



# Indian Institute of Information Technology Vadodara

## Gandhinagar + ICD

**Course ID:** CS 201  
**Full Marks:** 30

**Course name:** Object Oriented Design and Programming  
**Date:** 07.11.2023  
**Exam Duration:** 120 minutes

### Instructions:

- Attempt All Questions Sequentially
- 5 Marks would be deducted if the answers are not in sequential order
- Follow the "Remarks" mentioned in the last page. Evaluation would be done based upon the maximum permitted lines only
- Precise and to-the-point answers are encouraged
- Scan and Upload in Google Classroom for ICD campus students only.

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1. What are the challenges for software engineering. → See slides [2]

2. Mention four points on why object-oriented approach is suitable for a software development → See slides [4]

3. Differentiate between the following: → See slides  
i. Dynamic and Static Polymorphism  
ii. Is-A and Has-A relationship [4]

4. Draw a use-case diagram for the below mentioned scenario, Try to Draw in the link provided by the sir in whatsapp group [4]

- i. Students
  - a) Registers for a Course
  - b) Students must provide name, roll, email, and batch as mandatory information
  - c) After registration,
    - a. A password would be mailed to the email address
  - d) Members should login to Moodle account
  - e) Students who forgot their password for Moodle would re-emailed.
- ii. Employees
  - a) May use the features of the system
  - b) May view the Course Registration details

5. Choose any Complex system of your choice and answer the following

- i. Describe the system (underline the name of the complex system)
- ii. Mention three factors on why you consider the chosen system as a complex system
- iii. Elaborate on any one factor (as per your answer in 2.ii), and mention how would you address the selected factor using object orientation approaches
- iv. Mention any two non-functional requirements related to the complex system



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- v. Mention any two ways in which illusion of simplicity can be achieved in your chosen complex system
- vi. How can you ensure Canonical form of the chosen complex system?
- vii. What do you mean by the object model of the chosen complex system?
- viii. Would you consider the complex system as,
  - a) Discrete or Random. Justify the same.
  - b) Development process or Construction process. Justify the same.

[1 + 3 + 2 + 2 + 2 + 2 + 2 + 2 = 16]

#### **Remarks:**

Q1: Use one sentence maximum for each challenge

Q2: Use one sentence maximum for each of the four points

Q3: Each difference carries 1 point. Write maximum two differences using one sentence

Q4: A single use-case diagram is to be drawn. Rough work if required can be done at the end

Q5: (i) Use one sentence maximum.

(ii) Use one sentence maximum for each of the three factors

(iii) Use three sentences maximum for justification

(iv) Use maximum one sentence for each of the two points

(v) Use two sentences maximum for each of the two methodologies

(vi) Write only the name of factors which are to be considered for canonical form

(vii) Use one sentence maximum

(viii) Use one sentence for justifying your answer.

**Mid semester Exam 2023**

**SC201**

**Total Time: As per the institute norms**

**Total Marks: 80**

**All questions are compulsory.**

Q1: Explain the contribution of one Indian environmental scientist and one Indian environmental activist. 10

Q2. Explain what type of natural resource (renewable or non renewable) is water? 5

Q3. Environmental Science is a multidisciplinary subject. Elaborate. 5

Q4. What are some unique features of Indian environmentalism? 5

Q5. Write short notes: 5 marks each

1. Bio accumulation and bio magnification
2. Ecosystem people and biosphere people
3. Bio-piracy

Q6. One word answer: (if option is provided pick the right one. Only write the correct answers) 5 marks each

1. Who is the present Environmental Minister of India? *Bhupendra Patel*
2. World Environmental Day is celebrated on.....(July 5, June 5, January 10, July 10)
3. Total biodiversity hotspots in the world are.....of which.....are in India. ( 36/2, 1000/15, 32/3)
4. A simple food chain has .....links. (3-5, 0, 2-5)
5. ....is an example of primary succession. ( glacier retreat, landslide)
6. Plants are autotrophs. True or false
7. The Biodiversity Act 2002 strictly aims at preventing usage of biological resources for any commercial or scientific usage. True or false.
8. Country which has been pioneer in drip irrigation practice is..... Israel, US, China, Egypt



**Indian Institute of Information Technology – Vadodara**  
**Mid-Semester Examination Autumn 2023-24**  
**B. Tech. (IT & CSE)**  
**EC-201: Digital Logic Design**

Time: 2:0 hrs.

Max. Marks: 50

- ❖ Attempt all questions
- ❖ Calculator is not allowed

Q. 1 Do the followings

(a)  $(1110010110)_2 = (?)_{10}$   $(1625)_8$   $(3131)_{10}$  2

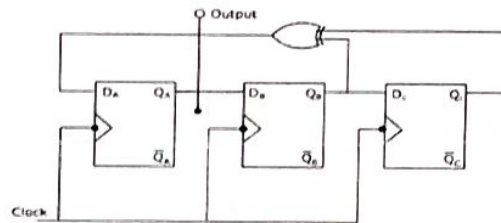
(b)  $(761.12)_8 = (?)_{10}$   $(1371.14)_{10}$  2

(c) Prove  $(A+B+C)(A+B'+C)(A+B+C') = (A+BC)(A+B+C) = A+BC$  2

(d) How many AND, OR and EXOR gates are required for the configuration of full adder?  $2 \text{ AND}, 1 \text{ OR}, 2 \text{ XOR}$  2

(e) The minimum number of 2-input NAND gates required to implement a 2-input XOR gate is 4 2

Q. 2 a) What is the output pattern observed at QA in the first four clock cycles? Assume the flip flops are in reset condition initially. (Please give the answer in the format: output in clock cycle 1(initial value), output in clock cycle 2, output in clock cycle 3, output in clock cycle 4) 5

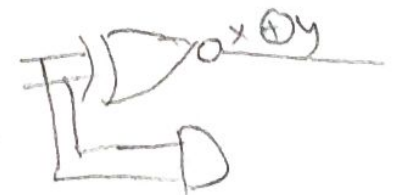
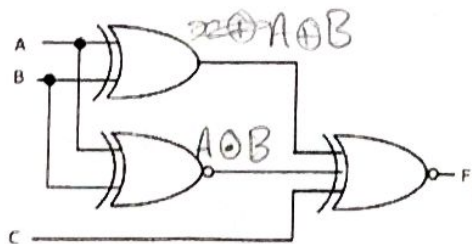


b) What is the minimum number of 2-input NAND gates required to implement a 4-variable function, function expressed in sum-of-minterms form as  $f = \Sigma(0, 2, 5, 7, 8, 10, 13, 15)$ ? Assume that all the inputs and their complements are available. 5

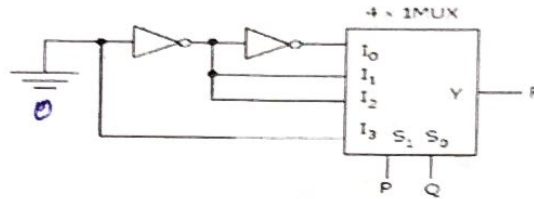
Q. 3 (a) Minimize the function using K-Map  $f(A, B, C, D) = \Sigma m(0, 1, 2, 3, 5, 7, 9, 10, 11, 13, 15)$  5

(b) Convert SR flip-flop to JK flip-flop and draw the state diagram of SR flip-flop and JK flip-flop. 5

Q. 4 a) For the output F to be 1 in the logic circuit shown, all possible input combination should be. 5

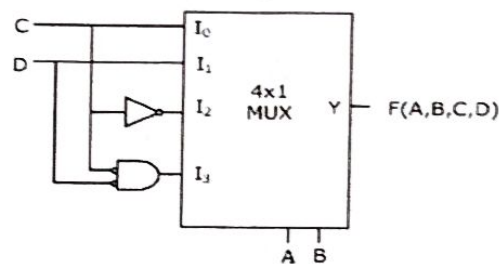


- b) The logic function implemented by the circuit below is (ground implies logic 0)

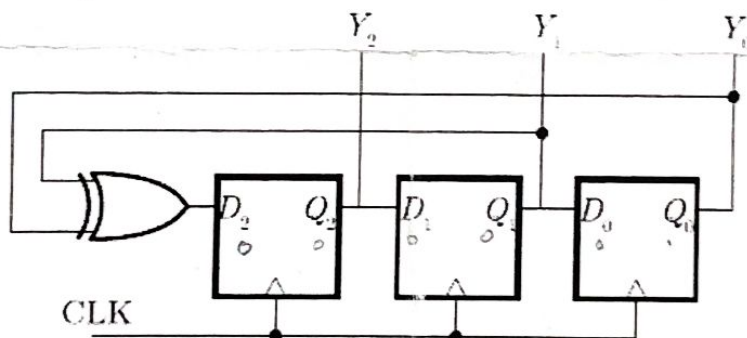


Q.5

- a) The Boolean function realized by the logic circuit shown is



- b) A three-bit pseudo random number generator is as shown in the figure. Initially, the value of output  $Y = Y_2 Y_1 Y_0$  is set to 111. The value of output  $Y$  after three & 10 clock cycles is



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IIIT Vadodara  
CS203: Design and Analysis of Algorithms

Midterm

Marks: 30

Course Instructor: Dr. Dibyendu Roy

Instructions: Clearly write your name and roll number. Question paper is of 2 pages. Solutions must be argued properly for getting credits. Scientific calculator is allowed.

(Q1)

[5 marks]

What do you mean by maximum-subarray of an array  $A[1 \dots n]$ . Describe an algorithm to find the maximum-subarray of  $A$  in  $\Theta(n \log_2 n)$ . *→ From notes*

(Q2)

[10 marks]

You are given a sequence of positive real numbers  $a[1 \dots n]$ . You can now add "+" (addition) and "×" (multiplication) signs between these numbers, and your goal is to generate an expression that has the largest value. As an example, if  $a = \{2, 3, 0.5, 2\}$ , then you should output the expression  $2 \times 3 + 0.5 + 2 = 8.5$ . This is larger than any other expression (e.g.  $2 \times 3 \times 0.5 \times 2 = 6$ ,  $2 + 3 + 0.5 + 2 = 7.5$ ,  $2 + 3 \times 0.5 + 2 = 5.5 \dots$ ). You must add either a "+" or a "×" between two consecutive numbers, and you are not allowed to change the ordering of the numbers or add brackets. As usual the expression is evaluated to first compute the products and then the sum. Design an algorithm that runs in time  $O(n^2)$  and outputs the largest possible value of the expression. For this problem you can assume all additions, multiplications and comparisons of real numbers can be done in  $O(1)$  time.

1. Write the recurrence equation and specify the base cases.
2. Design an algorithm (runs in time  $O(n^2)$ ) for achieving the maximum value of the expression. Prove the correctness of the algorithm and derive its time complexity.

(Q3)

[5 marks]

Alice is playing a game where she controls a character to walk on a  $m \times n$  table. The character starts at the bottom-left corner (coordinate  $(1, 1)$ ) and wants to go to the top-right corner (coordinate  $(m, n)$ ) (for better understanding see Table 1). The character can only move to the right (from  $(i, j)$  to  $(i, j + 1)$ ) or up (from  $(i, j)$  to  $(i + 1, j)$ ). Each square of the table has a non-negative value  $v[i, j]$ . The goal is to find a path from the starting point to the end point that maximizes the sum of  $v[i, j]$  for all the squares  $(i, j)$  on the path.

			(3, 4)
	→	→	↑
(1, 1) →	↑		

Table 1: Table of size  $3 \times 4$

1. Define the recurrence equation and specify the base cases.
2. Design an algorithm that outputs the desired maximum sum. Discuss its complexity.

(Q4)

[5 marks]

Consider an array  $A[1 \dots n]$  that is first decreasing and then increasing. More precisely, there is a coordinate  $1 \leq p \leq n$  such that for all  $i < p$ ,  $A[i] > A[i + 1]$ , and for all  $i \geq p$ ,  $A[i] < A[i + 1]$ . Your goal is to find the smallest element in this array. Design an algorithm to find the smallest element in  $O(\log_2 n)$  time complexity.

(Q5)

[5 marks]

State the Rod-cutting problem. Using dynamic programming design an efficient algorithm to find the optimal rod cutting.