

- Recent concurrency protocols*
- 8 (a) Explain the need of cascadeless schedule with an example. 2  
 (b) Differentiate between rigorous and strict two phase locking protocol. 2  
 (c) Explain the different types of timestamp values used in time stamp ordering protocol. 2
- 9 (a) Write the advantage and disadvantage of multi version concurrency control techniques. 2  
 (b) Differentiate between the approach used by a time stamp ordering protocol and multi version timestamp ordering protocol to handle a write (Q) operation. 2  
 (c) What steps are taken by a log based recovery scheme using checkpoints to recover from a system failure? 2
- 10 (a) Differentiate between log based recovery technique with Deferred (1) and immediate database modification scheme. 2  
 (b) What actions will be taken by the log based recovery technique for Deferred and immediate database modification, if a failure occurs after the Write(B) operation in the following schedule: 2

Deferred.

T<sub>1</sub> - Ready

T<sub>2</sub>, T<sub>3</sub> Restart

immediate.

T<sub>1</sub> - Ready

T<sub>2</sub> - Undo & Restart (c)

T<sub>3</sub> - Restart.

T1:	T2:	T3:
Read(A), A=A-500	Read(B), B=B+100	
Write (A) Commit		Read(C)
	Write(B) fail Commit	

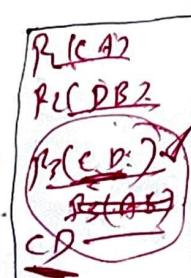
What is primary index? Explain the different types of primary index. 2

Sparse Index.

Dense Index.

R1(A)

R1(BD)  
f = (D+B)



FDM2L

Institute of Technical Education & Research, SOA

BSJG

END-SEMESTER EXAMINATION, DECEMBER-2019  
Introduction to Databases (CSE 3151)

SORV

DTGP

Programme: BTech  
Full Marks: 60

Semester: 5th  
Time: 3 Hours

Subject/Course Learning Outcome	Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture	L2	1 a,b,c	6
To apply relational algebra and relational calculus to express queries on relational schemas	L4	6 a,b,c	6
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modeling to construct the ER diagram	L4	2 a,b, c, 3 a, b,c	12
To analyze and design relational database schema using decomposition and normalization techniques	L6	4 a,b, c, 5 a, b,c	12
To understand and interpret the functional issues related to transaction and database recovery along with the concept of storage and database system architecture.	L4	7 a,b, c, 8 a, b,c 9 a,b, c, 10 a, b,c	24

\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

- 0.5 + 1.5
- (a) Explain the three schema architecture with a neat block diagram. 2  
 (b) Explain the role of a database administrator. 2  
 (c) What is data independence? Differentiate between logical and physical data independence. 2

QUESTION

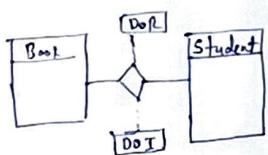
0.5

2. (a) Distinguish between candidate key and super key with example.

- (b) Explain the disjoint and overlapping generalization with respect to ER data model.

- (c) What is weak entity set? How the primary key of weak entity set is determined?

3. (a) Consider a database maintaining details of the books issued to the students. Each book is represented by its ISBN number, title, author name, year and price. Each book has a unique ISBN number. There may be multiple authors for one book. Each student is represented by its rollno, name, semester, branch and section. Each student has a unique rollno. The association of student and book is represented by the relationship named as issue. The date of issue and date of return of a book are associated with the relationship set issue. One student can issue multiple books. The database may include details of students who have not issued any book and details of books that have not issued to any student. Draw the ER diagram for the above database representing entity set, relationship set, mapping cardinality and participation constraints.



- (b) Translate the ER diagram represented in que. 3(a) to its corresponding relational schema.

- (c) Illustrate the referential integrity for the relational schema resulted in que 3(b) and draw its corresponding schema diagram.

4. (a) Consider the following set F of functional dependencies on the relation schema R(A,B,C,D): {A->BC, C->B, D->C}

Check whether AD->B is possible in F+ or not. Justify your answer using Armstrong's axioms.

$$\begin{aligned}
 C &\rightarrow B \\
 A \rightarrow B \text{ and } A \rightarrow C \\
 AD \rightarrow BD \text{ and } AD \rightarrow CD \\
 D \rightarrow C \Rightarrow AD \rightarrow AC
 \end{aligned}$$

$$\begin{aligned}
 A \rightarrow BC \\
 AD \rightarrow ABCD \\
 AD \rightarrow B
 \end{aligned}$$

$$\begin{aligned}
 A \rightarrow BC \\
 AD \rightarrow ABCD \\
 AD \rightarrow B
 \end{aligned}$$

0.5

A+0.5

- (b) Explain the desirable properties of schema 2 decomposition with example.

Find out the candidate keys for the relation 2 schema R(A',B',C',D') with functional dependency set F {B'->AD', A'->C', D'->BC'}.  $\frac{B' \in DECA - (ACT, ACK)}{B' \in BADC}$

5. (a) Distinguish between partial and full functional dependency with example.

Consider the relational Schema R(A,B,C,D) with Functional Dependency set : F {AB->CD, C->A, D->B}. Comment whether R satisfies property of BCNF or not with reason.

AB key  $\frac{co^1 \cdot CDAB}{CD, BC, AD}$   
BCNF decomposition of the schema given in que 2 5(b) is not desirable. Justify your answer

Consider the following relational schemas:

Employee (ename, city, state)  
Works (ename, company name, salary)  
Company (company name, city)

- (a) Write a relational algebra query to find the name of the employees getting salary more than 60,000 and working in TCS or WIPRO.

- (b) Write a query using Tuple relational Calculus to find the name of the employees living in city Cuttack and working in the companies placed in Bhubaneswar.

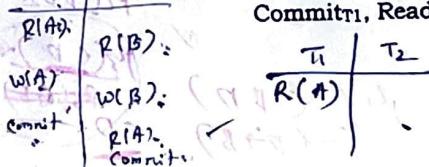
- (c) Write a query using Domain relational Calculus to find the name of the employees getting salary more than 60000.  $\{e \mid \exists c, s \in \text{Works} \wedge s > 60,000\}$

- 7 (a) What is transaction? Explain the different states of the transaction with diagram.

- (b) Differentiate between a serial and serializable schedule with proper example.

- (c) Check whether the given schedule S is conflict serializable and recoverable or not-

S : Readr1(A), Readr2(B), Writer1(A), Writer2(B), Commitr1, Readr2(A), Commitr2



- 8 (a) Explain the need of cascadeless schedule with an example. 2
- (b) Differentiate between rigorous and strict two phase locking protocol. 2
- (c) Explain the different types of timestamp values used in time stamp ordering protocol. 2
- 9 (a) Write the advantage and disadvantage of multi version concurrency control techniques. 2
- (b) Differentiate between the approach used by a time stamp ordering protocol and multi version timestamp ordering protocol to handle a write (Q) operation. 2
- (c) What steps are taken by a log based recovery scheme using checkpoints to recover from a system failure? 2
- 10 (a) Differentiate between log based recovery technique with Deferred and immediate database modification scheme. 2
- (b) What actions will be taken by the log based recovery technique for Deferred and immediate database modification, if a failure occurs after the Write(B) operation in the following schedule? 2
- (c) What is primary index? Explain the different types of primary index. 2

T1: Read(A) A=A-500	T2: Read(B) B=B-100	T3: Read(C)
Write (A) Commit	Write(B) Commit	

### END-SEMESTER EXAMINATION, DECEMBER-2019

#### Introduction to Databases (CSE 3151)

Programme: BTech  
Full Marks: 60

Semester: 5th  
Time: 3 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture	L2	1 a,b,c	6
To apply relational algebra and relational calculus to express queries on relational schemas	L4	6 a,b,c	6
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modeling to construct the ER diagram	L4	2 a,b, c, 3 a, b,c	12
To analyze and design relational database schema using decomposition and normalization techniques	L6	4 a,b, c, 5 a, b,c	12
To understand and interpret the functional issues related to transaction and database recovery along with the concept of storage and database system architecture.	L4	7 a,b, c, 8 a, b,c 9 a,b, c, 10 a, b,c	24

\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Explain the three schema architecture with a neat block diagram. 2
- (b) Explain the role of a database administrator. 2
- (c) What is data independence? Differentiate between logical and physical data independence. 2

2. (a) Distinguish between candidate key and super key with example. 2
- (b) Explain the disjoint and overlapping generalization with respect to ER data model. 2
- (c) What is weak entity set? How the primary key of weak entity set is determined? 2
3. (a) Consider a database maintaining details of the books issued to the students. Each book is represented by its ISBN number, title, author name, year and price. Each book has a unique ISBN number. There may be multiple authors for one book. Each student is represented by its rollno, name, semester, branch and section. Each student has a unique rollno. The association of student and book is represented by the relationship named as issue. The date of issue and date of return of a book are associated with the relationship set issue. One student can issue multiple books. The database may include details of students who have not issued any book and details of books that have not issued to any student. Draw the ER diagram for the above database representing entity set, relationship set, mapping cardinality and participation constraints. 2
- (b) Translate the ER diagram represented in que. 3(a) to its corresponding relational schema. 2
- (c) Illustrate the referential integrity for the relational schema resulted in que 3(b) and draw its corresponding schema diagram. 2
4. (a) Consider the following set F of functional dependencies on the relation schema R(A,B,C,D):  
 $\{A \rightarrow BC, C \rightarrow B, D \rightarrow C\}$   
 Check whether  $AD \rightarrow B$  is possible in  $F^+$  or not.  
 Justify your answer using Armstrong's axioms. 2
- \* (b) Explain the desirable properties of schema 2 decomposition with example. 2
- (e) Find out the candidate keys for the relation 2 schema  $R(A, B, C, D)$  with functional dependency set  $F \{B \rightarrow AD, A \rightarrow C, D \rightarrow BC\}$ . 2
5. (a) Distinguish between partial and full functional dependency with example. 2
- (b) Consider the relational Schema  $R(A,B,C,D)$  with 2 Functional Dependency set :  $F \{AB \rightarrow CD, C \rightarrow A, D \rightarrow B\}$ . Comment whether R satisfies property of BCNF or not with reason. 2
- (c) BCNF decomposition of the schema given in que 2 5(b) is not desirable. Justify your answer 2
6. Consider the following relational schemas:  
 Employee (ename, city, state)  
 Works (ename, company name, salary)  
 Company (company name, city)  
 (a) Write a relational algebra query to find the name of the employees getting salary more than 60,000 and working in TCS or WIPRO. 2
- (b) Write a query using Tuple relational Calculus to find the name of the employees living in city Cuttack and working in the companies placed in Bhubaneswar. 2
- (c) Write a query using Domain relational Calculus to find the name of the employees getting salary more than 60000. 2
7. (a) What is transaction? Explain the different states of the transaction with diagram. 2
- (b) Differentiate between a serial and serializable schedule with proper example. 2
- (c) Check whether the given schedule S is conflict serializable and recoverable or not-  
 $S : \text{Read}_1(A), \text{Read}_2(B), \text{Writer}_1(A), \text{Writer}_2(B), \text{Commit}_1, \text{Read}_2(A), \text{Commit}_2$  2

MID-SEMESTER EXAMINATION, SEPTEMBER-2019  
Introduction to Databases (CSE 3151)

Programme: BTech  
Full Marks: 30

Semester: 5th  
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture	L2	1 a, b, c. 2 b	8
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modeling to construct the ER diagram	L4	2 a, c. 3 a, b. c	10
To analyze and design relational database schema using decomposition and normalization techniques	L6	4 a,b,c 5 a,b,c	12

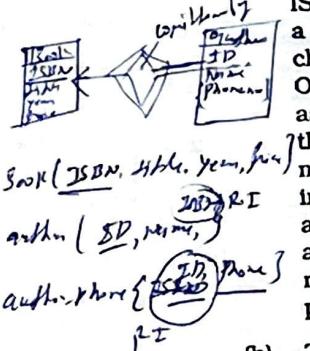
\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) List four significant differences between a file processing system and a DBMS. 2  
(b) Explain the role of different database users. 2
- (c) What is database schema? How is it different from database instances? 2
2. (a) Distinguish between primary key and partial key with example. 2  
(b) List the role of different storage manager components. 2

- (c) What is generalization? Specify the different completeness constraints imposed on generalization. 2

3. (a) Consider a database maintaining the book and its author details. Each book is represented by its ISBN number, title, year and price. Each book has a unique ISBN number. Author of the book is characterized by author\_id, name and phone\_no. One author may have multiple phone\_no.s. The association of author and book is represented by the relationship named as written\_by. One book may have more than one author. The database has included those author details, who has written atleast one book. Draw the ER diagram for the above database representing entity set, relationship set, mapping cardinality and participation constraints.



- (b) Translate the ER diagram represented in que. 3(a) to its corresponding relational schema. 2

- (c) Illustrate the referential integrity for the relational schema resulted in que 3(b) and draw its corresponding schema diagram. 2

4. (a) Consider the following set F of functional dependencies on the relation schema R(A,B,C,D):

$$\{ A \rightarrow BC, C \rightarrow B, D \rightarrow C \}$$

$AD \rightarrow AC$  by augmentation  
 $AB \rightarrow BCD$  by augmentation  
 $AD \rightarrow ABCD$  by symin.

Prove using Armstrong's axioms that AD is a candidate key.

- (b) Explain extraneous attribute with example. 2

- (c) Consider a relational schema R(A,B,C,D,E) with the functional dependencies on the relation schema:  $F = \{ A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A \}$ . 2

Check the properties of decomposition if R is decomposed into  $R_1(A,B,C)$  and  $R_2(A,D,E)$ .

$$F_1 = \{ A \rightarrow BC \}$$

$$F_2 = \{ E \rightarrow A, A \rightarrow D \}$$

$$\begin{cases} B \rightarrow E \\ AD \rightarrow E \\ E \rightarrow D \end{cases}$$

$$R_1 \cap R_2 = A$$

$$R_1 - R_2 = BC$$

$$R_2 - R_1 = DE$$

$$A \rightarrow BC$$

$$A \rightarrow DE$$

lossless join.  
not dependency preserving.

5. (a) Consider the relation schema Student\_grade (regd, name, course\_id, title, grade) with functional dependency set  $F = \{ \text{regd} \rightarrow \text{name}, \text{course\_id} \rightarrow \text{title}, (\text{regd}, \text{course\_id}) \rightarrow \text{grade} \}$ . In what normal form R is in? Comment whether R satisfies 2NF or not with reason. 2

- (b) Find the 2NF decomposition of the relation schema Student\_grade with the functional dependency set F given in que 5(a). 2

- (c) Define 3NF with proper example. 2

\*End of Questions\*

student-grade ( regd, name, course\_id, title, grade )  
 $f = \{ \text{regd} \rightarrow \text{name}, \text{course\_id} \rightarrow \text{title}, \text{regd, course\_id} \rightarrow \text{grade} \}$

Key + regd Course-id

P.A = regd, course\_id

N.P.A = title, name, grade.

First Normal:

$f$  is not in 2NF  
because P.D extel.

$f_1(\text{regd} \rightarrow \text{name})$      $f_2(\text{course\_id}, \text{title})$   
 $f_1 = \{ \text{regd} \rightarrow \text{name} \}$      $f_2 = \{ \text{course\_id} \rightarrow \text{title} \}$

$f_3(\text{regd, course\_id}, \text{grade})$

$f_3 = \{ \text{regd, course\_id} \rightarrow \text{grade} \}$

**END-SEMESTER EXAMINATION, JUNE-2023**  
**Introduction to Databases (CSE 3151)**

**Programme: BTech**  
**Full Marks: 60**

Semester: 6th  
Time: 3 Hours

- 8 (a) Write a relational algebra query to find the name of the employees living in the same city of the employee John. (consider the schemas given in que. 7)

- (b) Write a query using Domain relational Calculus to display the name and salary of the employees working in TCS. (consider the schemas given in que. 7) 2

- (c) Let  $R_i(z)$  and  $W_i(z)$  denote read and write operations on a data element  $z$  by a transaction  $T_i$ , respectively. Check whether the given schedule  $S$  with four transactions is a conflict serializable schedule or not.

S: R4(x) R2(x) R3(x) R1(y) W1(y) W2(x) W3(y) R4(y)



- 9 (a) Explain the approach used by the time stamp ordering protocol to handle a write (Q) operation.

T1	T2	(b)
RIA)	RIA)	
WIA)	Rejected	(c)
WIA)	WIA)	

- Check whether the given schedule S can complete all its operations in the given order using timestamp based protocol  
 $S = \text{Read}_1(A), \text{Read}_2(A), \text{Writer}_1(A), \text{Writer}_2(A)$ .

- What is transaction? Explain the usefulness of atomicity and isolation property of transaction.

- 10 (a) Differentiate between log based recovery technique with Deferred and immediate database modification scheme.

- (b) Specify the state of the system log and database corresponding to the execution of operations related to T1, T2 and T3, assuming initial value of A=2000, B=500 and C=1000. What actions will be taken by the log based recovery technique with immediate database modification, if a failure occurs after the Write(B) operation in the following schedule?

T1: Read(A) A=A-500	T2: Read(B) B=B-100	T3: Read(C)
Write(A) Commit	Write(B)	

① What is a cascadeless schedule? Check whether the given schedule S is cascadeless or not. S : Readr1(A), Readr2(B), Writer1(A), Commitr1, Readr3(A), Writers(A), Readr2(A), Commitr2, Commitr3

	71	72	T3
R1	1	0	0
W1	0	1	0
R3	0	0	1
W2	0	0	1
C1	1	1	0
C2	0	1	0
C3	0	0	1

	71	72	73	
tr3	P(AB)	P(BA)		
$\rightarrow T_3$	$w(A)$		$E(w_A)$	

Subject/Course Learning Outcome	Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture	L2	1 a,b,c, 2 b	8
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modeling to construct the ER diagram	L4	2 a, c, 3 a, b,c 4 a	12
To analyze and design relational database schema using decomposition and normalization techniques	L5	4 b, c, 5 a,b ,c 6 a,b,c	16
To apply relational algebra and relational calculus to express queries on relational schemas.	L4	7 a,b, c, 8 a, b	10
To understand and interpret the functional issues related to transaction and database recovery along with the concept of storage and database system architecture.	L4	8 c 9 a,b, c, 10 a, b, c	14

**\*\*Bloom's taxonomy levels:** Remembering (L1), Understanding (L2), Applying (L3), Analysing (L4), Evaluating (L5), Creating (L6)

Answer all questions. Each question carries equal mark.

- Answer all questions

1. (a) What is data model? Differentiate between relational and semi-structured data model. 2  
(b) What is data independence? Differentiate between logical and physical data independence. 2  
(c) What is the need of data abstraction? Explain the three levels of data abstraction. 1.5 2

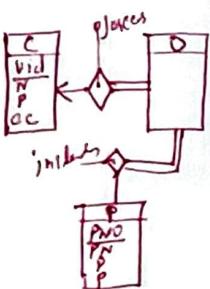
2. (a) Distinguish between candidate key and super key. Identify the all possible candidate keys for the employee entity set having attributes employee\_no, name, email\_id, phone\_no, department 2

C.K: employee no., email id, phone no.;  
Combination.

and salary.

- (b) Differentiate the role of sophisticated users and naïve users. 2  
(c) Explain the concept of generalization? Differentiate between disjoint and overlapping constraint imposed on generalization with proper example. 2

3. (a) Consider a database maintaining the details of the orders placed by customers in an online shopping system. Each customer is represented by a unique id, name, phoneno, customer\_city. One customer can place many orders. Each order is represented by a unique order\_no, amount, date and order\_status. Order includes some products. Each Product is represented by a unique product\_no, product\_name, description and price. The association of customer and order is represented by the relationship named as "places" and association of order and product is represented by the relationship named as "includes". One order can include many products and many orders can be placed for the same product. The database also keeps information about the customers who have registered but have not placed any order. Construct the ER diagram for the above database representing entity set, relationship set, mapping cardinality and participation constraints.



- ① (b) Develop the appropriate relational schemas for the database of online shopping system illustrated in the ER diagram related to que. 3(a). 2  
② (c) Analyze the referential integrity for the relational schema resulted in que 3(b) and draw its corresponding schema diagram. 2

4. (a) Consider the following set F of functional dependencies on the relation schema R(A,B,C,D, E) : {AB→C, BC→D, C→E}. List out the all possible candidate and super keys of R. AB. Super key all combination with AB total 8.

- (b) Let the set of functional dependencies F = {QR → S, R → P, S → Q} hold on a relation schema X = (PQRS). X is not in BCNF. Suppose X is decomposed into two schemas Y and Z where Y = (PR) and Z = (QRS). Check the properties of decomposition and check whether the decomposed schema satisfies the property of BCNF or not.

- (c) Consider the relational Schema R(A,B,C,D) with Functional Dependency set : F { BC→A, AD → B, C→AD }. Find the

$$F_c = \{ AD \rightarrow B \\ C \rightarrow AD \}$$

Big Redundant.

canonical cover of F.

$C \rightarrow AD \rightarrow B$   $AD \rightarrow B$   
 $AD$  is not superkey  
Not in 3NF.

5. (a) Key =  $BC$  Consider the relational Schema R(A,B,C,D) with Functional Dependency set : F { BC→A, AD → B, C→AD }. Comment whether R satisfies the property of 3NF or not with reason.

- (b) Find 3NF decomposition of R specified in 5(a) based on canonical cover of F. Represent the key attribute and the functional dependency set of each decomposed schema.

- R<sub>1</sub>(ADB) R<sub>2</sub>(ACD) F<sub>1</sub> = AD → B, F<sub>2</sub> = C → AD ①  
R<sub>1</sub>(ADB) R<sub>2</sub>(ACD) Yes

6. (a) ① What is partial dependency? Identify the number of partial dependencies in a relational schema R(X,Y,V,U,Z) with FD set F = {X → YZ, Z → V, V → XY}. Key = XU, ZV, YU X → Y } PFD

- ② Y is non prime. V → Y Partial  
Suppose the following functional dependencies hold on relation U with attributes P, Q, R, S, and T: {P → QR, RS → T}. Check whether the functional dependencies PS → T and PS → Q can be inferred from the above functional dependencies. (Justify using Armstrong's axioms)

7. (c) ③ Consider the relational Schema R(A,B,C,D) with the set of Dependency { B → ACD, AB → CD }. Comment whether R satisfies the property of 4NF or not with reason.

- c. Key = B Yes. S. K = B, AB ④

- Consider the following relational schemas:  
Employee (ename, ecity, estate) E  
Works (ename, company name, salary)  
Company (company name, city) C

- (a) Write a relational algebra query to find the name of the employees living in city Cuttack and working in the company placed in Bhubaneswar.  $\pi_{\text{ename}}(\sigma_{\text{ecity} = 'Cuttack'} \wedge \text{city} = 'BBSR')$  (Employee  $\cap$  Works  $\cap$  Company)

- (b) Write a query using Tuple relational Calculus to find the name of the employees working in the company placed in Mumbai and getting salary more than 80000.

- (c) Write a query using Domain relational Calculus to display the name and state of the employees who are working in any company placed in DELHI.

{ < ename, estate > |  $\exists$  city ( < ename, ecity, estate > ) } Employee

$\exists$  en, cn, s [ < en, cn, s >  $\in$  Work  $\wedge$  c (< en, cn, s >) ] } c = Delhi

**MID-SEMESTER EXAMINATION, April-2023**  
**Introduction to Databases (CSE 3151)**

Programme: BTech  
 Full Marks: 30

Semester: 6th  
 Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture	L2	1 a, b, c, 2 b	8
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modeling to construct the ER diagram	L4	2 a, c, 3 a, b, c	10
To analyze and design relational database schema using decomposition and normalization techniques	L6	4 a,b,c 5 a,b,c	12

\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) What is the need of data abstraction? Explain the three 2 level of data abstraction.
- (b) Differentiate the role of sophisticated users and 2 application programmers.
- (c) What is data model? Differentiate between relational 2 and semi-structured data model.
2. (a) Distinguish between candidate key, super key, primary 2 key and alternate key with example.

- (b) Outline the role of different query processor components. 2
- (c) Explain the concept of generalization? Differentiate between disjoint and overlapping constraint imposed on generalization with proper example. 2
3. (a) Consider a database maintaining the details of the orders placed by customers in a online shopping system. Each customer is represented by a unique id, name, phoneno, address. One customer can place many orders. Each order is represented by a unique order\_no, amount, date and order\_status. Order includes some products. Each Product is represented by a unique product\_no, product\_name, description and price. The association of customer and order is represented by the relationship named as "places" and association of order and product is represented by the relationship named as "includes". One order can include many products and many orders can be placed for the same product. The database also keeps information about the customers who have registered but have not placed any order. Construct the ER diagram for the above database representing entity, set, relationship set, mapping cardinality and participation constraints. 2
- (b) Develop the appropriate relational schemas for the database of online shopping system illustrated in the ER diagram related to que. 3(a). 2
- (c) Analyze the referential integrity for the relational schema resulted in que 3(b) and construct its corresponding schema diagram. 2
4. (a) Consider the following set F of functional dependencies on the relation schema R(A,B,C,D, E) :  $\{AB \rightarrow C, BC \rightarrow D, C \rightarrow E\}$ . List out the all possible candidate and super keys of R. (GATE 2022) 2

- (b) Consider a relational schema  $X(P,Q,R,S)$  with the functional dependencies on the relation schema:  
 $F = \{ QR \rightarrow S, R \rightarrow P, S \rightarrow Q \}$ . Check the properties of decomposition if R is decomposed into  $R1(P,R)$  and  $R2(Q,R,S)$ .
- (GATE 2019)
- (c) Consider the following table T and the set of functional dependencies F:  $\{ A \rightarrow B, C \rightarrow B, D \rightarrow ABC, AC \rightarrow D \}$
- | T: | A  | B  | C  | D |
|----|----|----|----|---|
| a1 | b1 | c1 | d1 |   |
| a1 | b1 | c2 | d2 |   |
| a2 | b1 | c1 | d3 |   |
| a2 | b1 | c3 | d4 |   |
- Given the following records or rows, indicate which record can be added in to table T without violating any of the functional dependencies in F. If a record or row cannot be legally added, justify it indicating which functional dependency is violated.
- Records : (a5, b6, c7, d8), (a2, b2, c1, d8), (a3, b1, c4, d3), (a1, b1, c2, d5)
5. (a) Explain 1NF with proper example. 2
- (b) What is partial dependency? Identify the number of partial dependencies in a relational schema  $R(X,Y,V,U,Z)$  with FD set  $F = \{X \rightarrow YZ, Z \rightarrow V, V \rightarrow XY\}$ . 2
- (c) A database of research articles in a journal uses a schema Article (volume, number, startpage, endpage, title, year, price) with the functional dependencies  $F = \{ (volume, number, startpage, endpage) \rightarrow title, (volume, number) \rightarrow year, (volume, number, startpage, endpage) \rightarrow price \}$ . Which is the weakest normal form that the schema satisfies? Comment whether it satisfies the property of 2NF or not with reason. If no, redesign the schema satisfying the properties of 2NF. (GATE 2016) 2

\*End of Questions\*

**MID-SEMESTER EXAMINATION, April-2024**  
**Introduction to Databases (CSE 3151)**

Programme: B.Tech. (CSE & CSIT)  
 Full Marks: 30

Semester: 6th  
 Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
To identify and explain the different components and functionalities of DBMS and their interdependence through the database architecture.	L1,L2	1a, b, c 2a, b	10
To analyze an enterprise schema for given user requirements and apply the conceptual database design principles through ER modelling to construct the ER diagram and corresponding relation schemas.	L4	2c, 3a,b,c	8
To analyze and design relational database schema using decomposition and normalization techniques.	L4	4a,b,c 5a, b, c	12

\*Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1.	(a)	What is a DBMS? State the advantages of using DBMS over file system?	2
	(b)	What is data dictionary? What information store in the data dictionary?	2
	(c)	What is data independence? Differentiate between logical and physical data independence.	2
2.	(a)	Distinguish between candidate key and secondary key. Identify the all possible candidate keys for the instructor entity set having attributes id, name, email_id, Phone_no and salary.	2
	(b)	Define composite attribute, multivalued attribute, derived attribute, and their representations for an ER diagram?	2
	(c)	What is a weak entity? How the primary key of the weak entity set is determined?	2

3.	(a)	Indian Postal Service (IPoS) prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, IPoS relies on a company-wide information system. Shipped items are the heart of the IPoS product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the IPoS system at a single retail center. Retail centers are characterized by their type, uniqueID, and address. Address of retail centers includes city, state, pin_code. Shipped items make their way to their destination via one or more standard IPoS transportation events (i.e., flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g., flight, truck), and a deliveryRoute. Create an Entity Relationship diagram that captures this information about the IPoS system. Be certain to indicate identifiers and constraints of ER model.	2
	(b)	Develop the appropriate relational schemas for the databases illustrated in the ER diagram related to que. 3(a).	2
	(c)	Analyze the referential integrity for the relational schema resulted in que 3(b) and draw its corresponding schema diagram.	2
4.	(a)	Find all possible candidate keys for R (A B C D E) having following functional dependencies set F= {A→BC, CD→E, B→D, E→A}.	2
	(b)	Suppose the relational schema R is decomposed into R1(A, B, C) and R2(A, D,E). Show that this decomposition is lossless if the following dependency holds {A→BC, CD→E, E→A, B→D}.	2
	(c)	Consider the following set of F of functional dependencies on the relation schema R(A,B,C,D): F = {A→C, C→B, D→C}. Prove using inference rule that functional dependency AD→B exist or not. Justify your answer.	2
5.	(a)	Consider the relation schema R(A, B, C, D,) with functional dependency set F= { BC → A, AD → B, C → AD} Comment whether it satisfies the property of 3NF or not with reason.	2
	(b)	Find the 3NF decomposition of the relation schema R with the functional dependency set F given in que 5(a) and check the properties of decomposition.	2
	(c)	Find the BCNF decomposition of the relation schema R with the functional dependency set F given in que 5(a) Check the resultant decomposition schema is identical with the BCNF decomposition of R obtained using canonical cover of F or not.	2
		*End of Questions*	