Question Paper

Exam Date & Time: 14-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. (INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - JUNE 2024
SUBJECT: ICT 2221/ICT_2221-DATABASE SYSTEMS

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) Consider a database used to record the marks that students get in different exams of different course offerings. (5)
i) Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the above database. Also construct an alternative E-R diagram that uses only a binary relationship between students and course-offerings. Make sure that only one relationship exists between a particular student and course-offering pair, yet you can represent the marks that a student gets in different exams of a course offering.
ii) Let R=(A,B,C) be the relational schema with the functional dependency F={A-> B, B-> c}. Decomposition of R: R1=(A,C), R2=(B,C). Does this decomposition preserve the given dependencies?
(3+2 = 5 marks)

1B) Construct B+ Tree which is order of 3 and values are 10,20,45,49,50. Delete 45 show the result in step-by-step process. (3)

1C) List out the how hashing technique is differentiated over indexing. (2)

2A) Consider the following employee database. (5)

EmployeeInfo Table:

EmpID	EmpFname	EmpLname	Department	Project	Address	DOB	Gender

EmployeePosition Table:

EmpID	EmpPosition	DateOfJoining	Salary

i) Write a query find number of employees whose DOB is between 02/05/1970 to 31/12/1975 and are grouped according to gender.
ii) Write a query to fetch all the records from the EmployeeInfo table ordered by EmpLname in descending order and Department in the ascending order.
iii) Write a query to fetch top N records.
iv) Write a query to fetch the number of employees working in the department 'HR'.
v) Write a query to retrieve the first four characters of EmpLname from the EmployeeInfo table.

2B) Consider the following two transactions: (3)

T1	T2
read(A)	read(B)
A := 10*A+4	B := 2*B+3
write(A)	write(B)
read(B)	read(A)
B := 3*B	A := 100-A
write(B)	write(A)

Write versions of the above two transactions that use two-phase locking.

2C) (2)

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.
The Catalog relation lists the prices charged for parts by Suppliers.
Write the following queries in relational algebra.
Find the names of suppliers who supply some red part.

3A) i) Given a relational Schema R(A, B, C, D) and set of Function Dependency FD = { B → A, AD → BC, C → ABD }. Find the canonical cover? (5)
ii) What is the normal form satisfied by following relation R based on F.
R(A,B,C,D) F:{A->B, B->C, C->D}

3B) Consider the following Schedule S invoving 5 transactions. (3)
S:
R1(X),R2(X),W2(X)R3(X)R4(Z)W3(X)W4(Z)R1(Z)W5(Z)
Identify if it is conflict serializable schedule and view serializable schedule.

3C) Suppose in a database, there are four transactions T1, T2, T3 and T4. Transaction T2 is waiting for transactions T3 and T4, transaction T1 is waiting for transaction T3, and transaction T3 is waiting for transaction T4 to release a data item. (2)
Identify the correct wait-for graph for the above scenario.

4A) Given a relation R(X, Y, Z) and Functional Dependency set FD = { XY → Z and Z → Y }, determine whether the given R is in BCNF? If not convert it into BCNF. Check if the decomposition is dependency preserving? (5)

4B) Consider a hash table with 8 slots. The hash function is h(X) = X mod 8. The collisions are resolved by chaining. Find out the maximum, minimum, and average chain lengths in the hash table. If the keys are inserted in the following order: 3, 18, 29, 25, 30, 43, 52, 67, 70. (3)

4C) Add lock and unlock instructions to following transactions so that they observe the two phase locking protocol. (2)

T1: Read(A)	T2:Read(B)
Read(B)	Read(A)
A=A+B	B=B+1
Write(A)	Write(B)

5A) What will be the output of SQL queries on the following instance of relational schema containing 2 tables SHOPPE and ACCESSORIES. (5)

Table : SHOPPE

Id	SName	Area
S01	ABC Computronics	CP
S02	All Infotech Media	GK II
S03	Tech Shoppe	CP
S04	Geeks Tecno Soft	Nehru Place
S05	Hitech Tech Store	Nehru Place

Table : ACCESSORIES

No	Name	Price	Id
A01	Mother Board	12000	S01
A02	Hard Disk	5000	S01
A03	Keyboard	500	S02
A04	Mouse	300	S01
A05	Mother Board	13000	S02
A06	Keyboard	400	S03
A07	LCD	6000	S04
T08	LCD	5500	S05
T09	Mouse	350	S05
T10	Hard Disk	4500	S03

i) SELECT DISTINCT NAME FROM ACCESSORIES WHERE PRICE>5000;
ii) SELECT AREA,COUNT(*) FROM SHOPPE GROUP BY AREA;
iii) SELECT AVG(PRICE), MAX(PRICE) FROM ACCESSORIES WHERE PRICE>=10000;
iv) SELECT NAME, PRICE*.05 DISCOUNT FROM ACCESSORIES WHERE ID IN ('S02','S03')

5B) Consider the Relational Schema for Employee as follows (3)
employee (*person name, street, city*)
works (*person name, company name, salary*)
company (*company name, city*)
Give an expression in the Relational Algebra to express each of the following queries.
i) Find the name of each employee who lives in city "Miami".
ii) Find the name of each employee whose salary is greater than $100000.
Find the name of each employee who lives in "Miami" and whose salary is greater than $100000.

5C) Show how B+ tree can be used to represent following table. (Use Second Column data as key) (2)

15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	80000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci.	75000
58583	Califieri	History	60000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

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