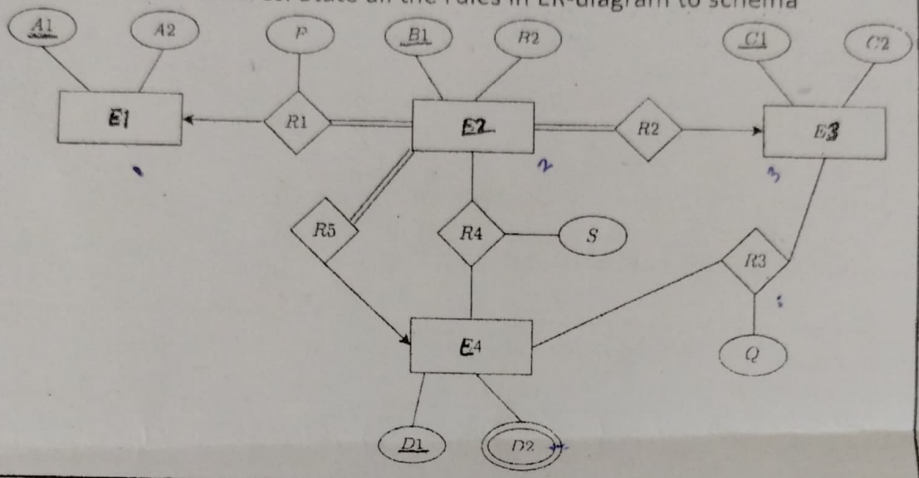
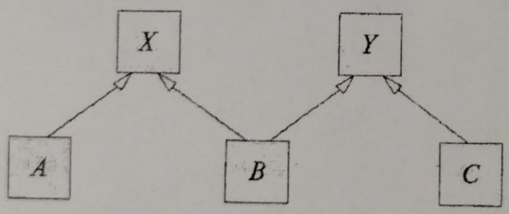
Degree: B.Tech. Semester: 3rd Branch: CSE/CSAI/CSDS/MAC

MID-SEMESTER EXAMINATION, September 2023

Max. Marks: **15**
Duration: **1:30** Hours

Course Title: Database Management Systems
Course Code: **COCSC05/CACSC05/CDCSC05/CMCSC05**

Note: - Attempt all questions in the given order only. Missing data/information (if any), maybe suitably assumed & mentioned in the answer.

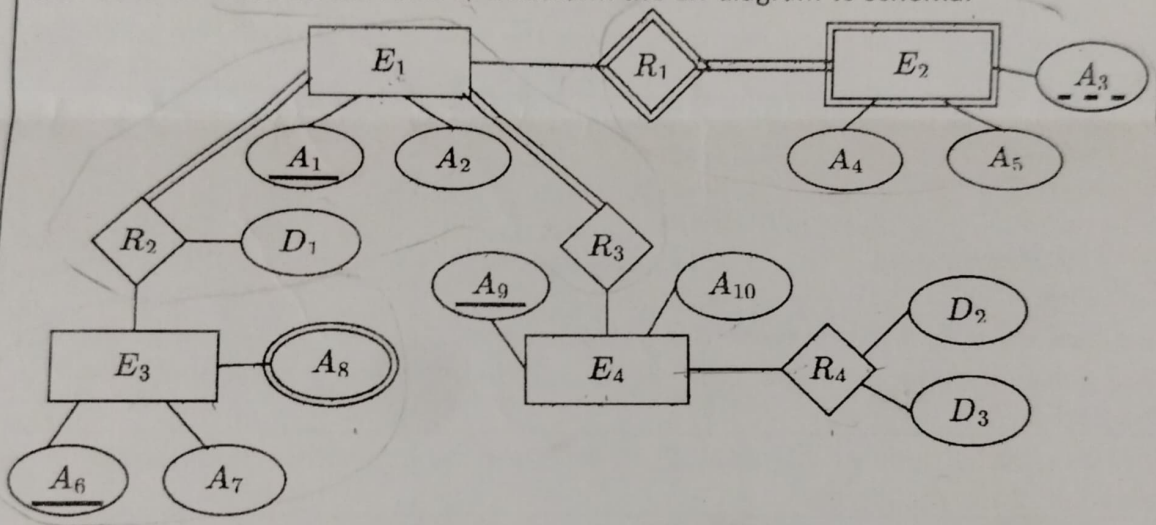
Q. No.	Question	Marks	CO
1a	Explain the difference between logical and physical data independence using suitable examples.	1.5	CO1
1b	Analyze the following ER-diagram. Find the number of tables/relations and provide their structures. State all the rules in ER-diagram to schema 	1.5	CO1
2a	State the different types of constraints in the relational databases? Explain each of them through suitable example.	1.5	CO2
2b	Explain the distinctions among the terms primary key, candidate key, and superkey using suitable examples.	1.5	CO2
3a	Consider the following lattice structure of generalization and specialization (attributes not shown).  For entity sets *A*, *B*, and *C*, explain how attributes are inherited from the higher-level entity sets *X* and *Y*. Discuss how to handle a case where an attribute of *X* has the same name as some attribute of *Y*.	2	CO1

3b	Consider the bank database of Q. No. 4a. Assume that branch names and ID uniquely identify branches and customers, but loans and accounts can be associated with more than one customer. (i) What are the appropriate primary keys? (ii) Given your choice of primary keys, identify appropriate foreign keys.	1	CO2
4a	Consider the following bank database. Give an expression in the relational algebra for each of the following queries: *branch (branch_name, branch_city, assets)* *customer (ID, customer_nume, customer_street, customer_city)* *loan (loan_number, branch_name, amount)* *borrower (ID, loan_number)* *account (account_number, branch_name, balance)* *depositor (ID, account_number)* (i) Count the number of branches in each city (ii) Find the ID of each borrower who has a loan in the branch "Downtown".	2	CO2
4b	Explain the difference between a weak and a strong entity set through a suitable example	1	CO2
5a	Let the following relation schemas be given: $R = (A,B,C)$, $S = (D,E,F)$ Let relations $r(R)$ and $s(S)$ be given. Give an expression in the tuple relational calculus that is equivalent to each of the following: a. $\Pi_A(r)$ b. $\sigma_{B=17}(r)$ c. $r \times s$	1.5	CO2
5b	Discuss various types of users in DBMS.	1.5	CO1

Degree: B. Tech Semester: 3rd - Course work
END-SEMESTER EXAMINATION, Nov-Dec 2023
Course Title: Database Management System
Course Code: COCSC05/CACSC05/CDCSC05/CMCSC05

Time: 03 Hours Max. Marks: 40

Note: - Attempt all the five questions. Missing data/ information (if any), maybe suitably assumed & mentioned in the answer.

Q. No.	Question	Marks	CO
Q 1	**Attempt any 2 parts of the following**		
1a	Highlight the key difference between the following with the help of suitable examples. i. DDL and DML ii. Candidate key and super key iii. Procedural and non-procedural language iv. Strong and weak entities	4	CO1
1b	Briefly describe the following terms with the help of an example. i. ACID properties ii. Data abstraction iii. Role of DBA iv. GRANT and REVOKE	4	CO1
1c	Analyze the following ER-diagram. Find the number of tables/relations and provide their schema. State all the rules to transform the ER-diagram to schema. 	4	CO1
Q 2	**Attempt any 2 parts of the following**		
2a	Considering relational databases below, give SQL expressions for the queries. *employee* (*ID*, *person name*, *street*, *city*), *works* (*ID*, *company name*, *salary*) *company* (*company name*, *city*), *manages* (*ID*, *manager id*) i. Find the *ID* of each employee who does not work for "First Bank Corpo- ration". ii. Find the *ID* of each employee who earns more than every employee of "Small Bank Corporation".	4	CO2
2b	Considering relations below, give relational algebra expressions for the queries. *branch*(*branch name*, *branch city*, *assets*) *customer* (*ID*, *customer name*, *customer_street*, *customer_city*) *loan* (*loan number*, *branch name*, *amount*), *borrower* (*ID*, *loan number*) *account* (*account number*, *branch name*, *balance*) *depositor* (*ID*, *account number*) i. Find each loan number with a loan amount greater than 11000. ii. Find the ID of each depositor who has an account with a balance greater than 18000 at the "Uptown" branch.	4	CO2

2c	Describe the concept of cardinality in the context of Entity-Relationship modeling. Provide examples of different cardinality ratios in relationships and explain their significance.	4	CO2
Q 3	**Attempt any 2 parts of the following**		
3a	Consider relation R(A B C D E F G H) with the FDs = {CH->G, A->BC, B->CFH, E->A, F->EG}. Find the highest normal form of R. If R is not in BCNF convert it into BCNF.	4	CO3
3b	Consider the relation R (A B C D E F) with following FDs. {A->B, CD->AB, BC->D, AE->F, CE->DA} decomposed into the following relations. R1(A B), R2(A C D), R3(B C D), R4(A E F), R5(C D E) Using the 3 properties of lossless decomposition check whether it is lossless or lossy decomposition. If it is lossless, prove it by applying the natural join of all the decomposed relations.	4	CO3
3c	Explain the canonical cover or minimal cover for functional dependencies. Consider F = {BCD->H, A->BC, CD->E, E->C, D->AEH, ABH->BD, DH->C}. Find the canonical cover for F.	4	CO3
Q 4	**Attempt any 2 parts of the following**		
4a	(i) What is conflict serializability? (ii) Consider the following schedules. Here, r,w,c denote read, write and commit. S1: r1(X); r2(Z); r1(Z); r3(X); r3(Y), w1(X), c1, w3(Y); c3; r2(Y); w2(Z); w2(Y); c2 S2: r1(X); r2(Z); r1(Z); r3(X); r3(Y); w1(X); w3(Y); r2(Y); w2(Z); w2(Y); c1; c2; c3 S3: r1(X); r2(Z); r3(X); r1(Z); r2(Y); r3(Y); w1(X); c1; w2(Z); w3(Y); w2(Y); c3; c2 using the precedence graph method, analyze the conflict serializability for schedules S1, S2, and S3.	1 3	CO4
4b	Consider the following two transactions. T1: read(X) T2: read(Y) read(Y) read(Z) read(Z) read(X) if X=0 then Y:=Y+1 if Y=0 then X:=X+1 write(Y) write(X) Add lock and unlock instructions to the transactions T1 and T2, so that they observe a two phase locking protocol. Can the execution of these transactions result in deadlock?	4	CO4
4c	Consider the schedules S1 and S2 in **4a.** Determine whether each schedule is cascadeless and recoverable.	4	CO4
Q 5	**Attempt any 2 parts of the following**		
5a	Explain deadlock with the help of a suitable schedule example. Analyse strict 2- Phase locking (2-PL) protocol with respect to deadlock handling.	4	CO4
5b	Consider the following log sequence of two transactions on a bank account (B) with an initial balance 12,000 that transfers 2000 to a mortgage (M) payment and then applies 5% interest. 1. <T1, start> 2. <T1, B, 12000, 10000> 3. <T1, M, 0, 2000> 4. <T1, commit> 5. <T2, start> 6. <T2, B, 10000, 10500> 7. <T2, commit> Now, what will happen to these transactions if the database system crashes as: **i.** Just before log record 7th is written. **ii.** Just before log record 4th. Justify your answer in each case.	2 + 2	CO5
5c	Illustrate shadow paging with the help of a suitable diagram.	4	CO5