Quiz** class. A quiz can be composed of up to 10 questions. Define the add method of the Quiz class to add a question to a quiz.

Define the **giveQuiz** method of the **Quiz** class to present each question in turn to the user, accept an answer for each one, and keep track of the results.

Define a class called **QuizTime** with a **main()** method that follows a menu based approach to populates a quiz, presents it by asking questions randomly, and prints the final results.

[20 Marks]

(b) Modify your program so that the complexity level of the questions given in the quiz is taken into account.

Overload the **giveQuiz** method so that it accepts two integer parameters that specify the minimum and maximum complexity levels for the quiz questions and only presents questions in that complexity range.

Modify the **main()** method to demonstrate this feature.

[10 Marks]

IIIT Vadodara
CS203: End Remote Exam
Total Marks: 25

January 5, 2022

1 Problem

Given below two recurrence relation with bound
(a)$T(n) = 2T(n/2) + n^2 logn$ (**Guess:-** $nlogn$)
(b)$T(n) = T(n-1) + n^2$ (**Guess:-**$nlogn$)

1. Prove the upper bound given for each recurrence relation is not true.
   You can only apply the **substitution method** (Substitution method: Make a guess then prove that your guess is correct).
   (You will not get marks, if you follow iterative substitution, Master method or Recursion Tree)
   (Marks: 2+2=4)

2. Make a right guess for the above recurrence relation and prove it by the **substitution method** that your guess is correct.
   (I will not check your answer if you use any other method for giving the bound) **(Marks: 2+2=4)**

2 Problem

You have to send your "full name(First, Middle (if any) and Last Name)" in encrypted form. (Those who have more than 3 words in his/her name, can take any three words, but write which word you are picking).

Following steps need to be followed for finding two random numbers:
1. Take your roll number,
2. Find the sum of the digit of your roll-number (S)
3. Compute R=S % 5. If the remainder is zero, then take R as 3, Otherwise, take whatever will be the remainder(R).
4. From R, Generate $T = R + 4$.
5. Thus you have two random Numbers R and T.
6. Add this R and T alternatively in number of frequency of character of your name.

For Example: If 202051208 S=20, R=S%5=0, then R is 3 and T is 7.
If 202051207, S=19, R=S%5=4, then R is 4 and T is 8.
Name :- Aman Roll-No (202051207)
Count the number of frequency of each character and show the table as

| I	II	III
Character	Frequency of Character	After adding value "R" or "T" in column "II"
A	2	6
M	1	9
N	1	5

Show the Huffman tree and the number of bits for each character when you use the variable encoding technique. **(Marks:- 2+3+4=9)**

3   Problem

Write the recursive structure of the Floyd Warshall Algorithm and its complexity.

Apply Floyd Warshall Algorithm to find shortest distances between every pair of vertices in a given edge-weighted directed Graph. .

Show all the matrices {D[0], D[1], ...} for getting the final solution. **(Marks: 3+5=8)**
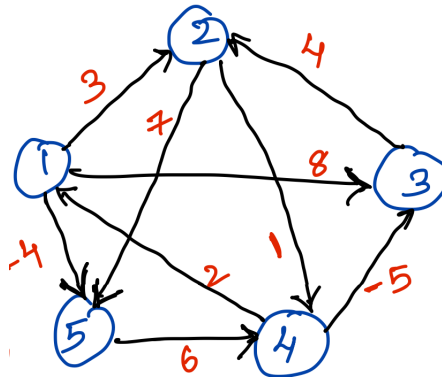
① $T(n) = 2T(n/2) + n^2 \log n$

Guess $T(n) = n \log n$

$$\leq c n^2 \log n$$

$\forall m < n,$ guess is true

$m = n/2$

$$T(n/2) \leq c \frac{n}{2} \log n/2$$

$$T(n) = 2T\left(\frac{n}{2}\right) + n^2 \log n$$

$$\leq 2\left[c \frac{n}{2} \log \frac{n}{2}\right] + n^2 \log n$$

$$\leq c n \log \frac{n}{2} + n^2 \log n \quad \text{denominator}$$

$$\leq n^2 \log n \quad \text{not}$$

Our guess is^correct.

Right Guess

$$T(n) \leq c \, n^2 \log n$$

$$\forall \, m \leq n \qquad m = n/2$$

$$T\left(\frac{m}{2}\right) \leq c \, \frac{n^2}{4} \log \frac{n}{2}$$

$$T(n) = 2 \, T\left(\frac{n}{2}\right) + n^2 \log n$$

$$\leq 2 \left[\frac{n^2}{4} \log \frac{n}{2} \right] + n^2 \log n$$

$$\leq \frac{n^2}{2} \log \frac{n}{2} + n^2 \log n$$

$$\leq n^2 \log n = O(n^2 \log n)$$

Our guess is true

② $T(n) = T(n-1) + n^2$

Guess is $n \log n$

$T(m) = T(n-1)$

$T(n-1) \leq c(n-1) \log(n-1)$

$T(n) \neq T(n-1) + n^2$

$\leq c(n-1) \log(n-1) + n^2$

$\leq cn \log(n-1) - c\log(n-1) + n^2$

$\leq O(n^2)$

Our guess is not true.

Right Guess, $T(n) = O(n^3)$

$\forall m, \quad m = n-1$

$T(n-1) \leq c(n-1)^3$

$T(n) = T(n-1) + n^2$

$\leq c(n-1)^3 + n^2$

$\leq c(n)^3 - 3n^2 + 3n - 1 + n^2$

$\leq cn^3$

③
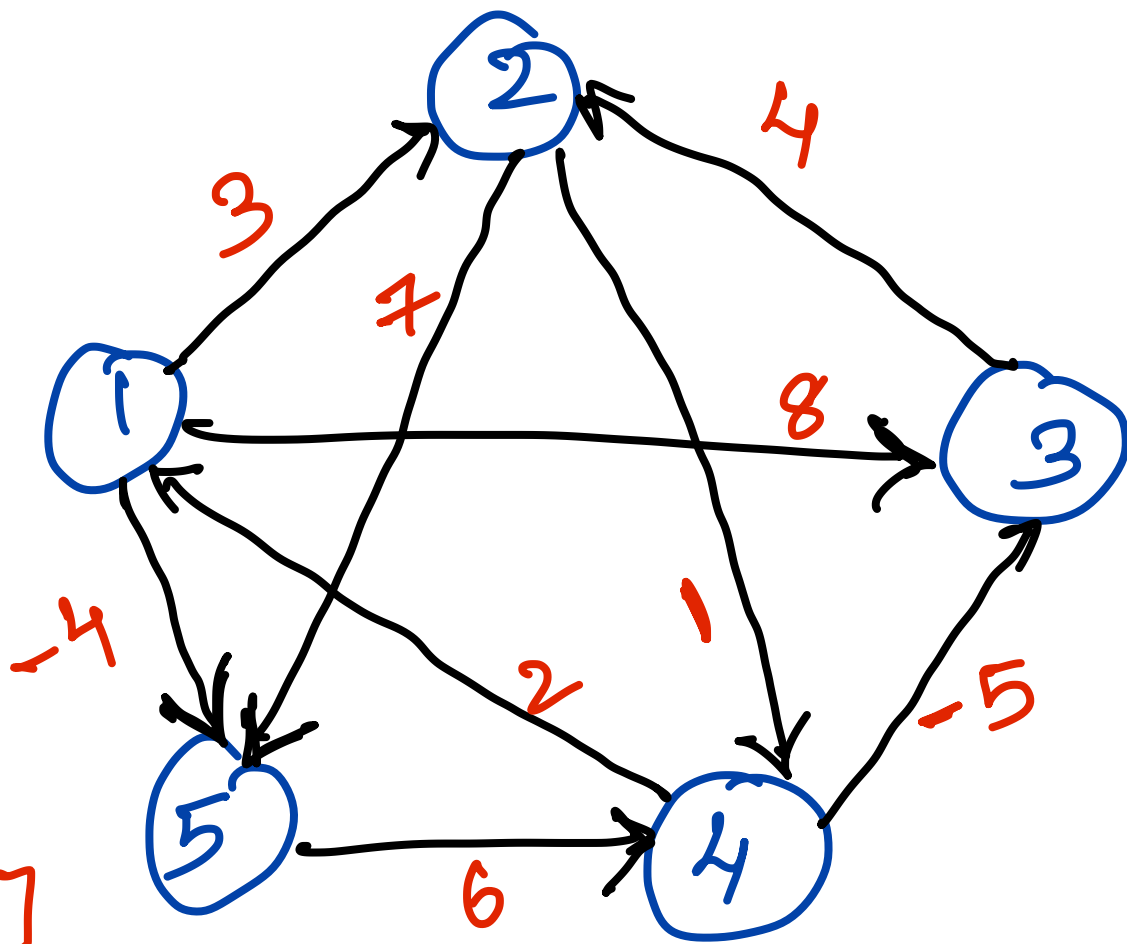
D[0]

	1	2	3	4	5
1	0	3	8	∞	-4
2	∞	0	∞	1	7
3	∞	4	0	∞	∞
4	2	∞	-5	0	∞
5	∞	∞	∞	6	0

D[1]

	1	2	3	4	5
1	0	3	8	∞	-4
2	∞	0	∞	1	7
3	∞	4	0	∞	∞
4	2	5	-5	0	-2
5	∞	∞	∞	6	0

D[2]

	1	2	3	4	5
1	0	3	8	4	-4
2	∞	0	∞	1	7
3	∞	4	0	5	11
4	2	5	-5	0	-2
5	∞	∞	∞	6	0

D[3]

	1	2	3	4	5
1	0	3	8	4	-4
2	∞	0	∞	1	7
3	∞	4	0	5	11
4	2	-1	-5	0	-2
5	∞	∞	∞	6	0

D[4]

	1	2	3	4	5
1	0	3	-1	4	-4
2	3	0	-4	1	-1
3	-7	4	0	5	3
4	2	-1	-5	0	-2
5	8	5	1	6	0

	1	2	3	4	5
1	0	1	-3	2	-4
2	3	0	-4	1	-1
3	7	4	0	5	3
4	2	-1	-5	0	-2
5	8	5	1	6	0

Recursive Def^n

$$F[i, j, 0] = 0 \quad \text{if } (i == j) \text{ and}$$
$$C[i, j] \text{ otherwise}$$

$$F[i, j, k] = \min \left\{ F[i, j, k-1], \right.$$
$$\left. F[i, k, k-1] + F[k, j, k-1] \right\}$$

Indian Institute of Information Technology Vadodara

End Sem Examination-Autumn-2021-22
Specialization: B. Tech. (CSE & IT)
Course Code: EC-201 (Digital Logic Design)

Time: 1 Hours   Date: 07/01/2022   Max. Marks: 50

Read the instructions carefully.
- **Attempt ALL the questions. Each question carry 10 Marks.**
- **OnlineStudnets: Take a fresh Notebook to write the answers for all sessions in sequential manner. On top of each page, write Institute ID, Name and Signature. Evaluation will not be done for pages without the detail.**
- **Offline Students: Do the same as per the answer provided.**
- **Write each new answer in the new page.**
- **Scan the pages and save in pdf format with file name: EndSem_EC201_Student Roll no._Name_Section 1/2 _Campus**

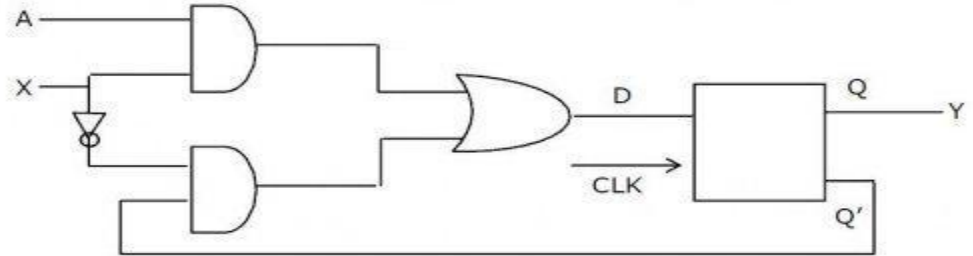| 1.	a)For the given logic circuit, Find out the value of Y.
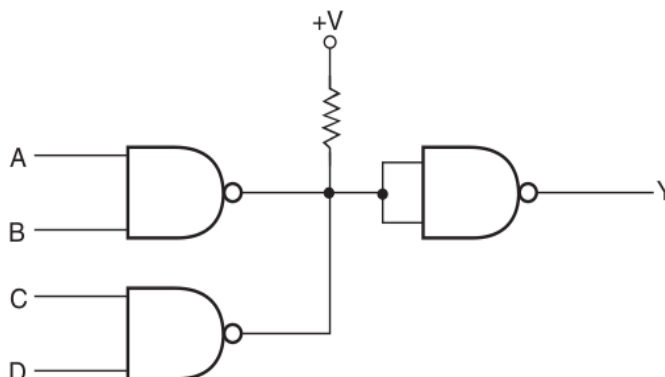
b) Simplify the following equation
PQRS+PQR'S'+PQRS'+PQR'S+PQRST+PQR'S'T'+PQR'ST

2.	a) For given function Z(P, Q) = Σ 0, 2 . Find the product of the sum of Z(P,Q) and also find the POS and SOP of Z' (P, Q).

b) How many flip-flops are required to make a MOD-32 binary counter?

| 3.	a) For a given positive edge triggered D FF.

Consider the following timing diagram. Let A_i represent the logic level on the line A in the i-th clock period. Let A' represent the complement of A. The correct output sequence on Y over the clock periods 1 through 5 is
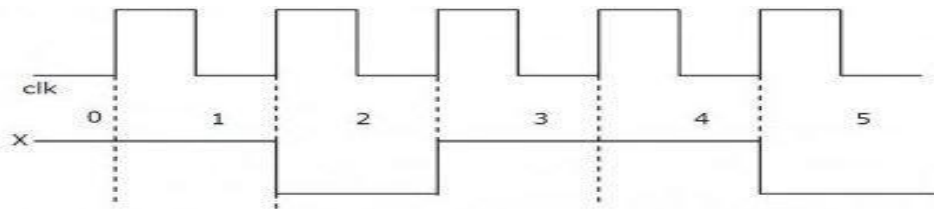
b) Write VHDL code to realize the XOR, XNOR and to check the functionality by simulating the design.

4.	a) Following circuit given , Find out state table and diagram
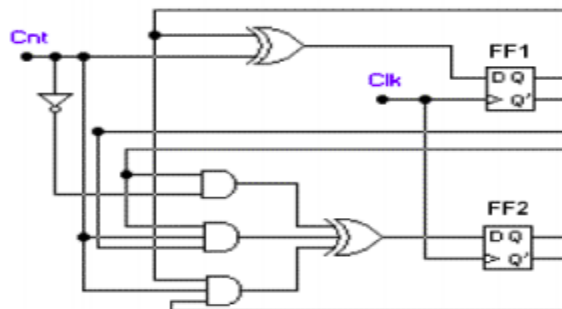
b) Following table given, Design a circuit using any flip-flops

Present State	Next State		Output	
	X = 0	X = 1	x = 0	x = 1
Q0 Q1	Q_0 Q_1	Q_0 Q_1		
0 0	0 0	0 1	0	0
0 1	0 0	1 0	0	0
1 0	1 1	1 0	0	0
1 1	0 0	0 1	0	1

| 5. | a) Design n-bit binary adder-subtractor. Where n is the last digit of your phone number. |

b) The next state table of a 2 bit saturating up-counter is given below.

Q_1	Q_0	Q_1^+	Q_0^+
0	0	0	1
0	1	1	0
1	0	1	1
1	1	1	1

The counter is built as a synchronous sequential circuit using T flip-flops. Find out the value for T1 and T0.

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY VADODARA

END-SEMESTER EXAM: AUTUMN 2021

B.TECH. III SEMESTER (GANDHINAGAR & DIU CAMPUS)

MA 201: PROBABILITY AND STATISTICS

MAX MARKS: 15
Duration: 60 MINUTES

INSTRUCTIONS -

1. ATTEMPT **ANY THREE** QUESTIONS. ALL QUESTIONS CARRY **ALMOST** EQUAL MARKS **(5+ 5 + 5 Marks).**
2. USE OF SCIENTIFIC-CALCULATOR/MATLAB/OCTAVE IS ALLOWED ONLY FOR CALCULATION PURPOSES. THEREFORE, WRITE THE STEPS PROPERLY.
3. ATTEMPT ONE QUESTION AT ONE PLACE. TRY TO MAINTAIN THE QUESTION ORDERING.
4. WRITE YOUR ROLL NO AND PAGE NO WITH SIGN.
5. SCAN THE PDF FILE, RENAME IT AS **MA201_ENDEXAM_YOURINSTITUTEID_NAME.PDF**
6. UPLOAD YOUR **MA201_ENDSEMEXAM_** FILE TO THE GOOGLE-FORM. 15 MINUTES IS GIVEN FOR UPLOADING.

Qus - 1: A manager evaluates effectiveness of major hardware upgrade by running a certain process 5 times before the upgrade (sample $X = [12, 8, 6, 29, 57]$) and 5 times after it (sample $Y = [5, 3, 15, 74, 2]$). Based on these data, the average running time is 22.4 minutes before the upgrade, 19.8 minutes after it. Historically, the standard deviation has been 2.0975 minutes, and presumably it has not changed. **(Assume x = 95% or x = 90% confidence interval if your roll number is odd or even).**

(a) Construct a $x\%$ confidence interval for population mean of the sample X and as well as for Y .

(b) Construct a $x\%$ confidence interval for difference of population mean of the samples X and Y. Why the margin for confidence interval in (c) should be more than that in (a)?

(c) Looking at (c), was the hardware up-gradation successful with $x\%$ confidence (or $(1 - x)\%$ level of significance)?

(d) Find the Pvalue and claim whether hardware upgrade was successful or not?

(WRITE THE STEPS CLEARLY, BEFORE CALCULATIONS)

Qus - 2: A sample of n observations is collected from a continuous distribution with density $f(x) = \lambda^2 x e^{-\lambda x}$ for $x > 0$.

(a) Find the estimate of λ by maximum likelihood method.

(b) Name the distribution f(x) and estimate λ by moment method (Use the mean formula directly for the distribution).

(c) Are both the estimates in (a) and (b) the same? Find the error estimation $std(\widehat{\lambda})$.

(d) Calculate $\widehat{\lambda}$ and $std(\widehat{\lambda})$ for the sample **X of size 4** generated from your roll number. If your roll number is **202051001** then generate the sample of size $X = [20, 20, 51, 101]$.

(WRITE THE STEPS CLEARLY, BEFORE CALCULATIONS)

Qus - 3: Suppose a discrete random variable X is the outcome of a three-faced dice (sample space of X is $\Omega \equiv \{0, 1, 2\}$).

The PDF of X is given by $\Pr\{X = 0\} = 1/5$, $\Pr\{X = 1\} = 3/5$, $\Pr\{X = 2\} = 1/5$.

(a) Find probability of the outcome $X = 1$ occurs 2 times, and $X = 2$ occurs 3 times in 6 trials?

(b) Find probability that the outcome $X = 1$ occurs second time in $6th$ trial.

(c) If this dice is rolled $n = 90$ times, find $\Pr\{M_n \geq 424/375\}$ using the central limit theorem where $M_n = (X_1 + X_2 + ...X_n)/n$ and X_k is the kth trial of the random variable X.

(For (a), (b) , WRITE THE FORMULAS ONLY AND OMIT CALCULATIONS. For (c), WRITE THE STEPS CLEARLY)

Qus - 4: Are the continuous random variables X and Y, whose joint PDF is given as $f_{X,Y}(x, y) = C$ for $0 < x < y < 1$, independent? Find $E[X]$, $E[Y]$ and $E[XY]$

OR

Qus - 4: Find $E[X]$, $Var[X]$, $E[Y]$, $Var[Y]$, $Cov[X,Y]$ of the discrete random variables X and Y, whose joint PDF is given as follows:

$$
\begin{bmatrix}
 & & \mathbf{X} & \mathbf{X} \\
\mathbf{P_{X,Y}(x,y)} & & \mathbf{0} & \mathbf{1} \\
\mathbf{y} & \mathbf{0} & 0.24 & 0.26 \\
\mathbf{y} & \mathbf{1} & 0.12 & 0.38
\end{bmatrix}
$$

(WRITE SOME STEPS. YOU CAN USE MATLAB OR https://octave-online.net/ in checking the answers.)

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Indian Institute of Information Technology, Vadodara

END SEM Exam

Environment Science (SC 201)

Time: 01: 00 hr.   **Total Marks: 15**

I. Critically discuss the National Action Plan on Climate Change of India (1x5=5 marks)

II. Write the role of various stakeholders in E-waste management system in India (1x5=5 marks)

III. Discuss the historical development of Climate Change Policy (1x5=5 marks)