Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech 2nd year (Mid Semester), 2023

Branch : CSE

Semester: 3rd

Title of the Course: Digital Electronics & logic Design

Course Code: ECBB 206

Time: 1 Hour 30 Minutes

Maximum Marks: 25

Note: Attempt all questions

(5×5=25)

Q. No.	Questions	Marks	CO	PO	BL	PI
1	Implement the following function using (a) 8:1 MUX (**Take *D* as a MUX input**) and (b) 4:1 MUX (**Take *C* and *D* as MUX inputs**) $F(A,B,C,D) = \sum m(0,1,3,4,7,8,9,11,14,15)$	5	3		L6	
2	Design a 4-bit combinational logic circuit 2's complementer.	5	3		L6	
3	Draw a NAND logic diagram that implements the complements of the following function. $F(A,B,C,D) = \sum m(0,1,2,3,4,8,9,12)$	5	1		L1	
4	Simplify the following function and implement them with NOR gate. $F = wx' + y'z' + w'yz'$	5	1		L1	
5	Perform the following operation (a) 11101-1100 (using 2's complement) (b) 76532-4250 (using 10's complement) (c) Add the number using 2's complement method (+123)+(-999) (d)Express the given decimal in Gray code form: 563	1+1+2+1	2		L4	

Roll No.:.....

National Institute of Technology, Delhi

Mid Semester Examination (Autumn Semester 2023)

Branch	**: CSE**	**Maximum Marks**	**: 25**
Semester	**: 3rd**	**Time**	**: 1.5 Hours**
Title of the Course	**: Database Management Systems**	**Course Code**	**: CSBB 204**

Note: Read all questions carefully.

Q. No	Questions	Marks	CO	BL	PO
1 (a)	Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system?	02	CO1	L2	2
1 (b)	Consider the following set of requirements for a bank database: A large bank has several branches at different places. Each branch maintains the account details of the customers. The customers may open join as well as single accounts. The bank also provides loan to the customer for different purposes. Bank keeps record of each transaction by the customer to his account. All of the branches have employees and some employees are managers". Draw a logical schema that captures this information.	03	CO1	L2	2
1 (c)	Explain the terms Generalization, Specialization and Aggregation in DBMS with suitable example.	02	CO1	L2	2
1 (d)	What do you mean by physical data independence and how it is used in database.	01	CO1	L2	2
2.	XYZ hospital is a multi-specialty hospital that includes a number of departments, rooms, doctors, nurses, compounders, and other staff working in the hospital. Patients having different kinds of ailments come to the hospital and get check-up done from the concerned doctors. If required they are admitted in the hospital and discharged after treatment. The aim of this case study is to design and develop a database for the hospital to maintain the records of various departments, rooms, and doctors in the hospital. It also maintains records of the regular patients, patients admitted in the hospital, the check-up of patients done by the doctors, the patients that have been operated, and patients discharged from the hospital. **Description:** a) In hospital, there are many departments like Orthopedic, Pathology, Emergency, Dental, Gynecology, Anesthetics, I.C.U., Blood Bank, Operation Theater, Laboratory, M.R.I., Neurology, Cardiology, Cancer Department, Corpse, etc.	07	CO2	L3	3

	b) There is an OPD where patients come and get a card (that is, entry card of the patient) for check up from the concerned doctor. c) After making entry in the card, they go to the concerned doctor's room and the doctor checks up their ailments. d) According to the ailments, the doctor either prescribes medicine or admits the patient in the concerned department. e) The patient may choose either private or general room according to his/her need. But before getting admission in the hospital, the patient has to fulfill certain formalities of the hospital like room charges, etc. f) After the treatment is completed, the doctor discharges the patient. Before discharging from the hospital, the patient again has to complete certain formalities of the hospital like balance charges, test charges, operation charges (if any), blood charges, doctors' charges, etc. g) Next, we talk about the doctors of the hospital. There are two types of the doctors in the hospital, namely, regular doctors and call on doctors. Regular doctors are those doctors who come to the hospital daily. h) Calls on doctors are those doctors who are called by the hospital if the concerned doctor is not available. Design an ER schema for this application, and draw an ER diagram for that schema. Specify key attributes of each entity type, and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete.				
3.	Consider the employee database shown below where the primary keys are underlined. Give an expression in SQL for each of the following queries. *employee (employee_name, street, city)* *works (employee_name, company_name, salary)* *company (company_name, city)* *manages (employee_name, manager_name)* Answer any **5** queries: a) Find the names and cities of residence of all employees who work for "First Bank Corporation". b) Find the names, street addresses, and cities of residence of all employees who work for "First Bank Corporation" and earn more than $10,000. c) Find all employees in the database who earn more than each employee of "Small Bank Corporation". d) Assume that the companies may be located in several cities. Find all companies located in every city in which "Small Bank Corporation" is located. e) Find those companies whose employees earn a higher salary, on average, than the average salary at "First Bank Corporation". f) Find the company that has the most employees.	5 x 2 =10	CO3	L3	3

राष्ट्रीयप्रौद्योगिकीसंस्थानदिल्ली

NATIONAL INSTITUTE OF TECHNOLOGY DELHI

(शिक्षामंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

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Course Code: CSBB 203	Course Title: Operating System
Duration: 1.5 hrs	Max Marks: 25
This Question paper consists of 5 questions and 2 pages. Attempt all the questions and be brief while writing the answers.	

<table>
<tr><th>Q. No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th></tr>
<tr><td>1 a.</td><td>What are the goals of the Operating System? To what extent different classes of Operating Systems have achieved these goals?</td><td>3</td><td>CO1</td><td>L2</td></tr>
<tr><td>b.</td><td>What are different states of a process? List all the conditions in which a process make transitions from running to waiting.</td><td>3</td><td>CO2</td><td>L2</td></tr>
<tr><td>2 a.</td><td>Consider the following snapshot of a system for processes and resources`. Total instances of A, B and C are 3, 14 and 13 respectively.
<table>
<tr><th></th><th>Allocation (A B C)</th><th>Max (A B C)</th></tr>
<tr><td>T0</td><td>0 0 1</td><td>0 0 1</td></tr>
<tr><td>T1</td><td>1 0 0</td><td>1 7 5</td></tr>
<tr><td>T2</td><td>1 3 5</td><td>2 3 5</td></tr>
<tr><td>T3</td><td>0 6 3</td><td>0 6 5</td></tr>
<tr><td>T4</td><td>0 0 1</td><td>0 6 5</td></tr>
</table>
Answer the following questions using the banker's algorithm:
(i) What is the content of the Need (A,B,C) matrix and Available (A,B,C) array?
(ii) Is the system in a safe state? If yes, specify the safe sequence.
(iii)If a request from thread T1 arrives for (0,4,2), can the request be granted?</td><td>4</td><td>CO2</td><td>L3</td></tr>
<tr><td>b.</td><td>How can a circular wait condition be avoided to prevent deadlock?</td><td>2</td><td>CO2</td><td>L2p</td></tr>
<tr><td>3.</td><td>Explain the following:
(a) Busy Waiting
(b) User level Threads vs Kernel Level Threads</td><td>4</td><td>CO1</td><td>L2</td></tr>
</table>

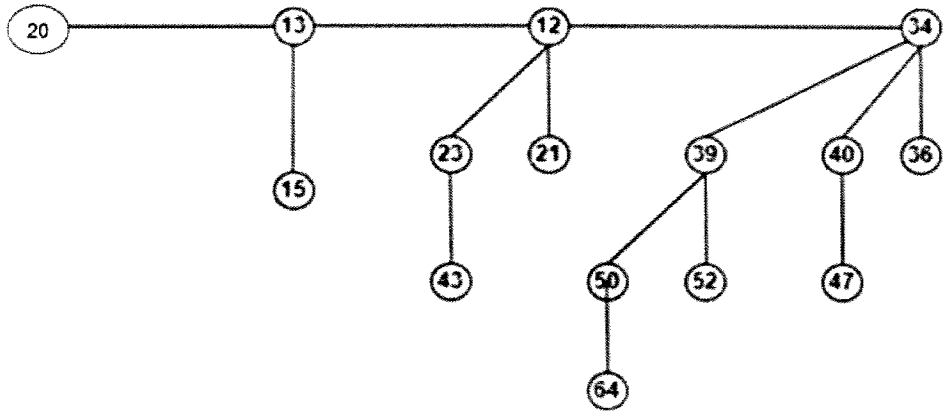
4.	Consider the following table of arrival time and burst time for the three processes P0, P1, P2 and P3. The preemptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time and average turnaround time for the four processes? **Process / Arrival time / Burst time** P0 — 0 ms — 7 ms P1 — 2 ms — 4 ms P2 — 3 ms — 5 ms P3 — 3 ms — 3 ms	4	CO2	L3
5 a.	Consider a system with three processes namely P, Q, R, three binary semaphores R, S, U (each initialised to 1) and one counting semaphore T (initialised to 2). Three processes proceed as follows: **Process P** {while(TRUE) {P(S) P(T) P(U) <Add item to the buffer> V(T) V(S) V(U)}} **Process Q** {while(TRUE) {P(R) P(T) P(U) <Add item to the buffer> V(R) V(U) V(T)}} **Process R** {while(TRUE) { P(U) P(T) <Add item to the buffer> V(T) V(U) } } Is there any deadlock possible in this code? If yes, explain why?	1.5	CO2	L3

b.	Variable mutual_x_flag is used in two Processes namely P1 and P2 to achieve mutual exclusion. Two shared variables Y and Z (initialised to 1) are incremented by the processes P1 and P2 in the critical section.
	(i) Does the following code ensure mutual exclusion if the initial value of mutual_x_flag is FALSE. If not, make changes to the code to ensure mutual exclusion using semaphore.
	
	`Ensure_mExclusion`
	`{ if (mutual_x_flag == FALSE)`
	`{ mutual_x_flag= TRUE;`
	`/* Enters Critical Section */`
	`Y=Y+1;`
	`Z=Z+1;`
	`Y=Y-1;`
	`/* Exits Critical Section */`
	`mutual_x_flag= FALSE;`
	`}}`
	
	(ii) Write codes for both the processes P1 and P2 using semaphores to make sure that Process P2 executes only after the execution of P1.
		3.5	CO2	L4

National Institute of Technology, Delhi
Name of the Examination: Design and Analysis of Algorithms
Mid-Semester Examination (Autumn Semester 2023)

Branch: CSE **Semester:III[rd]**
Title of the Course: Design and Analysis of Algorithms **Course Code: CSBB-202**
Time: 1.5 hours **Maximum Marks: 25**

Q.no	Question	Marks	CO	BL	PO
	Section I: Each question carries 1 mark				
1	Prove or disprove: For any functions f and g, $f(n) + g(n) = \Theta(\max\{f(n), g(n)\})$.	1	CO1	K2	1
2	How many comparisons will be made to sort the array arr = {1,5,3,8,2} using counting sort? a) 5 b) 7 c) 9 d) 0	1	CO2	K2	2
3	Rank the following functions by the order of growth: (n+1)!, n!, 4^n, $4n^2$, $\log_2 n$, $n\log_2 n$, $(3/2)^n$	1	CO3	K3	2
4	The number of trees in a binomial heap with n nodes is..... a) log2 n b) n c) n log n d) n/2	1	CO4	K4	3
	Section II: Each question carries 3 marks				
5	Write an algorithm for Merge Sort and compute the Time and Space Complexity? Illustrate the operation of Merge Sort on the following array: A = {10,12,15,8,7,2,19,1,4,5,0,3}.	3	CO2	K6	4
6	Draw the B-tree of order 4 created by inserting the following data arriving in sequence. 75,99, 8, 9, 10, 11,78,6,53,45,33,90,1,15,25.	3	CO3	K3	4

7	Perform an Extract min and Union operation to update the following Binomial Heap.(Note: Extract min followed by union operation should be performed only once)  	3	CO4	K4	4
	Section III: Each question carries 6 marks				
8	Identify the Longest Common Subsequence from the two sequences of characters: a.) P = <A, B, C, D, B, C, D, C, D, D> Q = <B, C, D, C, D> b.) P = <1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1> Q = <0, 1, 1, 0>	6	CO3	K5	3
9	Create a B-tree from the following list of elements of order 3 and order 4. Discuss the deletion of a key from a B-tree created for order 3 and 4(Note: Only 1 key should be deleted from both the trees). H,G,T,W,Q,F,D, A,B,M,L,N,S,U,V,O,P,Y,X,R,E,Z,K,I,J,C.	6	CO4	K6	4