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SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Fall Semester 2018-19

CAT-II

Course Name	: Database Management Systems	Duration	: 90 Minutes
Course Code	: CSE2004	Max. Marks	: 50

*Answer All the Questions (5 \* 10 = 50 Marks)*

1. Consider the given following set of functional dependencies for a relation R(A,B,C,D,E,F).  
 $F = \{AB \rightarrow C, DC \rightarrow AE, E \rightarrow F\}$   
a) What are the keys of this relation?  
b) Is this relation in BCNF? If not, explain why by showing one violation.  
c) Is the decomposition  $(A, B, C, D) (B, C, D, E, F)$  a dependency preserving decomposition? If not, explicate. (10)
2. A relation named EMP\_DEPT with attributes: ENAME, SSN, BDATE, ADDRESS, DNUMBER, DNAME, and DMGRSSN.  
Consider also the set G of functional dependencies for EMP\_DEPT:  
 $G = \{SSN \rightarrow ENAME, BDATE, ADDRESS, DNUMBER, DNUMBER \rightarrow DNAME, DMGRSSN\}$   
a) Calculate the closures  $SSN^+$  and  $DNAME^+$  with respect to G.  
b) Is the set of functional dependencies G minimal? If not, find a minimal set of functional dependencies that are equivalent to G.  
c) List an update anomaly, insertion anomaly, deletion anomaly that can occur for relation EMP\_DEPT. (10)
3. Consider the following relations:  
Applicants (id, name, city, sid)  
Schools (sid, sname, rank)  
Major (id, major)  
Engrave SQL query to find all applicants who wants major in CSE, live in Seattle, and go to a school ranked less than 10.  
Draw the initial query tree and optimize the query tree using heuristic approach (10)
4. Inspect the following three schedules for three concurrent transactions T1, T2, T3. (10)  
 $S1 = \{r2(c), r2(b), w2(b), r3(b), r3(d), r3(e), r1(a), w1(a), w3(b), w3(c), r2(a), r2(d), w2(d), r1(b), w1(b), w2(a)\}$

$$S2 = \{r3(b), r3(c), r3(d), r1(a), w1(a), w3(b), w3(c), r2(c), r1(b), w1(b), r2(b), w2(b), r2(a), w2(a), r2(d), w2(d)\}$$

$$S3 = \{r1(a), w1(a), r2(c), r2(b), w2(b), r2(d), r2(a), w2(a), w2(d), r1(b), w2(b), r3(b), r3(c), w3(b), w3(c), r3(d)\}$$

For each of the three interleaved schedules, determine if the schedule is serializable. If so, give an equivalent serial schedule.

5. Contemplate the Pubs Database Schema given below:

(10)

Pubs Database Schema

author(author\_id, first\_name, last\_name)

author\_pub(author\_id, pub\_id, author\_position)

book(book\_id, book\_title, month, year, editor)

pub(pub\_id, title, book\_id)

- primary keys are underlined
- author\_id in author\_pub is a foreign key referencing author
- pub\_id in author\_pub is a foreign key referencing pub
- book\_id in pub is a foreign key referencing book
- editor in book is a foreign key referencing author(author\_id)

Pubs Database State

<u>author_id</u>	<u>first_name</u>	<u>last_name</u>
1	John	Mitchell
2	Donald	Huet
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Cherry	White
8	Moshe	Vardi
9	Row	Büttner

<u>author_id</u>	<u>pub_id</u>	<u>author_position</u>
1	1	1
2	1	1
3	2	2
4	3	1
5	4	1
6	5	2
7	6	1

<u>book_id</u>	<u>book_title</u>	<u>month</u>	<u>year</u>	<u>editor</u>
1	CACM	April	1960	2
2	CACM	July	1974	3
3	LISP	July	1948	2
4	LMS	November	1956	7
5	MLnd	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

<u>pub_id</u>	<u>title</u>	<u>book_id</u>
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

Engrave relational algebra expression for the following:

- Find the names of all authors who are book editors
- Find the names of all authors who have at least one publication in the database
- Find the authors authored a pub that was published in July
- Count the number of books for each year.

Reg. No.: 21B1S1279  
Name : Kavayam



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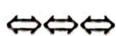
### Continuous Assessment Test (CAT-2) – March 2023

Programme	: B.Tech (CSE)	Semester	: Winter Semester 2022-23
Course Code	: BCSE302L	Slot	: E2+TE2
Course Title	Database Systems		
Faculty(s)	: Dr. Appalaraju Muralidhar Dr. L.M. Jenila Livingston Dr. A. Balasundaram Dr. J. Uma Maheswari Dr. Abishi Chowdhury Dr. Rajesh M Dr. Manjula D	Class Nbr(s)	: CH2022235000916 CH2022235000919 CH2022235000920 CH2022235001197 CH2022235001198 CH2022235001262 CH2022235001264
Time	: One Hour and Thirty Minutes	Max. Marks	: 50

#### Answer ALL the Questions

1.	Consider the relation R={P,Q,R,S,T} and the given set of functional dependencies:  FD: {P → Q, R → S, QR → S, Q → PRT, T → R}.  i. Find the minimal cover of FD. [6 marks] ii. List down the super keys and candidate keys of R. [4 marks]	[10]
2.	Given a relation R with eight attributes and four functional dependencies. Perform the Normalization process up to the Third Normal form.  R( <u>Projno</u> , <u>Projname</u> , <u>Emp_no</u> , <u>Emp_name</u> , <u>Job_class</u> , <u>Charge_hrs</u> , <u>Hrs_billed</u> , <u>Tot_charges</u> )  FD1 : Projno → Projname FD2 : Emp_no → Emp_name, Job_class FD3 : Projno , Emp_no → Hrs_billed, tot_charges FD4 : Job_class → Charge_hrs	[10]
3.	a) Construct a B <sup>+</sup> tree of order 4 using the key values 24, 45, 11, 89, 55, 67, 49, 38, 7, 23, 12, 78, 97, 36, 21. Show the constructed B <sup>+</sup> tree. [7 marks]  b) Delete the key values 38, 12, and 89 from the constructed B <sup>+</sup> tree [3 marks]	[10]

4.	<p>Consider the following relations concerning cricket players.</p> <p>Player (PlayerId, PlayerName, Country, Age, Runs, Wickets)  IPL (PlayerId, TeamId, TeamName, MatchesPlayed)  TestCricket (PlayerId, Year)</p> <p>Write Relational algebra expressions for the following queries:</p> <ol style="list-style-type: none"> <li>Select all the attributes from Player relation for which the number of wickets is greater than or equal to 200. (1½ marks)</li> <li>List all the player ids, team ids, and matches played from IPL relation. (1½ marks)</li> <li>List the players' details, who have not played for IPL. (2 marks)</li> <li>Count the number of players who have played for both IPL and Test Cricket. (2 marks)</li> <li>List the player names along with their age, who have played for the IPL team 'CSK'. (2 marks)</li> <li>Rename the relation IPL to IPLCricket (1 mark)</li> </ol>	[10]
5.	<p>Given the following relations:</p> <p>Participants (pno, name, address, telephone, email);  Categories (code , category_name, description );  Winners (pno, code, year, award);</p> <p>The SQL query to retrieve all Silver medal winners with each winner's name, category, and year is given below:</p> <pre>SELECT name, category_name, year FROM Participants p, Categories c, Winners w, WHERE p.pno=w.pno and c.code=w.code and award='SILVER'</pre> <p>Perform the following:</p> <ol style="list-style-type: none"> <li>Write the equivalent relation algebraic expression [2 marks]</li> <li>Draw a query tree for the above relational algebraic expression [2 marks]</li> <li>Apply heuristic optimization to optimize the query and draw the optimized query tree for the query.[6 marks]</li> </ol>	[10]



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Name : Mubin



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### Continuous Assessment Test (CAT-2) – March 2023

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Course Title	Database Systems		
Faculty(s)	: Dr. Appalaraju Muralidhar Dr. L.M. Jenila Livingston Dr. A. Balasundaram Dr. J. Uma Maheswari Dr. Abishi Chowdhury Dr. Rajesh M Dr. Manjula D	Class Nbr(s)	: CH2022235000916 CH2022235000919 CH2022235000920 CH2022235001197 CH2022235001198 CH2022235001262 CH2022235001264
Time	: One Hour and Thirty Minutes	Max. Marks	: 50

**Answer ALL the Questions**

1.		Consider the relation R={P,Q,R,S,T} and the given set of functional dependencies:  FD: {P → Q, R → S, QR → S, Q → PRT, T → R}.  i. Find the minimal cover of FD. [6 marks] ii. List down the super keys and candidate keys of R. [4 marks]	[10]
2.		Given a relation R with eight attributes and four functional dependencies. Perform the Normalization process up to the Third Normal form.  R( <u>Projno</u> , Projname, <u>Emp_no</u> , Emp_name, Job_class, Charge_hrs, <u>Hrs_billed</u> , Tot_charges)  FD1 : Projno → Projname FD2 : Emp_no → Emp_name, Job_class FD3 : Projno , Emp_no → Hrs_billed, tot_charges FD4 : Job_class → Charge_hrs	[10]
3.	a)	Construct a B <sup>+</sup> tree of order 4 using the key values 24, 45, 11, 89, 55, 67, 49, 38, 7, 23, 12, 78, 97, 36, 21. Show the constructed B+ tree. [7 marks]  b) Delete the key values 38, 12, and 89 from the constructed B <sup>+</sup> tree [3 marks]	[10]

4.	<p>Consider the following relations concerning cricket players.</p> <p>Player (PlayerId, PlayerName, Country, Age, Runs, Wickets)  IPL (PlayerId, TeamId, TeamName, MatchesPlayed)  TestCricket (PlayerId, Year)</p> <p>Write Relational algebra expressions for the following queries:</p> <ol style="list-style-type: none"> <li>Select all the attributes from Player relation for which the number of wickets is greater than or equal to 200. (1½ marks)</li> <li>List all the player ids, team ids, and matches played from IPL relation. (1½ marks)</li> <li>List the players' details, who have not played for IPL. (2 marks)</li> <li>Count the number of players who have played for both IPL and Test Cricket. (2 marks)</li> <li>List the player names along with their age, who have played for the IPL team 'CSK'. (2 marks)</li> <li>Rename the relation IPL to IPLCricket (1 mark)</li> </ol>	[10]
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Reg. No.:

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Continuous Assessment Test-II – March 2023

Programme	: B.Tech CSE	Semester	: Win Sem(2022-23)
		Code	: BCSE302L
Course Title	: Database Systems	Class Nbr(s)	: CH2022235000582 CH2022235000583 CH2022235000584 CH2022235000585 CH2022235000586 CH2022235000587
Faculty (s)	: Dr. Janani T, Dr. Leninisha Shanmugam Dr. Rishikeshan CA, Dr. Tamilarasi K Dr. Brindha, Dr. Jaisakthi S M	Slot	: B1+TB1
Time	: 90 Mins	Max. Marks	: 50 marks

Answer all the Questions

1. a) Find the minimal cover of the set of Functional Dependencies. (5Marks)

Given:  $R = \{A, B, C, D, E, H\}$ ,  $F: \{A \rightarrow BC, B \rightarrow CE, A \rightarrow E, AC \rightarrow H, D \rightarrow B\}$

- b) Suppose a relational schema  $R (A, B, C, D, E, F, G, H)$  and a set of Functional Dependency as followings. List all candidate keys of  $R$ . (5Marks)

10

$CH \rightarrow G$ ,  
 $A \rightarrow BC$   
 $B \rightarrow CFH$   
 $E \rightarrow A$   
 $F \rightarrow EG$ .

2. An Industry wants to maintain a database to keep track of Employees (PermanentEmployees, ContractEmployees) their children and their cars. For this purpose, initially in the relation:

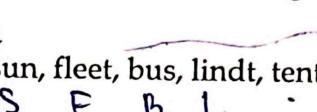
EmpData(Eid, EName, EAddress, cNbr, cName, cAddress, aLic, aMake)

Eid	EName	EAddress	cNbr	cName	cAddress	aLic	aMake
111	Nils	Adayar	333	Eva	Adayar	ABC123	Toyota
222	Anna	Adayar	333	Eva	Adayar	ABC123	Toyota
111	Nils	Adayar	444	Johan	Adayar	ABC123	Toyota
222	Anna	Adayar	444	Johan	Adayar	ABC123	Toyota
111	Nils	Adayar	333	Eva	Adayar	DEF456	Ford
222	Anna	Adayar	333	Eva	Adayar	DEF456	Ford
111	Nils	Adayar	444	Johan	Adayar	DEF456	Ford
222	Anna	Adayar	444	Johan	Adayar	DEF456	Ford

10

Eid, EName, EAddress is the employee number, name and address of a employee. cNbr, cName, cAddress is the corresponding information for a child. Each employee has exactly one address. aLic, aMake is the license number and make of a car. A car may be owned by more than one employee. The functional dependencies hold by the relation as follows

- FD1.  $Eid \rightarrow EName, EAddress$
- FD2.  $cNbr \rightarrow cName, cAddress$
- FD3.  $aLic \rightarrow aMake$

- a) Is this relation in BCNF? Justify. If not, decompose it into relations that are in BCNF. (6marks)
- b) If the decomposed relations violates 4NF and then normalize it to make it satisfy the 4NF. (4marks)
3. Construct a B+ Tree by performing the below operations and give explanation at each step. Order of a node is three.
  - a) Insert the key values in the order (sun, fleet, bus, lindt, tent) and show the resulting B+ Tree.  (3 marks)
  - b) After performing the above operation, delete the keys lindt, fleet in the given order and show the resulting B+ tree. (4 marks)
  - c) After performing the above operations, insert the keys in order (cane, pen, van) and show the resulting B+ tree (3 marks)
4. Considering the following relations, write a relational algebra expression followed by SQL query.

Flights (Flight Number, from, to, distance, departure\_time, arrival\_time, price)  
Aircraft (aircraft\_id, aircraft\_name, cruising\_range)  
Certified (employee\_id, aircraft\_id)  
Employees (employee\_id, employee\_name, salary)

Note: Employees relation describes pilots and other employees also. Every pilot is certified for some aircraft and only pilots are certified to fly.

  - a) Display the employees name of pilots who can operate planes with cruising range greater than 30000 miles but are nor certified on any Boeing. (5Marks)
  - b) For all aircrafts with cruising range over 1000 miles find the name of aircraft and the average salary of all pilots certified for this aircraft. (5Marks)
5. Consider the following relations of a university database.

Faculty (EmpId, Name, Phno, School, DateOfJoining)  
Student (RegNo, Name, Phno, School)  
Course (CourseCode, CourseName, Credits)  
CourseAllocation (ClassNumber, AEmpId, ACourseCode, Venue, MaxStrength, Slot)  
StudReg (RegNo, ClassNumber)

  - a) Provide an initial query tree to retrieve Name and Phone numbers of Faculty members who are handling DBMS (CourseName) and joined after 01-01-2023. (5Marks)
  - b) Convert the constructed canonical tree to optimized tree using Heuristic technique. Explain each step with appropriate trees. (5Marks)



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### Continuous Assessment Test (CAT) – II - March 2024

Programme	: B.Tech (CSE)	Semester	: Winter Semester 2023-2024
Course Code & Course Title	: BCSE302L & Database Systems	Slot	: A2+TA2
Faculty	: Dr. M. Premalatha Prof. Sukanya G Dr. Vijayakumar K P Dr. Graceline Jasmine S	Class Number(s)	: CH2023240502443 CH2023240502444 CH2023240502446 CH2023240502447
Duration	: 90 Mins	Max. Mark	: 50

**Answer all questions**

Q. No	Sub Sec.	Description	Marks																																								
1.		<p>Consider the relation R (U, V, W, X, Y, Z) and the following functional dependencies: {U → W, UV → W, W → XZ, WX → Z, YW → UV, YZ → W}</p> <p>i). Find the closure for all the L.H.S and compute the candidate key (2 Marks)</p> <p>ii). Find the minimal Cover (6 Marks)</p> <p>iii). Find the candidate key from the final set of functional dependencies and compare the newly generated candidate key, with the candidate key generated from, sub division i) of Question number 1 and justify your answer. (2 Marks)</p>	10																																								
2.		<p>Consider the cars available in the Southern Indian market.</p> <p>Table 1: Cars</p> <table border="1"> <thead> <tr> <th>Company</th><th>Country</th><th>Make</th><th>Model</th><th>Distributor</th></tr> </thead> <tbody> <tr> <td>Hyundai</td><td>Korea</td><td>Nios</td><td>Asta, Sportz</td><td>Kun</td></tr> <tr> <td>Skoda</td><td>Germany</td><td>Kushaq</td><td>TSI Active</td><td>Gurudev</td></tr> <tr> <td>Tata</td><td>India</td><td>Altroz</td><td>XE</td><td>Gurudev</td></tr> <tr> <td>Tata</td><td>India</td><td>Nexon</td><td>XM</td><td>Gurudev</td></tr> <tr> <td>Skoda</td><td>Germany</td><td>Kushaq</td><td>TSI Monte</td><td>Kun</td></tr> <tr> <td>KIA</td><td>Korea</td><td>Sonet</td><td>HTE, HTK</td><td>Kun</td></tr> <tr> <td>KIA</td><td>Korea</td><td>Seltos</td><td>HTE, HTK</td><td>Capital Kia</td></tr> </tbody> </table> <p>a) Find out the type of anomaly for the following cases considering Table 1 (3 Marks)</p> <p>i). Suppose KIA, a company from Korea, is now collaborating with Tata to bring the make XM in the Indian market with no distributor announced yet</p> <p>ii). Suppose Kun is no more a distributor for the make Asta of Hyundai, a company from Korea</p> <p>iii). Suppose Hyundai is no more a Korean company due to its 100% procurement by Tata, a company from India.</p> <p>b) Normalize the Table 1 up to the Third Normal form (7 Marks)</p>	Company	Country	Make	Model	Distributor	Hyundai	Korea	Nios	Asta, Sportz	Kun	Skoda	Germany	Kushaq	TSI Active	Gurudev	Tata	India	Altroz	XE	Gurudev	Tata	India	Nexon	XM	Gurudev	Skoda	Germany	Kushaq	TSI Monte	Kun	KIA	Korea	Sonet	HTE, HTK	Kun	KIA	Korea	Seltos	HTE, HTK	Capital Kia	10
Company	Country	Make	Model	Distributor																																							
Hyundai	Korea	Nios	Asta, Sportz	Kun																																							
Skoda	Germany	Kushaq	TSI Active	Gurudev																																							
Tata	India	Altroz	XE	Gurudev																																							
Tata	India	Nexon	XM	Gurudev																																							
Skoda	Germany	Kushaq	TSI Monte	Kun																																							
KIA	Korea	Sonet	HTE, HTK	Kun																																							
KIA	Korea	Seltos	HTE, HTK	Capital Kia																																							
3.		<p>Consider the following car rental business scenario and create four tables namely car, customer, rental and bill with appropriate key constraints applied on it: Cars are always rented from one location and are brought back to the same location. Customers may pay by cash or credit card. Customers who call the agency may request a particular car or model. A bill is presented to the customers after the travel.</p> <p>Note: Use Natural Join or Cartesian Product without using <i>on</i> keyword. Specify the appropriate schemas for the scenario, write SQL query and relational algebra expression for the following: (5*2=10 Marks)</p>	10																																								

	<p>i). List the customer's details who resides in Chennai and have rented Marathi 'baleno'.</p> <p>ii). List the bills generated so far for the model 'innova'.</p> <p>iii). Specify the name of the customer who have rented Audi car for more than 3 times</p> <p>iv). Find the average bills for each city if the average bill exceeds 20000</p> <p>v). List the name of the customer, the car model he rented, his from location, to location along with the date on which the car is rented.</p>																									
4.	<p>Consider the following schema</p> <p>customer(<u>custid</u>, custname, address)</p> <p>items(<u>iid</u>, iname, price)</p> <p>order(<u>iid</u>, <u>cid</u>, qty)</p> <p>Query: List the item names purchased by more than average number of items purchased by all the customers</p> <p>For the specified query, perform the following:</p> <ol style="list-style-type: none"> <li>Derive the relational algebra expression for the above query using Cartesian product without using 'on' keyword. (2 Marks)</li> <li>Optimize the relational algebra expression by drawing the step by step optimized execution plan with rules involved (6 Marks)</li> <li>Write the optimal relational algebra expression (2 Marks)</li> </ol>	10																								
5.	<p>Consider the information related to orders and salesman</p> <table border="1"> <thead> <tr> <th>Ord_No</th> <th>Cust_id</th> <th>Product_Name</th> </tr> </thead> <tbody> <tr> <td>60001</td> <td>2003</td> <td>Handbag</td> </tr> <tr> <td>60004</td> <td>2005</td> <td>Handbag</td> </tr> <tr> <td>60015</td> <td>2008</td> <td>Watch</td> </tr> <tr> <td>60021</td> <td>2001</td> <td>Calculator</td> </tr> <tr> <td>60011</td> <td>2004</td> <td>Pots</td> </tr> <tr> <td>60008</td> <td>2000</td> <td>Calculator</td> </tr> <tr> <td>60009</td> <td>2009</td> <td>Watch</td> </tr> </tbody> </table> <p>Perform the following for the <b>dense and sparse indexing</b>: (5*2=10 Marks)</p> <ol style="list-style-type: none"> <li>Create a primary index for the attribute "<i>Product_Name</i>"</li> <li>Add the instance "60007 2012 Watch"</li> <li>Add the instance "60014 2006 Wallet"</li> <li>Delete the instance "60021 2001 Calculator"</li> <li>Delete the instance "60011 2004 Pots"</li> </ol>	Ord_No	Cust_id	Product_Name	60001	2003	Handbag	60004	2005	Handbag	60015	2008	Watch	60021	2001	Calculator	60011	2004	Pots	60008	2000	Calculator	60009	2009	Watch	10
Ord_No	Cust_id	Product_Name																								
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60009	2009	Watch																								

\*\*\*\*\*All the best\*\*\*\*\*



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CHENNAI

Reg. Number:	72B(E135)
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### Continuous Assessment Test (CAT) – II - March 2024

Programme	:	B.Tech (CSE)	Semester	:	Winter Semester 2023-2024
Course Code & Course Title	:	BCSE302L & Database Systems	Slot (s)	:	A1+TA1
Faculty	:	Dr. M. Premalatha Dr. Priyaadharshini M Dr. Vijayakumar K P	Class Numbers	:	CH2023240502438 CH2023240502440 CH2023240502441
Duration	:	90 Mins	Max. Mark	:	50

**Answer all questions**

Q No	Sub Sec.	Description	Marks																																																																						
1		<p>Consider the following invoice details</p> <table border="1"> <thead> <tr> <th colspan="10">Invoice details</th> </tr> <tr> <th>Inv. no.</th> <th>Date</th> <th>Customer</th> <th>Cust. no.</th> <th>Address</th> <th>Inv. item no.</th> <th>Product</th> <th>Prod no.</th> <th>No.</th> <th>Price</th> </tr> </thead> <tbody> <tr> <td>123</td> <td>01/29/2018</td> <td>John Public</td> <td>11</td> <td>35 Wood Lane, Springfield, ME 04487</td> <td>1</td> <td>Monitor</td> <td>2-0023-D</td> <td>10</td> <td>\$200</td> </tr> <tr> <td>123</td> <td>01/29/2018</td> <td>John Public</td> <td>11</td> <td>35 Wood Lane, Springfield, ME 04487</td> <td>2</td> <td>Mousepad</td> <td>4-0023-D</td> <td>12</td> <td>\$06</td> </tr> <tr> <td>123</td> <td>01/29/2018</td> <td>John Public</td> <td>11</td> <td>35 Wood Lane, Springfield, ME 04487</td> <td>3</td> <td>Chair</td> <td>5-0023-D</td> <td>1</td> <td>\$120</td> </tr> <tr> <td>124</td> <td>01/30/2018</td> <td>Jane Doe</td> <td>12</td> <td>72 Windy Road, Springfield, ME 04487</td> <td>1</td> <td>Laptop</td> <td>1-0023-D</td> <td>2</td> <td>\$1,200</td> </tr> <tr> <td>124</td> <td>01/30/2018</td> <td>Jane Doe</td> <td>12</td> <td>72 Windy Road, Springfield, ME 04487</td> <td>2</td> <td>Headset</td> <td>3-0023-D</td> <td>2</td> <td>\$75</td> </tr> </tbody> </table> <p>a) Perform the following: (10 Marks)</p> <ol style="list-style-type: none"> <li>Specify the functional dependency for the relation (2 Mark)</li> <li>Identify any two super keys and any one candidate key (2 Marks)</li> <li>Find the minimal cover (6 Marks)</li> </ol>	Invoice details										Inv. no.	Date	Customer	Cust. no.	Address	Inv. item no.	Product	Prod no.	No.	Price	123	01/29/2018	John Public	11	35 Wood Lane, Springfield, ME 04487	1	Monitor	2-0023-D	10	\$200	123	01/29/2018	John Public	11	35 Wood Lane, Springfield, ME 04487	2	Mousepad	4-0023-D	12	\$06	123	01/29/2018	John Public	11	35 Wood Lane, Springfield, ME 04487	3	Chair	5-0023-D	1	\$120	124	01/30/2018	Jane Doe	12	72 Windy Road, Springfield, ME 04487	1	Laptop	1-0023-D	2	\$1,200	124	01/30/2018	Jane Doe	12	72 Windy Road, Springfield, ME 04487	2	Headset	3-0023-D	2	\$75	20
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124	01/30/2018	Jane Doe	12	72 Windy Road, Springfield, ME 04487	2	Headset	3-0023-D	2	\$75																																																																

b)

During the process of applying an index for the invoice details, justify the following:

- i). Specify the attributes which are apt for applying a dense index and sparse index. Justify your answer (2 Marks)
- ii). Construct a dense and sparse index for the product attribute. (2 Marks)
- iii). Update the dense and sparse index while inserting an instance (125, 02/28/2018, Mark, 13, 85, Windy Road, Springfield, ME 04487, 4, Mouse, 6-0023-D, 20, \$2) (2 Marks)
- iv). Update the dense and sparse index while deleting a record for a 'mousepad' product (2 Marks)
- v). Construct a two level indexing for the 'product' attribute (2 Marks)

2	<p>Consider the following employee relational schema:</p> <pre> employee(empid, name(fname, lname), job_code, job_title, job_responsibility, salary, join_date, state_name, city, state_code, dept_id, dept_name, shift, email) empid→name, email, city, state_name, pin_code job_code→job_title, job_responsibility, salary empid, job_code, dept_id→join_date, shift dept_id→dept_name pin_code→city, state_name </pre> <p>a) Consider that you are designing an application to maintain the employee's details as given in the employee schema. Apply <u>normalization</u> on employee relations until you reach the highest normal form with appropriate justification (10 Marks)</p> <p>b) From the normalized employee schema derived from question number 2a), perform the following: (10 Marks)</p> <ul style="list-style-type: none"> <li>i). Write the cartesian product relational algebra expression to specify the name of the employee who works as a supervisor in the UDS department and earns the maximum salary. (2 marks)</li> <li>ii). Apply query optimization for the question number 2b)(i) and draw the optimized tree for each step. (6 Marks)</li> <li>iii). Write the optimal relational algebra expression. (2 Marks)</li> </ul>	20
3	<p>Consider the below schemas</p> <pre> boy(name, address, phone, payment_mode) icecream(flavour, manufacturer, price) buys(name, flavour) </pre> <p>Write the SQL query and the <u>relational algebra</u> expression for the following: (5*2=10 Marks)</p> <p>Note: Use natural joins wherever is applicable</p> <ul style="list-style-type: none"> <li>i). Name the manufacturer who manufactures the maximum number of ice-cream flavors. [2]</li> <li>ii). List the name of the boys who doesn't prefer cash payment mode only when they order Ibobo's mango flavor [2]</li> <li>iii). List the ice-cream flavor which costs minimum which was not purchased by the boy Pranav[2]</li> <li>iv). List the boy details who purchased all the items of Aruna's icecreams. [2]</li> <li>v). List the name of all the boys who hasn't purchased any of the ice-creams [2]</li> </ul>	10

\*\*\*\*\*All the best\*\*\*\*\*

**Continuous Assessment Test II – April 2024**

Programme	: B.Tech. CSE and its specialization	Semester	: Winter 2023-24
Course	: Database Systems	Code	: BCSE 302L
Faculty and	: Dr A Muralidhar	Slot(s)	:
Class	: Dr. L.Jani Anbarasi		
Number	: Dr. Abishi Chowdhury Dr. Amrit Pal Dr. Leninisha Shanmugam Dr. L.M. Jenila Livingston Dr. G. Logeswari	(CH2023240501557) (CH2023240501562) (CH2023240501564) (CH2023240501566) (CH2023240501569) (CH2023240501572) (CH2023240503346)	D2+TD2
Duration	: 1½ Hours	Max. Marks	: 50

**Answer ALL the Questions**

Q. N. o.	Sub - di- vi- sion	Question Text	Marks															
1	a)	<p>Consider the following relation:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>PLANT</th><th>MANAGER</th><th>MACHINE</th><th>SUPPLIER_NAME</th><th>SUPPLIER_CITY</th></tr> </thead> <tbody> <tr> <td>Plant-A</td><td>Ravi</td><td>Lath Boiler</td><td>Jay industry Abb appliance</td><td>Ahmedabad Surat</td></tr> <tr> <td>Plant-B</td><td>Meena</td><td>Cutter Boiler CNC</td><td>Raj machinery Dakshi industry Jay industry</td><td>Vadodara Rajkot Ahmedabad</td></tr> </tbody> </table> <p>Plant, Supplier_name <math>\rightarrow</math> Manager, Machine, Supplier_city  Supplier_name <math>\rightarrow</math> Supplier_city  Manager <math>\rightarrow</math> Supplier_city  Plant <math>\rightarrow</math> Machine</p> <p>i) Find out the anomalies exists in the given relation. [ 2 marks ]  ii) Normalize the given relation up to third normal forms. [ 8 marks ]</p>	PLANT	MANAGER	MACHINE	SUPPLIER_NAME	SUPPLIER_CITY	Plant-A	Ravi	Lath Boiler	Jay industry Abb appliance	Ahmedabad Surat	Plant-B	Meena	Cutter Boiler CNC	Raj machinery Dakshi industry Jay industry	Vadodara Rajkot Ahmedabad	10
PLANT	MANAGER	MACHINE	SUPPLIER_NAME	SUPPLIER_CITY														
Plant-A	Ravi	Lath Boiler	Jay industry Abb appliance	Ahmedabad Surat														
Plant-B	Meena	Cutter Boiler CNC	Raj machinery Dakshi industry Jay industry	Vadodara Rajkot Ahmedabad														
2	a)	<p>Construct a B+ Tree for the following key values in the order 4. (7marks)  Key values are: (44, 55, 15, 18, 21, 24, 27, 30, 65, 77, 29, 92, 33)</p>	10															
	b)	Delete values 55 and 44 from the tree (3marks)																
3	a)	<p>Suppose you have to insert the keys J, F, A, H, C, G, M, L, P in the mentioned order into an initially empty hash table of length 10 using any one open hashing with hash function <math>h(k) = k \bmod 10</math>. Consider the ASCII value to hash the given keys (A = 65, B = 66, and so on). What is the</p>	10															

resultant hash table? (4marks)

- b) Hash the following keys using dynamic hashing with bucket size 4. (6marks)

Keys	Equivalent binary representation
14	01011
4	00100
21	10101
25	11001
15	01111
1	00001
9	01001
20	10100
2	00010
17	10001
7	00111

4

- a) Consider the following relations of a Banking Database Management System and answer the following queries in the form of relational algebra expressions.

Employee (E\_id, Emp\_name, salary, city)

Works\_for (E\_id, B\_id)

Bank (B\_id, Bank\_name, city, phone)

- Find the salaries of all the employees who live in the same city as the bank for which they work. [1 mark]
- List out the employee names residing in the city where DFC bank is located. [2 marks]

10

**Q5** Consider the following relations of a University Database Management System:

Student (Reg\_no, sName, phone, email\_id, D\_id)

Department (D\_id, D\_name, address)

Course (C\_id, C\_name, D\_id, credits)

Result (C\_id, Reg\_no, Grade)

Write a query in SQL that finds the names, email ids, and grades of the students who have chosen Java Programming from CSE department.

Demonstrate the step by step process towards query optimization.

[7 marks]

5 a) Consider two transactions  $T_1$  and  $T_2$

$T_1$	$T_2$
begin_transaction	begin transaction
read (A)	read (A)
read (B)	read (B)
read (C)	read (C)
$B := B + 15$	$A := A + 15$
$C := C + 1$	$C := C + 1$
write (B)	write (A)
write (C)	write (C)
commit	commit

Let the initial values of A and B be 100, and the initial value of C be 0.

Show that every serial execution of these two transactions preserves the consistency of the database. (3marks)

b) Consider the three transactions  $T_1$ ,  $T_2$ , and  $T_3$ , and the schedule S1.

Transaction  $T_1$ :  $r1(x); r1(z); w1(x)$

Transaction  $T_2$ :  $r2(z); r2(y); w2(z); w2(y)$

Transaction  $T_3$ :  $r3(x); r3(y); w3(y)$

Schedule S1:  $r1(x); r2(z); r1(z); r3(x); r3(y); w1(x); w3(y); r2(y); w2(z); w2(y)$

- i. Draw the serializability (precedence) for S1, state whether the schedule is conflict serializable. (5marks)
- ii. Write down any two equivalent serial schedules. (2marks)



**VIT**

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Decided by the University under section 20 of the Act, 1956  
CHENNAI

Reg. Number:

### Continuous Assessment Test (CAT) – II - APR 2024

Programme	:	B.Tech. CSE and its specialization	Semester	:	Winter 2023-24
Course Code & Course Title	:	BCSE302L / Database Systems	Slot	:	D2+TD2
Faculty	:	Dr. Appalaraju Muralidhar Dr. Jenila Livingston L M Dr. Jani Anbarasi L Dr. Amrit Pal Dr. Leninisha Shanmugam Dr. Abishi Chowdhury Dr. Logeswari G	Class Number	:	CH2023240501557 CH2023240501572 CH2023240501562 CH2023240501566 CH2023240501569 CH2023240501564 CH2023240503346
Duration	:	1 Hr. 30 Mins.	Max. Mark		50

#### General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

#### Answer all questions

Q. No	Sub Sec.	Description	Marks
1		<p>Consider the following relation:  <math>R(\text{Electrician\_ID}, \text{Electrician\_Name}, \text{Customer\_ID}, \text{Customer\_Name}, \text{Date}, \text{Defect}, \text{Solution\_Code}, \text{Charge})</math></p> <p>Each row in this relation represents a case where an electrician visits a customer and attends to a defect on a particular date. The defects are unique for each customer attended by the electrician. Each defect has a solution which is assigned a solution code and each solution code has a fixed charge associated with it. Each electrician and customer is provided with an electrician id and customer id respectively. Given this scenario, perform the following:</p> <ol style="list-style-type: none"> <li>Identify the keys and functional dependencies.</li> <li>Which normal form is the current relation in? Justify your answer.</li> <li>Determine if the above relation can be decomposed to BCNF.</li> </ol>	
2	a	Construct a B+ tree with order 4 for the following keys: 51, 63, 65, 77, 99, 52, 64, 76, 88, 100	[7]
	b	Delete 63 and 99 from the constructed tree and draw the final tree after deletion.	[3]
3		<p>Assume that a COMPANY schema comprises of the following relations:</p> <p><b>EMPLOYEE</b> (fname, lname, initial, ssn, dob, address, gender, salary, supervisor_ssn, dno)</p> <p><b>DEPARTMENT</b> (dname, dnumber, mgr_ssn, mgr_start_dt)</p>	

	<p><u>DEPT_LOCATIONS</u>(dnumber, dlocation)  <u>WORKS_ON</u>(essn, pno, hours)  <u>PROJECT</u>(pname, pnumber, plocation, dnum)  <u>DEPENDENT</u>(essn, dependent_name, gender, dob, relationship)</p> <p>Specify the relational algebraic expression on this schema for the following queries:</p> <ol style="list-style-type: none"> <li>Retrieve the names of all employees who work more than 10 hours per week on the 'ProductY' project.</li> <li>Retrieve the names of all employees who do not work on any project.</li> <li>For each department, retrieve the department name and the average salary of all employees working in that department.</li> <li>Retrieve the average salary of all female employees.</li> <li>List the last names of all department managers who have no dependents.</li> </ol>	[5*2 = 10]
4	<p>Consider the following tables:  <u>DEPARTMENT</u>(id, name)  <u>PRODUCT</u>(id, name, department_id, shelf_id, producer_id, price)  <u>NUTRITION_DATA</u>(product_id, calories, fat, carbohydrate, protein)</p> <p>Using Heuristic optimization, draw the optimized query tree for the below query.</p> <pre>SELECT p.name AS product, d.name AS department FROM department d, product p, nutrition_data nd WHERE d.id = p.department_id and nd.product_id = p.id and p.price &lt; 1000 and nd.fat = 0</pre>	[10]
5	<p>a Let S1 be the schedule of operations comprising three transactions T1, T2 and T3 in a database system:</p> <p>S1: R2(B), R1(A), R3(C), R1(B), W1(A), R2(C), W2(B), R3(A), W3(C)</p> <p>Check whether the given schedule S1 is conflict-serializable or not? If yes, give the possible serialization order.</p> <p>b Using extendible hashing, hash the keys 17, 5, 6, 23, 24, 11, 30, 7, 10, 21, 27 with bucket size 3.</p>	[4] [6]

\*\*\*\*\* All the best \*\*\*\*\*

# Let's Connect.....!! 😊



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