

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B. Sc. (Engg.) Part-3 Odd Semester Examination-2023**  
**Course: CSE-3121 (Database Management Systems)**

**Full Marks: 52.5**

**Time: 3 Hours**

**[Answer six questions taking three from each section]**

**Section-A**

- |    |   |      |
|----|---|------|
| 1. | (a) Define Database and DBMS.   | 2    |
|    | (b) What are the disadvantages of File Processing System?   | 3    |
|    | (c) Write the functions of a Database Administrator (DBA)?  | 3.75 |
| 2. | (a) What is data abstraction? Discuss different levels of data abstraction.                                     | 3.75 |
|    | (b) Explain DDL and DML as the DBMS languages.  | 2    |
|    | (c) Define Super key, Candidate key, and Primary key with example.  | 3    |
| 3. | (a) Define composite, multi-valued, and derived attributes with example.  | 3    |
|    | (b) Draw a complete E-R diagram for a university database with the following entity sets and relationship sets. | 2.75 |
|    | Entity sets:  |      |
|    | Student(SId, SName, Program)  |      |
|    | Course Offering(Year, Semester, RoomNo)   |      |
|    | Instructor(InsId, InsName, Designation, Dept)   |      |
|    | Course(CNo, CTTitle, Credits)   |      |
|    | Relationship sets:  |      |
|    | Enrolls: between Student and Course (a many-to-many relationship)   |      |
|    | Teaches: between Course Offering and Instructor (a many-to-many relationship)                                   |      |
|    | IsOffered: between Course Offering and Course (a many-to-one relationship)                                      |      |
|    | (c) What is mapping cardinality? Briefly discuss different types of mapping cardinalities.                      | 3    |
| 4. | (a) Explain with diagram Specialization, Generalization, and Aggregation features of E-R model.                 | 4.75 |
|    | (b) Derive the tables for relationship set and entity sets for Figure-1 and Figure-2.                           | 4    |

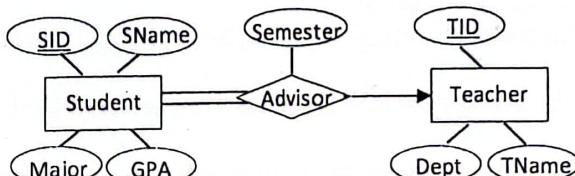


Figure-1

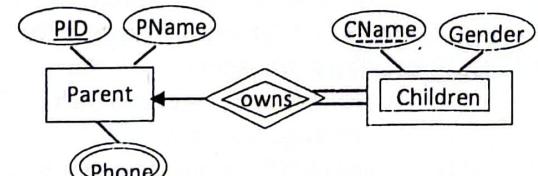


Figure-2

**Section-B**

- |        |   |   |
|--------|---|---|
| 5. (a) | Write the relational algebra from the tables mentioned below from Figure-3 to Figure-8 for the following queries: | 5 |
|        | (i) Find out the customer names who have either an account or a loan or both.                                     |   |
|        | (ii) Find out the customer names who have both an account and a loan.   |   |
|        | (iii) Find out the customer names who have a loan but not an account.   |   |
|        | (iv) Find the branch name of the customers who have an account in the bank and who live in Rajshahi.              |   |
|        | (v) Find out the customer names who have accounts in all banks.   |   |

customer_name	account_no
Karim	A-101
Rahim	A-102
Kamal	A-103
Jamal	A-104
Rafiq	A-105

Figure-3: depositor

customer_name	loan_no
Shafiq	L-101
Karim	L-102
Salam	L-103
Rahim	L-104
Barkat	L-105

Figure-4: borrower

customer_name	customer_City
Karim	Dhaka
Rahim	Rajshahi
Kamal	Khulna
Jamal	Dhaka
Rafiq	Rajshahi

Figure-5: customer

branch_name	account_no
Savar	A-101
Motihar	A-102
Rupsha	A-103
Dhanmondi	A-104
Godagari	A-105

Figure-6: account

customer_name	bank_name
Karim	Sonali
Rahim	Rupali
Kamal	Sonali
Jamal	Rupali
Rahim	Sonali

Figure-7: transaction

bank_name
Sonali
Rupali

Figure-8: bank

- (b) Explain left outer join, right outer join, and full outer join operations in relational algebra. 3.75
6. (a) What is view? Shortly explain different types of views. 2.75  
 (b) Suppose there are three schema for two relations and with their relationship set as follows: 3  
*Customer(cus-name, cus-street, cus-city), Account(branch-name, acc-no, balance)*  
*Depositor(cus-name, acc-no)*  
 Now write the SQL commands for the following queries:  
 (i) to find the average balance for each customer who lives in Rajshahi city and has at least three accounts.  
 (ii) to find those branches for which the average balance is greater than or equal to all average balances.
- (c) Write a SQL command to apply a *check* constraint on the field *balance* during creation of an *Account* table with schema *Account(acc-no, acc-name, balance)* to check a negative balance when inserting records in the table. 1
- (d) What is trigger? Explain. 2
7. (a) What do you mean by functional dependency? From the following table can we write 2  
 (Name,CGPA)  $\rightarrow$  (Dept,LG) or not?
- | Name  | Dept | CGPA | LG |
|-------|------|------|----|
| Karim | CSE  | 3.75 | A  |
| Rahim | ICE  | 4.00 | A+ |
| Kamal | EEE  | 3.50 | A- |
| Rahim | ICE  | 4.00 | A+ |
| Karim | CSE  | 3.75 | A  |

```
SELECT c.cust_name, AVG(a.balance) AS X
FROM Customer c
JOIN Account a ON c.cust_id = a.cust_id
WHERE c.city = 'Rajshahi'
GROUP BY c.cust_id, c.cust_name
HAVING COUNT(a.acc_id) >= 3;
```
- (b) Suppose there is a relation R with the following schema and functional dependency: 3.75  
*R(A,B,C,D,E)* and  $FD = \{AB \rightarrow CDE, D \rightarrow A\}$   
 Now prove that the relation is in Third Normal Form (3NF) but not in Boyce-Codd Normal Form (BCNF).

- (c) Suppose the following relation  $R(A,B,C)$  is decomposed into two relations  $R_1(A,B)$  and  $R_2(A,C)$ . 3

A	B	C
1	1	1
2	1	2
3	2	1
4	3	2

Now prove that the decomposition is a lossless joint decomposition.

8. (a) Discuss how mirroring and striping of disks are used to improve reliability and performance? 3  
 (b) Explain in short the ACID properties of transaction. 2  
 (c) Does the following schedule preserve the consistency between transaction  $T_1$  and  $T_2$ ? Explain 1.75  
 your answer.

$T_1$	$T_2$
read(A) A:=A-50	read(A) temp:=A*0.1 A:=A-temp write(A) read(B)
write(A) read(B) B:=B+50 write(B)	B:=B+temp write(B)

- (d) Briefly discuss different states of transaction with diagram. 2

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[Answer any three questions from each Section]

**Section-A**

- |   |      |
|---|------|
| 1(a) What is file processing system? There are some advantages of DBMS over file processing system.<br>Explain them.  | 3    |
| (b) Define the terms domain constraints, referential integrity, assertions and authorization.   | 3    |
| (c) Different types of users use the database ranging from sophisticated to unsophisticated. Briefly discuss each type of database users.   | 2.75 |
| 2(a) What are rules to obtain Tables from (i) one-to-many relationships without total participation (ii) one-to-many relationship with one entity set having total participation on "many" side (iii) one-to-one relationship without total participation (iv) one-to-one relationship with one entity set having total participation | 3.5  |
| (b) Obtain Tables from the Fig 2.1, Fig 2.2, Fig 2.3  | 5.25 |

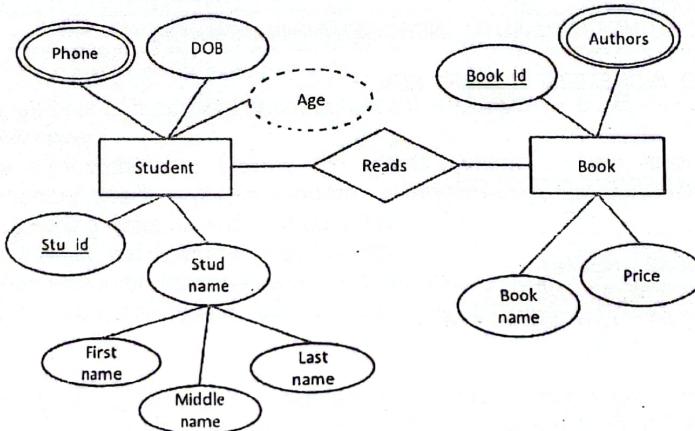


Fig 2.1

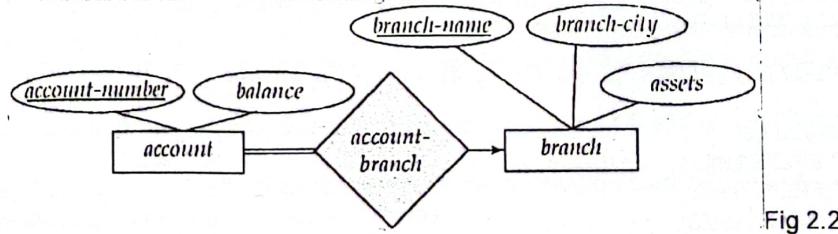


Fig 2.2

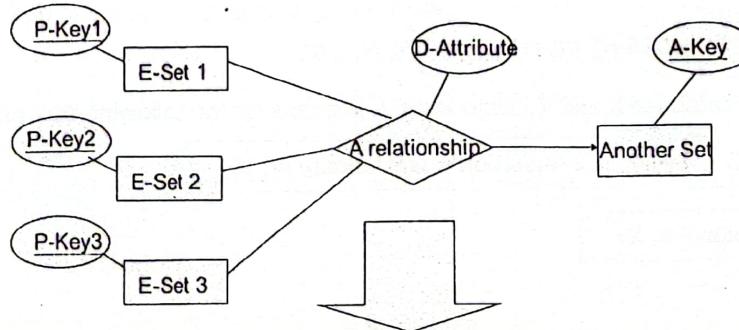


Fig 2.3

- |   |      |
|---|------|
| 3(a) Is it " $\Pi_{\text{Attribute List 1}}(\Pi_{\text{Attribute List 2}}(R)) = \Pi_{\text{Attribute List 2}}(\Pi_{\text{Attribute List 1}}(R))$ " true? Explain your answer.   | 2.75 |
| (b) Which students (ID and Name) of Relation R take ALL the courses that Albert Einstein of Relation S is taking? Could you please provide the relation algebra to obtain the result and display the intermediate micro-operations at each step before reaching the final output? | 6    |

R			
ID	Name	Cell Phone	Course
40112	Rubel	01712220010	CSE112
40112	Rubel	01345921242	CSE123
40113	Sumon	01354255125	CSE122
40113	Sumon	01852321012	CSE123
40113	Sumon	01526541298	CSE126
40128	Suvro	01423712583	CSE121
40128	Suvro	01235129842	CSE122
40128	Suvro	01931251358	CSE123
40240	Prince	01632541287	CSE121
40240	Prince	01274231581	CSE123
40240	Prince	01428951243	CSE126

S			
ID	Name	Cell Phone	Course
40101	Albert Einstein	044125412	CSE121
40101	Albert Einstein	044125412	CSE122
40101	Albert Einstein	044125412	CSE123

4(a) Consider the following codes:

6.25

```

CREATE TABLE test1(a1 INT);
CREATE TABLE test2(a2 INT);
CREATE TABLE test3(a3 INT NOT NULL AUTO_INCREMENT PRIMARY KEY);
CREATE TABLE test4(
    a4 INT NOT NULL AUTO_INCREMENT PRIMARY KEY,
    b4 INT DEFAULT 0
);
delimiter |
CREATE TRIGGER testref BEFORE INSERT ON test1
FOR EACH ROW
BEGIN
    INSERT INTO test2 SET a2 = NEW.a1;
    DELETE FROM test3 WHERE a3 = NEW.a1;
    UPDATE test4 SET b4 = b4 + 1 WHERE a4 = NEW.a1;
END;
|
delimiter ;

```

INSERT INTO test3 (a3) VALUES (NULL), (NULL), (NULL), (NULL), (NULL),  
 (NULL), (NULL), (NULL), (NULL);

INSERT INTO test4 (a4) VALUES (0), (0), (0), (0), (0), (0), (0), (0), (0);

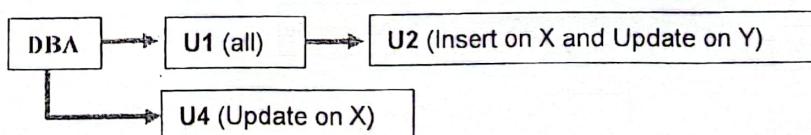
Now, what will you get

- (i) SELECT \* FROM test1;
- (ii) SELECT \* FROM test2;
- (iii) SELECT \* FROM test3;
- (iv) SELECT \* FROM test4;

When "INSERT INTO test1 VALUES (1), (3), (1), (7), (1), (8), (4), (4)"

(b) There two relations in a database X and Y, Write MySQL statements for the following Authorization Graph

2.5



### Section-B

5(a) Consider the following SQL code:

4

```

CREATE TABLE shop (
    article INT UNSIGNED DEFAULT '0000' NOT NULL,
    dealer CHAR(20) DEFAULT '' NOT NULL,
    price DECIMAL(16,2) DEFAULT '0.00' NOT NULL,
    PRIMARY KEY(article, dealer));

```

```

INSERT INTO shop VALUES
    (1,'A',3.45),(1,'B',3.99),(2,'A',10.99),(3,'B',1.45),
    (3,'C',1.69),(3,'D',1.25),(4,'D',19.95);

```

Now, what will be output of the following SQL statement:

- (i) SELECT \* FROM shop ORDER BY article;

```

(iii) SELECT MAX(article) AS article FROM shop;
(iv) SELECT article, dealer, price
      FROM shop
     WHERE price=(SELECT MAX(price) FROM shop);
(v)  SELECT article, MAX(price) AS price
      FROM shop
     GROUP BY article
    ORDER BY article;

```

- (b) Consider the Tables *Employee* and *EmpDept*, then write SQL statements for the following queries: 4.75
- Select the detail of the employee whose name start with P
  - Select the detail of employee whose email's Id is in Gmail.
  - Select the name of the employee who is working under Abhishek.
  - Select the detail of employee who are working In HR department

Table Name: Employee

Empid	EmpName	Department	ContactNo	EmailId	EmpHeadId
101	Isha	E-101	1234567890	isha@gmail.com	105
102	Priya	E-104	1234567890	priya@yahoo.com	103
103	Neha	E-101	1234567890	neha@gmail.com	101
104	Rahul	E-102	1234567890	rahul@yahoo.com	105
105	Abhishek	E-101	1234567890	abhishek@gmail.com	102

Table : EmpDept

DeptId	DeptName	Dept_off	DeptHead
E-101	HR	Monday	105
E-102	Development	Tuesday	101
E-103	Hous Keeping	Saturday	103
E-104	Sales	Sunday	104
E-105	Purchase	Tuesday	104

- 6(a) Let  $R = (A, B, C, D, E)$ , and set of functional dependencies  $F = \{ABCD \rightarrow E, E \rightarrow D, AC \rightarrow D, A \rightarrow B\}$  5.75  
Find out teh canonical cover.
- (b) Let Lending-schema = (branch-name, branch-city, assets, customer-name, loan-number, amount), and set of functional dependencies  $F = \{\text{branch-name} \rightarrow \text{branch-city}, \text{assets}, \text{loan-number} \rightarrow \text{amount}, \text{branch-name}\}$ . Let, Lending-schema is decomposed as  
(i) Branch-schema = (branch-name, branch-city, assets),  
(ii) Loan-schema = (loan-number, branch-name, amount) and  
(iii) Borrower-schema = (customer-name, loan-number). Can you clarify if they represent a lossless join decomposition?
- 7(a) Given the relation  $R = (A, B, C, D)$ , the set of functional dependencies  $F = \{A \rightarrow B, C \rightarrow D, B \rightarrow C\}$ , Let 3  
three BCNF decompositions: (i)  $R1 = \{(A, B), (C, D), (B, C)\}$ , (ii)  $R2 = \{(A, B), (C, D), (A, C)\}$ , (iii)  $R3 = \{(B, C), (A, D), (A, B)\}$ . Verify if they are in BCNF or not.
- (b) Let Lending-schema = (branch-name, branch-city, assets, customer-name, loan-number, amount), and set of functional dependencies  $F = \{\text{branch-name} \rightarrow \text{assets}, \text{branch-city}, \text{loan-number} \rightarrow \text{amount}, \text{branch-name}\}$ . Decompose it in BCNF. 4
- (c) Use Armstrong's axioms to prove the soundness of the union rule: if  $\alpha \rightarrow \beta$  and  $\alpha \rightarrow \gamma$  then  $\alpha \rightarrow \beta\gamma$  1.75
- 8(a) What is a database transaction? Briefly discuss the database transaction state with figure. 3  
(b) Explain two-phase locking protocol with lock conversions. 3  
(c) Explain the situation of the partial schedule given below. 2.75

**Department of Computer Science and Engineering  
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B.Sc.(Engg.) Part III (Odd semester) Examination 2021

Course Title; Database Management System

Full marks:52.5

Course code: CSE- 3121

Time: 3 Hours

[Answer three questions from each part]

**Part A**

- |      |   |      |
|------|---|------|
| 1(a) | Explain, what are the difficulties you may face to manage students records in a <i>Microsoft Excel</i> sheet? | 2.5  |
| (b)  | Explain different Levels of <i>Abstraction</i> of a Databases Management System?                              | 3.75 |
| (c)  | What are <i>Instances</i> and <i>Schemas</i> of Databases Management System? Explain with examples.           | 2.5  |
| 2(a) | Do you find any problem with the relationship shown in Fig 2.1? Explain your answer.                          | 3    |
| (b)  | Replace the <i>Ternary</i> relationship shown in Fig 2.2 with <i>Binary</i> relationship. Explain your idea.  | 3    |

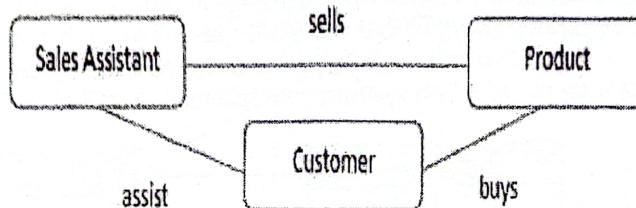


Fig 2.1

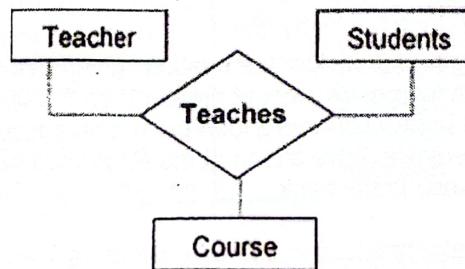


Fig 2.2

- |      |   |      |
|------|---|------|
| .(c) | What is <i>Strong Entity set</i> ? What are the problems of a <i>Weak Entity set</i> ?  | 2.75 |
| 3(a) | How can you form tables for <i>Entity set/Relationship set</i> from the following <i>ER diagram</i> (Fig 3.1 ~ Fig 3.4). Form the table(s) and explain your approaches. | 6    |

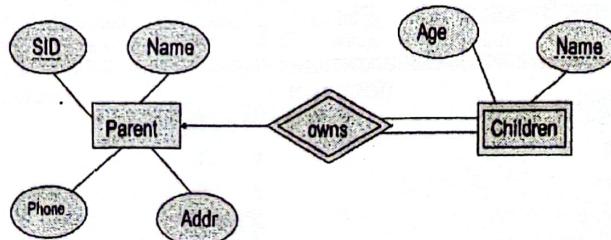


Fig 3.1

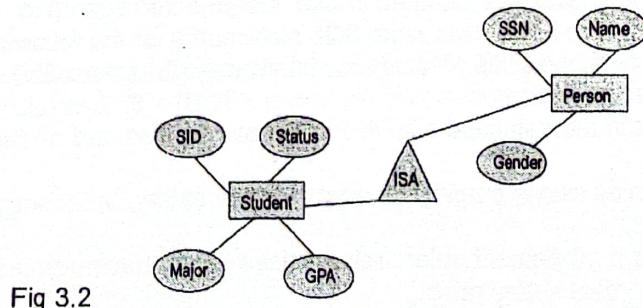


Fig 3.2

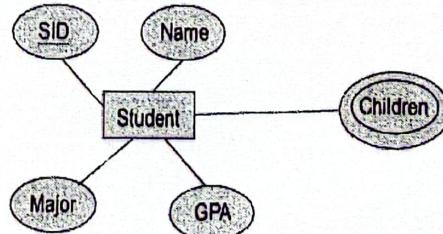


Fig 3.3

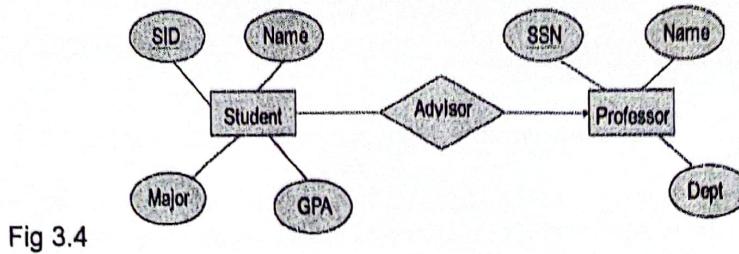


Fig 3.4

- (b) What are tests those must be made to preserve the following referential integrity constraint  $\Pi_a(r_2) \subseteq \Pi_k(r_1)$  for *Insert* and *Update* operations. 2.75

4(a) What will happen when *Triggers* are called in a cascading nature? 1.25  
 (b) What do you understand by the *Authorization Graph* shown in Fig. 4.1 1

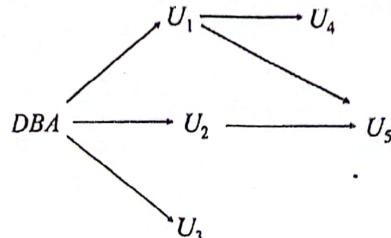


Fig. 4.1

- (c) Write an expression in relational algebra (consider the relations given below). 4.5

  - (i) to find the loan number for each loan of an amount greater than \$1200
  - (ii) to find out the customers of the bank who have a loan but not an account
  - (iii) to find the names of all customers who have a loan at the *Perryridge* branch.
  - (iv) to find the largest account balance in the bank

(d) Write an expression in relational algebra to find out all customers who have an account at all the branches located in *Brooklyn* (consider the relations given below). 2

## **Part B**

- 5(a) Briefly discuss how '%', '\_' and 'like' be used in SQL statement to search for string data? Give example 2.75  
(b) Consider the relations given below, and write SQL statements for the following queries. 6

  - (i) Find the names, streets and cities of residence of all employees who work for "Sonali" and earn more than 1,20,000 per annum.
  - (ii) Find all employees in the database who live in the same cities and on the same streets as do their managers.
  - (iii) Find those companies whose employees earn a higher salary, on average, than the average salary at "Agrani" Bank.
  - (iv) Give all managers a 10 percent salary raise unless salary becomes greater than 19,000; in such cases, give only a 3 percent salary raise.
  - (v) Show the 'works' relation instance after executing (iv).

Employee		
eName	Street	City
Arif	51 west	Rajshahi
Sumon	S2 east	Mymensingh
Sagor	Neemgachhi	Sirajgong
Abdul	Binodpur	Rajshahi
Himesh	Nazrul ave	Dhaka
Amirul	Chawk bazar	Sylhet
Salib	99 north	Chittagong

Works		
eName	cName	salary
Sumon	Agrani	12000
Abdul	Sonal	13000
Himesh	Agrani	6000
Amirul	Sonal	20000
Sagor	Sonal	8000
Arif	Janata	18000

Manages	
eName	mName
Amirul	Amirul
Abdul	Amirul
Sagor	Amirul
Sumon	Sumon
Himesh	Sumon
Arif	Arif

company	
cName	city
Agrani	Rajshahi
Sonal	Sylhet
Janata	Dhaka

- 6(a) What are the advantages, (i) RAID level 5 over RAID level 4 and (ii) RAID level 4 over RAID level 3? 2  
 (b) For the following two schedules shown in Fig. 6.1 and Fig. 6.2, by applying necessary swapping of non-conflicting instructions, prove that these are conflict equivalent. 3.5  
 (c) Is the schedule shown in Fig. 6.3 consistency preserving? Explain your answer. 3.25

$T_1$	$T_2$
read(A) write(A)	read(A) write(A)
read(B) write(B)	read(B) write(B)

Fig. 6.1

$T_1$	$T_2$
read(A) write(A) read(B) write(B)	read(A) write(A) read(B) write(B)
	read(A) write(A) read(B) write(B)

Fig. 6.2

$T_1$	$T_2$
read(A) $A := A - 50$	read(A) $temp := A * 0.1$ $A := A - temp$ write(A) read(B)
	write(A) read(B) $B := B + 50$ write(B)

Fig. 6.3

- 7(a) For  $R = (A, B, C)$ ,  $F = \{A \rightarrow B, B \rightarrow C\}$ , if  $R$  is decomposed in (i)  $R1 = (A, B)$ ,  $R2 = (B, C)$  and (ii)  $R1 = (A, B)$ ,  $R2 = (A, C)$ , then explain whether they are *Lossless-join decomposition* or not. 2.5  
 (b) Let, set of Functional Dependencies  $F = \{A \rightarrow BC, CD \rightarrow E, E \rightarrow C, D \rightarrow AEH, ABH \rightarrow BD, DH \rightarrow BCA\}$ . Check if  $BCD \rightarrow H$  is true or not. 2  
 (c) Let,  $R = (A, B, C)$ ,  $F = \{A \rightarrow BC, B \rightarrow C, A \rightarrow B, B \rightarrow C\}$ . Find out Canonical Cover and then the Candidate key/Primary key. 4.25  
 8(a) For following relations as shown in Fig. 8.1 ~ Fig. 8.3, find set of Functional Dependencies for those three relations. If Fig. 8.2 and Fig. 8.3 are decomposed from Fig. 8.1, is the decomposition dependency preserving? Explain your answer. 2.53

A	B	C
1	1	1
2	1	2
3	2	1
4	2	2

Fig. 8.1

A	B
1	1
2	1
3	2
4	2

Fig. 8.2

B	C
1	1
1	2
2	1
2	2

Fig. 8.3

- (b) Let  $R = (ABCDE)$ , set of Functional Dependencies  $F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow A\}$ . Let  $R$  is decomposed as  $R1 = (ABC)$  and  $R2 = (CDE)$ , prove that this decomposition is dependency preserving. 5.25

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B.Sc.(Engg.) Part III (Odd semester) Examination 2020

Course code: CSE 3121

Course Title: Database Management System

Full marks: 52.5

Time: 3 Hours

[Answer three questions from each part]

**Part A**

- |   |
|---|
| 1(a) What is DBMS? Discuss its advantages over file based system in storing data? <span style="float: right;">3</span><br>(b) Describe the level of abstraction in a DBMS. <span style="float: right;">3</span><br>(c) What are the responsibilities of a Database Administrator? <span style="float: right;">2.75</span>   |
| 2(a) What is Mapping Cardinalities? Explain different types of Mapping Cardinalities <span style="float: right;">2.5</span><br>(b) Express the operation of Deletion, Insertion and updating in relational algebra. <span style="float: right;">2.5</span><br>(c) Write an expression in relational algebra<br>(i) to find all customers who have both a loan and an account.<br>(ii) to find the largest account balance in the bank <span style="float: right;">3.75</span> |

customer-name	loan-number
Adams	L-16
Curry	L-93
Hayes	L-15
Jackson	L-14
Jones	L-17
Smith	L-11
Smith	L-23
Williams	L-17

borrower

customer-name	account-number
Hayes	A-102
Johnson	A-101
Johnson	A-201
Jones	A-217
Lindsay	A-222
Smith	A-215
Turner	A-305

depositor

account-number	branch-name	balance
A-101	Downtown	500
A-102	Perryridge	400
A-201	Brighton	900
A-215	Mianus	700
A-217	Brighton	750
A-222	Redwood	700
A-305	Round Hill	350

account

customer-name	customer-street	customer-city
Adams	Spring	Pittsfield
Brooks	Senator	Brooklyn
Curry	North	Rye
Glenn	Sand Hill	Woodside
Green	Walnut	Stamford
Hayes	Main	Harrison
Johnson	Alma	Palo Alto
Jones	Main	Harrison
Lindsay	Park	Fitzfield
Smith	North	Rye
Turner	Putram	Stamford
Williams	Nassau	Princeton

customer

- |  |
|--|
| 3(a) What are tests those must be made in order to preserve the following referential integrity constraint <span style="float: right;">3</span><br>$\Pi_{\alpha}(r_2) \subseteq \Pi_K(r_1)$ for Insert and Update operation. |
| (b) Explain every step, how can you use an Operation to get boys name (B.Name) and their roll registered on those courses that are taken by ALL the girls (G.Name)? <span style="float: right;">5.75</span>                  |

B.Name	Roll	Cell	CourseID
X	201	01711	CSE101
X	201	01711	CSE 102
Y	202	01711	CSE 103
Y	202	01911	CSE 102
Y	202	01911	CSE 101
Z	203	01811	CSE 104
Z	203	01811	CSE 101
W	204	01811	CSE 102

G.Name	Roll	Cell	CourseID
A	101	01711	CSE101
A	101	01711	CSE 102
A	101	01711	CSE 103
B	102	01911	CSE 102
B	102	01911	CSE 101
C	103	01811	CSE 104
C	103	01811	CSE 101
C	103	01811	CSE 102

- |   |
|---|
| 4(a) For the followings relations, derive the contents of relations for natural-join, left-outer-join, right-outer-join and full-outer-join. <span style="float: right;">3</span> |
|---|

loan_number	branch_name	amount
L-170	Downtown	3000
L-230	Redwood	4000
L-260	Perryridge	1700

customer-name	loan_number
Jones	L-170
Smith	L-230
Hayes	L-155

- |  |
|--|
| (b) Consider the relations given in question no#2, derive the contents of the relation found from the following query: <span style="float: right;">5.75</span> |
|--|

```

(i) select customer-name
from customer
where customer-street like '%Main%'

(ii) (select customer-name
from depositor)
union
(select customer-name
from borrower)

(iii) select branch-name, avg(balance)
from account
group by branch-name

```

**Part-B**

- 5(a) What are the tests to be done to check referential integrity constraint when a database is modified by 3  
Insert or Delete or Update operations?
- (b) What are Triggers? What are the Triggering Events? 3
- (c) What is View? Explain with an example. 2.75
- 6(a) What is a database transaction? Discuss ACID properties of database transaction. 2.75
- (b) Consider the following transactions- 3
- T1: read(A)  
read(B)  
 $B=A+B$   
write(B)
- T2: write(A)  
read(B)
- Add lock and unlock instruction so that the transaction T1 and T2 observe two-phase locking protocol. Is it deadlock free?
- (c) What is RAID? Discuss different RAID Levels. 3
- 7(a) What are the Conflicting Instructions? Explain them with examples. 4.75
- (b) For  $R = (A, B, C)$ ,  $F = \{A \rightarrow B, B \rightarrow C\}$ , if R is decomposed in (i)  $R_1 = (A, B)$ ,  $R_2 = (B, C)$  and (ii)  $R_1 = (A, B)$ ,  $R_2 = (A, C)$ , then explain whether they are Lossless-join decomposition and/or Dependency preserving 4.00
- 8(a) What do you mean by Closure of a Set of Functional Dependencies? 2
- (b) Given relation schema  $R = \{A, B, C, D, E\}$ . and FDs  $A \rightarrow BC$ ,  $CD \rightarrow E$ ,  $B \rightarrow D$ ,  $E \rightarrow A$ , now find 2 out  $A^+$ ,  $(AB)^+$ ,  $(BC)^+$ ,  $(ABC)^+$ .
- (c) The given relational scheme R with attributes A,B,C,D,F and the FDs  $A \rightarrow BC$ ,  $B \rightarrow E$ ,  $CD \rightarrow EF$ , prove that functional dependency  $AD \rightarrow F$  holds in R. 2.25
- (d) Given  $F = \{A \rightarrow C, AB \rightarrow C\}$ , prove that B is extraneous in  $AB \rightarrow C$ . 2.5