Roll No.:.....

National Institute of Technology, Delhi

End Semester Examination (Autumn Semester 2023)

Branch	**: CSE**	**Maximum Marks**	**: 50**
Semester	**: 3rd**	**Time**	**: 3 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) Differentiate between Database, Database Management System and Relational Database Management System.	03	CO1	L2	1
	b) Database _____ which is the logical design of the database, and the database _____ which is a snapshot of the data in the database at a given instant in time.	02	CO1	L2	1
	c) What is Two phase Locking (2PL)? Describe with the help of example. d) Write short note on Recovery	04	CO4	L5	2
	e) With an example show how a referential integrity can be implemented.	01	CO4	L5	2
2.	a) Explain composite, single, simple, composite and derived attribute.	04	CO2	L3	1,2
	b) Let E1 and E2 be two entities in an E/R diagram with simple single-valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one-to-many and R2 is many-to-many. R1 and R2 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model? Explain.	02			
3.	**Consider the transactions T1, T2, and T3 and the schedules S1 and S2 given below.** T1: r1(X); r1(Z); w1(X); w1(Z) T2: r2(Y); r2(Z); w2(Z) T3: r3(Y); r3(X); w3(Y) S1: r1(X); r3(Y); r3(X); r2(Y); r2(Z);w3(Y); w2(Z); r1(Z); w1(X); w1(Z) S2: r1(X); r3(Y); r2(Y); r3(X); r1(Z); r2(Z); w3(Y); w1(X); w2(Z); w1(Z) a) Check whether the schedule S1 and S2 are conflict-serializable or not. Incase S1 and S2 is/are conflict-serializable, give an equivalent serial schedule. b) Apply the two-phase locking protocol to above schedules. Will the protocol allow the execution of these schedules?	08	CO4	L5	6
4.	Suppose you are given a relation R with four attributes ABCD and FDs $AB \rightarrow C$, $AB \rightarrow D$, $C \rightarrow A$, $D \rightarrow B$ (a) Identify the candidate key(s) for R. (b) Identify the best normal form that R satisfies.	10	CO4	L5	3

	(c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.				
5.	Assume a system having a system log with immediate updates has the following log entries, ending with a system crash: <start_transaction, R> <write_item, R, X, 1, 5> <write_item, R, Y, -1, 0> <commit, R> <start_transaction, S> <write_item, S, Z, 8, 12> <checkpoint record> <write_item, S, X, 5, 10> <start_transaction, T> <write_item, T, Y, 0, 15> <commit, S> --- System Crash --- i. a. Which transactions, if any, need to be redone? b. Which transactions, if any, need to be undone? c. Which transactions, if any, are not affected by the crash. ii. Now assume the system uses deferred updates. a.Rewrite the log entries for the transactions in (i) for this logging method. b.Which transactions, if any, need to redone after the failure. c.Which transactions, if any, need to be undone? d.Which transaction, if any, are not affected by the crash?	08	CO4	L5	5
6.	Consider the following schema: Suppliers (sid: integer, sname: string, address: string) Parts (pid: integer, pname: string, color: string) Catalog(sid: integer, pid: integer, cost: real) The key fields are underlined, and the domain of each field is listed after the fieldname. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in relational algebra: 1. Find the names of suppliers who supply some red part. 2. Find the sids of suppliers who supply some red part or are at 221 Packer Street. 3. Find the sids of suppliers who supply every red part. 4 . Find pairs of sids such that the supplier with the first sid charges more for some part than the supplier with the second sid. 5 . Find the pids of parts supplied by at least two different suppliers.	08	CO3	L4	4

राष्ट्रीयप्रौद्योगिकीसंस्थानदिल्ली

NATIONAL INSTITUTE OF TECHNOLOGY DELHI

(शिक्षामंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

(An autonomous Institute under the aegis of Ministry of Education (Shiksha Mantralaya), Govt. of India)

Course Code: CSBB 203	Course Title: Operating System
Duration: 3 hrs	Max Marks: 50
This Question paper consists of 6 questions and 2 pages. Attempt all the questions and be brief while writing the answers.	

Q. No	Questions	Marks	CO	BL
1 a.	What is the need of Disk scheduling algorithm? On what factors the performance of the Disk scheduling algorithm depends? Explain.	3	CO2	L2
b.	Suppose that a disk drive has 300 cylinders, numbers from 0 to 299. The drive is currently serving a request at cylinder 98, and the previous request was at cylinder 78. The queue of pending requests is 86, 170, 113, 148, 56, 13, 120, 47, 52 Find the total head movement (in number of cylinders) incurred while servicing these requests if C-LOOK algorithm is used for scheduling.	4	CO4	L3
2 a.	What is paging in the Operating System? Explain with the help of an example. Write its advantages and disadvantages.	5	CO2	L3
b.	Consider the following page reference string: 1, 2, 3, 4, 2, 3, 5, 6, 2, 4, 7, 6, 3, 4, 2, 1, 3, 6, 7, 2 Remember that all the frames are initially empty. How many page faults would occur for the following page replacement algorithms with 4 page frames (i) LRU Replacement (ii) Optimal Replacement	6	CO4	L4
3 a.	What are different File allocation methods? Explain along with advantages and disadvantages of each of them.	5	CO3	L2
b.	What are the different ways to provide protection in the File system? Explain.	3	CO3	L2
c.	What is the File system mounting and its primary purpose?	2	CO3	L2
4 a.	What is thrashing in the Operating system? What are the different techniques to handle thrashing? Explain.	4	CO2	L2
b.	What are different responsibilities that are to be performed by Short term, Medium term and Long term Scheduler? Elaborate.	4	CO2	L2

5 a.	Consider a logical address space of 64 pages with 2,048 words per page, mapped onto a physical memory of 32 frames. (i) How many bits are required in the logical address? (ii) How many bits are required in the physical address?	2	CO4	L3
b.	A demand paging system takes 200 time units to service a page fault and 400 time units to replace a dirty page. The probability of a page fault is 0.06. In case of a page fault, the probability of the page being dirty is 0.07. Find the average access time if the memory access time is 10 time units.	3	CO4	L4
6 a.	Define Deadlock. Write all the conditions that are necessary for the occurrence of deadlock.	3	CO2	L2
b.	Explain the following terms: (i) Belady's Anomaly (ii) Bounded Wait in Process Synchronization (iii) Race Condition	6	CO2	L2

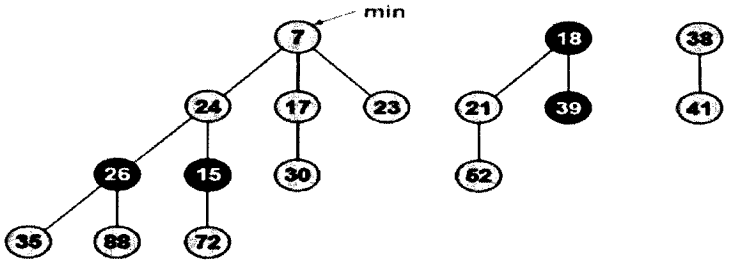
National Institute of Technology, Delhi
Name of the Examination: Design and Analysis of Algorithms
End-Semester Examination (Autumn Semester 2023)

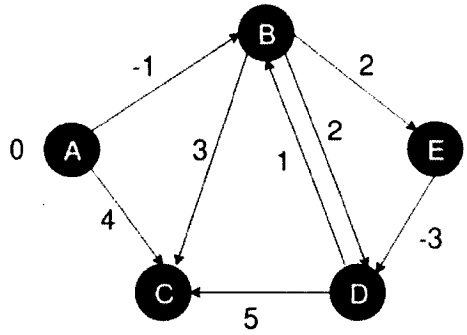
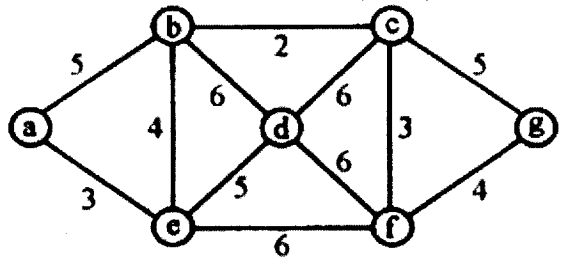
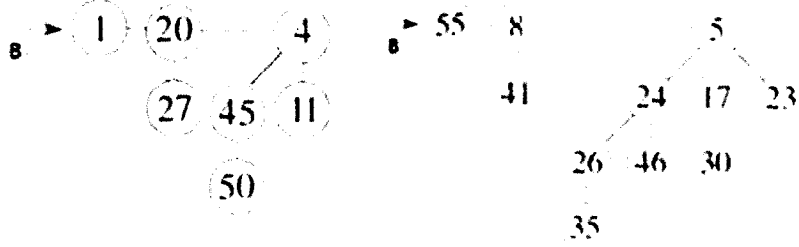
Branch: CSE **Semester:III[rd]**
Title of the Course: Design and Analysis of Algorithms **Course Code: CSBB-202**
Time: 3 hours **Maximum Marks: 50**

Q.no	Question	Marks	CO	BL	PO
	Section I: Each question carries 1 mark				
1	Explain the significance of asymptotic notations in analyzing an algorithm using an example.	1	CO1	K2	1

2	What is time complexity of fun()?
	int fun(int n)
	{int count = 0;
	for (int i = n; i > 0; i /= 2)
	for (int j = 0; j < i; j++)
	count += 1;
	return count; }
		1	CO1	K2	4

3	How can a sorting algorithm be called "stable"? Explain with an example.	1	CO2	K3	2
4	In a simple, undirected, connected, weighted graph with at least three vertices and unique edge weights, the heaviest edge in the graph is in no minimum spanning tree. Describe whether the statement is True or False.	1	CO2	K4	3
5	Suppose the expected number of valid shifts is small and the modulus is larger than the length of the pattern; then what is the matching time of the Rabin Karp Algorithm?	1	CO3	K3	2
	Section II: Each question carries 6 marks				
5	a) Consider the given below Fibonacci heap. Shoe the Fibonacci heap that result after delete the min.	6	CO2	K3	4

	 b) Show the results of inserting the keys S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X in order into an empty B-tree. Use t=3, where t is the minimum degree of B-tree.				
6	a) Illustrate the operation of counting sort on the following array: A={4, 0, 2, 0, 1, 3, 5, 4, 1, 3, 2, 3}. b) Consider the given statement as input: "To be or not to be, that is the question: Whether it is nobler in mind to suffer. The slings and arrows of outrageous fortune. Or to take arms against a sea of troubles And, by opposing, end them." Your task is to find the position of the word 'mind' in the given statement. You can apply any of the string-matching algorithms discussed in the class.	6	CO4	K6	5
	Section III: Each question carries 7 marks				
7	Poe the penguin has made a huge stack of 'n' pancakes on a plate. The pancakes are labelled 1 to n from top to bottom, and pancake *i* has size Pi (Pi > 0 and larger Pi means larger pancake). He decides to feed Barr the Bear with his new creation. Unfortunately, Barr the Bear is an artistic eater and wants the pancake tower to look like a pyramid (i.e. sorted pancakes with the largest at the bottom). To appease the bear, Poe decides to use his special pancake tongs to rearrange the pancakes. With the tongs, he can flip the order of i th pancake (from the top) to j th pancake (from the top) for any $1 \le i \le j \le n$. As an example, if the initial pancake sequence of sizes is [1, 1, 5, 3, 3], using the tongs on pancakes 2 to 5 will result in [1, 3, 3, 5, 1] (by flipping [1, 5, 3, 3] into [3, 3, 5, 1]). However, this is a tiring operation and will cost Poe j −i units of energy. Poe wants to find a sequence of pairs (i, j) such that flipping the pancakes by following this sequence of pairs will cause the pancakes to become sorted, so the chosen flips use little energy. Your task is to design algorithms to help Poe. This algorithm will take an array of pancake sizes {P1, . . . , Pn} as input and will sort the pancakes, assuming that a "flip" takes constant time. (Other operations, such as reading the array etc, also take constant time, as usual.) The algorithm's running time is computed as usual, assigning O(1) time per flip. In addition to running time, we will analyze the energy of the algorithm. The energy is defined as the sum of all flips performed by the algorithm. Analyse the running time and energy of your algorithm and prove correctness. (Suppose the pancakes are of arbitrary positive sizes)	7	CO4	K4	3
	Section IV: Each question carries 8 marks				
8	a) Find single source shortest path using Bellman ford Algorithm from the given below graph, consider node A as source node.	8	CO3	K4	5

	 b) Given two strings, return the longest common subsequence between the two strings. **Input**: s1 = "zfadeg", s2 = "cdfsdg"				
9	Consider the following graph and find the minimum spanning tree using Prim's and Kruskal's algorithms. Also, write the worst-case complexity. 	8	CO4	K5	4
	Section V: Each question carries 10 marks				
10	a) Perform the union operation on the given below binomial heaps B1 and B2.  b) Given a sequence of matrices, find the most efficient way to multiply these matrices together. The efficient way is the one that involves the least number of multiplications. Matrix array m= {40, 20, 30, 10, 30}. Find the minimum number of scalar multiplications using the dynamic programming approach.	10	CO3	K4	5