UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)
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IT2305 – Database Systems I
Multiple Choice Question Paper

23rd October, 2016

Important Instructions :

- The duration of the paper is **2 (two) hour**.
- The medium of instruction and questions is English.
- The paper has **45 questions** and **20 pages**.
- All questions are of the MCQ (Multiple Choice Questions) type.
- All questions should be answered.
- Each question will have 5 (five) choices with **one or more** correct answers.
- All questions will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from 0 (*All the incorrect choices are marked & no correct choices are marked*) to +1 (*All the correct choices are marked & no incorrect choices are marked*).
- Answers should be marked on the special answer sheet provided.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.
- Mark the correct choices on the question paper first and then transfer them to the given answer sheet which will be machine marked. **Please completely read and follow the instructions given on the other side of the answer sheet before you shade your correct choices.**
- Calculators are not allowed.

1) An example scenario which illustrates Logical Data Independence is

(a) When a Hash index used in one of the existing tables is changed to B-Tree index.
(b) When a new column is added to an existing table in the schema.
(c) When additional access structures are created to improve performance.
(d) When switching from one file organization to another.
(e) When the database is restructured by splitting a single table into two.

2) Which of the following is/are true with respect to ANSI/SPARC architecture?

(a) Any given database has exactly one conceptual schema and one external schema.
(b) Conceptual schema is concerned with individual user perceptions.
(c) The physical storage structure of the database is described by the internal schema.
(d) Each external schema includes a different user view for each user group.
(e) The internal schema is defined using a data definition language.

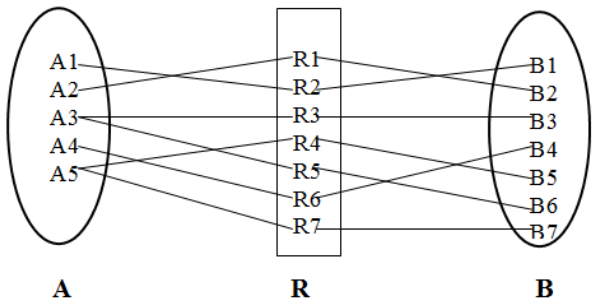
3) Which of the following are true regarding anomalies that result from data redundancy?

(a) Only creation and update anomalies are resulted from data redundancy.
(b) Only insertion, update and creation anomalies are resulted from data redundancy.
(c) **Only insertion, update and delete anomalies are resulted from data redundancy.**
(d) Only deletion anomalies are resulted from data redundancy.
(e) Only insertion and update anomalies are resulted from data redundancy.

4) Select the advantage(s) of database systems over file based approach from the given answers.

(a) Minimize data recovery capabilities
(b) Minimize isolation of data
(c) Increase data duplication
(d) Increase data security mechanisms
(e) Minimize data redundancy

5) The following figure represents a relationship R between two entities, A and B. What is the cardinality and degree of the relationship R respectively?



(a) 1 : N , Unary (b) M:N, Unary (c) Binary, 1:N
(d) **1:N, Binary** (e) Binary, N:1

6) Select the keyword(s) that could be a part of a Data Manipulation Language (DML).

(a) CREATE	(b) **INSERT**
(c) GRANT	**(d) DELETE**
(e) DROP	

7) Consider the following relations used in a database of a book store.

Books (ISBNNo, CopyNo, Title)
Employees (EmpID, Name, NICNo, email)
Purchases (PurchaseID,Title,Amount,EmpID) : Purchases relation is maintained to track the books purchased and the employee who issued the book.

Choose the correct statement(s) with respect to the relations.

(a) The composite key; ISBNNo and CopyNo is the primary key of 'Books'.

(b) EmpID, NICNo and email are the candidate keys of 'Employees'.

(c) ISBNNo is the primary key of 'Books'.

(d) If EmpID is the primary key of 'Employees' and ISBNNo is the primary key of 'Books', EmpID and Title are the foreign keys used in 'Purchases'.

(e) If Title is not the primary key of 'Books', usage of Title in Purchases might lead to data inconsistencies.

8) Following is a set of relations of a company in which all its employees receive a salary above Rs.20,000 and each employee must work at a single branch of the company. Primary keys are underlined and Foreign keys are in italics.

Employee(<u>EmpID</u>,Name,Salary,*BranchNo*)
Branch(<u>BranchNo</u>,Address)

Select the statement(s) that describe how referential integrity is maintained in the company schema.

(a) One cannot insert a tuple to 'Employee' if the BranchNo of that employee doesn't exist in 'Branch'.

(b) One cannot insert a tuple to 'Employee' if EmpID is not unique.

(c) If a branch is deleted from 'Branch', the details of employees who worked at that branch must be deleted from 'Employee'.

(d) One cannot insert an employee to 'Employee' if the salary is lower than Rs.20,000

(e) If a branch is deleted from 'Branch', BranchNo column of 'Employee' who worked at that branch should be filled with NULL.

9) If P, Q, R represent union-compatible relations, which of the following is/are correct with respect to relational algebra operations?

(a) $P \cap Q = P - (P - Q)$	**(b) $(P \cup S) \cup T = P \cup (S \cup T)$**	(c) $(P \cap S) \cup T = P \cap (S \cup T)$
(d) $P - R = R - P$	**(e) $Q \cap R = R \cap Q$**	

10) The symmetric difference of two relations P and Q consists of tuples in P and tuples in Q which do not appear in the intersection of P and Q. Which of the following relational algebra expressions represent the symmetric difference of P and Q? (Note: '/' denotes the division operator)

(a) $(P \cup Q) / (P \cap Q)$	**(b) $(P \cup Q) - (P \cap Q)$**	**(c) $(P - Q) \cup (Q - P)$**
(d) $(P / Q) \cup (Q / P)$	(e) $(P - Q) \cup (Q / P)$	

Consider the following library schema to answer the questions from 11-16. Primary keys are underlined and foreign keys are in italics.

Library_Branch (LibID, BranchName, TelNo)

Author (AuthID, Name, Gender, Age)

Book (ISBN, Title, Publisher, *AuthID*)

Category (CategoryID, CategoryName)

Book_Category (*ISBN*, *CategoryID*)

Book_Copy (CopyID, *ISBN*, *LibID*)

Relational operators used are Project (π), Select (σ), Natural Join (⋈), Right Outer Join (⟖), Left Outer Join (⟕), Cartesian Product (X), Union (∪), Intersection (∩), Set Difference (-), and Division (÷).

11) **Which of the following sequences of operations would result in the ISBN numbers of all books which are either 'Poetry' or 'Comic'?**

(a) π_{ISBN} (Category $\bowtie_{\text{ISBN = ISBN OR CategoryName = 'Poetry' OR CategoryName = 'Comics'}}$ Book_Category)

(b) $\sigma_{\text{CategoryName = 'Poetry' OR CategoryName = 'Comics'}}$ (Category) $\bowtie_{\text{ISBN = ISBN}}$ Book_Category

(c) σ_{ISBN} ($\sigma_{\text{CategoryName = 'Poetry' OR CategoryName = 'Comics'}}$ (Category) $\bowtie_{\text{ISBN = ISBN}}$ Book_Category)

(d) π_{ISBN} (Category $\bowtie_{\text{CategoryName = 'Poetry' AND CategoryName = 'Comics'}}$ Book_Category)

(e) **π_{ISBN} ($\sigma_{\text{CategoryName = 'Poetry' OR CategoryName = 'Comics'}}$ (Category) $\bowtie_{\text{CategoryID = CategoryID}}$ Book_Category)**

Correct answer: **Blank**

12) Which of the following sequences of operations would list the names of the authors who have at least one of their books in 'Colombo' branch?

(a) **RESULT1 ← $\sigma_{\text{BranchName = 'Colombo'}}$ (Library_Branch)**
RESULT2 ← π_{ISBN} (RESULT1 $\bowtie_{\text{LibID = LibID}}$ Book_Copy)
RESULT3 ← π_{AuthID} (RESULT2 $\bowtie_{\text{ISBN = ISBN}}$ Book)
RESULT ← π_{Name} (RESULT3 $\bowtie_{\text{AuthID = AuthID}}$ Author)

(b) RESULT1 ← π_{LibID} ($\sigma_{\text{BranchName = 'Colombo'}}$ (Library_Branch))
RESULT2 ← $\pi_{\text{LibID, ISBN}}$ (Book_Copy)
RESULT3 ← RESULT1 ∪ RESULT2
RESULT4 ← π_{AuthID} (RESULT3 $\bowtie_{\text{ISBN = ISBN}}$ Book)
RESULT ← π_{Name} (RESULT4 $\bowtie_{\text{AuthID = AuthID}}$ Author)

(c) **RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Colombo'}}$ Book_Copy)**
RESULT2 ← π_{AuthID} (RESULT1 $\bowtie_{\text{ISBN = ISBN}}$ Book)
RESULT ← π_{Name} (RESULT2 $\bowtie_{\text{AuthID = AuthID}}$ Author)

(d) RESULT1 ← π_{LibID} ($\sigma_{\text{BranchName = 'Colombo'}}$ (Library_Branch))
RESULT2 ← $\pi_{\text{LibID, ISBN}}$ (Book_Copy)
RESULT3 ← RESULT1 ∩ RESULT2
RESULT4 ← π_{AuthID} (RESULT3 $\bowtie_{\text{ISBN = ISBN}}$ Book)
RESULT ← π_{Name} (RESULT4 $\bowtie_{\text{AuthID = AuthID}}$ Author)

(e) RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Colombo'}}$ Book_Copy)
RESULT2 ← π_{AuthID} (Book – RESULT1)
RESULT ← π_{Name} (RESULT2 $\bowtie_{\text{AuthID = AuthID}}$ Author)

13) Which of the following sequences of operations would result in the title and publisher of all the books in all branches, and their category id only if the book is in the 'Kandy' branch?

(a) RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Kandy'}}$ Book_Copy)
RESULT2 ← Book_Category $\bowtie_{\text{ISBN = ISBN}}$ RESULT1
RESULT ← $\pi_{\text{Title, Publisher, CategoryID}}$ (Book $\bowtie_{\text{ISBN = ISBN}}$ RESULT2)

(b) **RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Kandy'}}$ Book_Copy)**
RESULT2 ← Book_Category $\bowtie_{\text{ISBN = ISBN}}$ RESULT1
RESULT ← $\pi_{\text{Title, Publisher, CategoryID}}$ (Book $\bowtie_{\text{ISBN = ISBN}}$ RESULT2)

(c) RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Kandy'}}$ Book_Copy)
RESULT2 ← Book_Category X RESULT1
RESULT ← $\pi_{\text{Title, Publisher, CategoryID}}$ (Book $\bowtie_{\text{ISBN = ISBN}}$ RESULT2)

(d) RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Kandy'}}$ Book_Copy)
RESULT2 ← Book_Category $\bowtie_{\text{ISBN = ISBN}}$ RESULT1
RESULT ← $\pi_{\text{Title, Publisher, CategoryID}}$ (Book $\bowtie_{\text{ISBN = ISBN}}$ RESULT2)

(e) RESULT1 ← π_{ISBN} (Library_Branch $\bowtie_{\text{LibID = LibID AND BranchName = 'Kandy'}}$ Book_Copy)
RESULT2 ← Book_Category $\bowtie_{\text{ISBN = ISBN}}$ RESULT1
RESULT ← $\pi_{\text{Title, Publisher, CategoryID}}$ (Book X RESULT2)

14) Consider the following sequence of relational algebra operations;

$RESULT1 \leftarrow \pi_{CategoryID} (\sigma_{CategoryName = 'Fiction' \text{ OR } CategoryName = 'Science'} (Category))$
$RESULT2 \leftarrow \pi_{ISBN} (Book\_Category \div RESULT1)$
$RESULT3 \leftarrow \pi_{LibID} (RESULT2 \bowtie_{ISBN = ISBN} Book\_Copy)$
$RESULT \leftarrow \pi_{BranchName} (RESULT3 \bowtie_{LibID = LibID} Library\_Branch)$

Which of the following would be the result of the above sequence?

(a) List the branch names of all library branches which have all the science fictions.

(b) List the branch names of all library branches which have all the books that fall into either science or fiction category.

(c) **List the branch names of all library branches which have at least one book that falls into both fiction and science categories.**

(d) List the branch names of all library branches which have at least one book that falls into either science or fiction category.

(e) List the branch names of all library branches which have no science fictions.

Correct answer: **(c) or Blank**

15) Suppose the two tables Author and Book were created with the following SQL statements;

```
CREATE TABLE Author
    (AuthID int PRIMARY KEY, Name varchar (50), Gender varchar (20), Age int,
     UNIQUE (Name));

CREATE TABLE Book
    (ISBN int PRIMARY KEY, Title varchar (50), Publisher varchar (50), AuthID int,
     Foreign Key (AuthID) references Author (AuthID) ON DELETE RESTRICT);
```

Consider that the two tables were initially empty and the following SQL statements were executed in the given order.

I. INSERT INTO Author VALUES (001, 'Nimal Perera', 'Male', 34);
II. INSERT INTO Author VALUES (002, 'Wimal de Silva', 'Male',51);
III. UPDATE Author SET Name = 'Nimal Perera' WHERE AuthID = 002;
IV. INSERT INTO Book VALUES (12673, 'Introduction to DBMS', 'ABC Publishers', 002);
V. DELETE FROM Author WHERE AuthID = 001;
VI. DELETE FROM Author WHERE AuthID = 002;
VII. DELETE FROM Book WHERE AuthID = 002;
VIII. DROP TABLE Author;

Which of the statements will get executed and perform the expected task without being rejected?

(a) I, II, IV, V, VIII (b) I, II, III, IV, V, VIII (c) I, II, IV, V, VII, VIII
(d) I, II, IV, V, VI, VII **(e) I, II, IV, V, VII**

16) Consider the following task required to be achieved;

"For each library branch which has more than 5 copies of each book category, select the branch name, category id and the number of copies."

I.
```
SELECT L.BranchName, B.CategoryID, COUNT(*)
FROM Library_Branch L, Book_Category B, Book_Copy C
WHERE L.LibID = C.LibID AND B.ISBN = C.ISBN
GROUP BY L.BranchName, B.CategoryID
HAVING COUNT (*) > 5;
```

II.
```
SELECT L.BranchName, B.CategoryID, COUNT(*)
FROM Library_Branch L, Book_Category B, Book_Copy C
WHERE L.LibID = C.LibID AND C.ISBN IN
        (SELECT ISBN FROM Book_Category GROUP BY CategoryID)
GROUP BY L.BranchName
HAVING COUNT (*) > 5;
```

Which of the following statements are true regarding the given task and the queries I and II that were executed in order to achieve the relevant output?

(a) Only query I returns the expected output.

(b) Only query II returns the expected output.

(c) Both queries I and II return the expected output.

(d) Query II does not return the expected output.

(e) Query II cannot be executed and returns an error.

17) Which of the given SQL statements is/are equivalent to the following relational algebra expression?

$$\pi_{\text{Name, Gender}}\textbf{(Employee)} - \pi_{\text{Name, Gender}}\textbf{(DepartmentHead)}$$

(a) (SELECT Name, Gender FROM Employee) EXCEPT (SELECT Name, Gender FROM DepartmentHead)

(b) (SELECT Name, Gender FROM Employee) NOT EXISTS (SELECT Name, Gender FROM DepartmentHead)

(c) (SELECT Name, Gender FROM Employee) INTERSECTION (SELECT Name, Gender FROM DepartmentHead)

(d) (SELECT Name, Gender FROM Employee) LEFT OUTER JOIN (SELECT Name, Gender FROM DepartmentHead)

(e) (SELECT Name, Gender FROM Employee) IN (SELECT Name, Gender FROM DepartmentHead)

Consider the following three relations with the given attributes and data types to answer questions 18-19. Primary keys are underlined and foreign keys are in italics.

Actor (ActorID char (05), Name varchar (50))
Movie (MovieID char (05), MovieName varchar (50), Budget REAL, ReleaseDate date)
Acts_On (*ActorID* char (05), *MovieID* char (05))

18) Which of the following SQL statements would return for each actor, the average budget of all movies released before 16th May 2003 which were acted on by that actor?

(a)
```
SELECT A.Name, AVG (M.Budget)
FROM Actor A, Movie M, Acts_On C
WHERE A.ActorID = C.ActorID AND M.MovieID = C.MovieID
    AND ReleaseDate < 'May-16-2003'
GROUP BY A.Name;
```

(b)
```
SELECT A.Name, AVG (M.Budget)
FROM Actor A, Movie M, Acts_On C
WHERE A.ActorID = C.ActorID AND M.MovieID = C.MovieID
        AND ReleaseDate < 'May-16-2003'
GROUP BY A.Name, M.Budget;
```

(c)
```
SELECT A.Name, AVG (M.Budget)
FROM Actor A
JOIN Acts_On C ON A.ActorID = C.ActorID
JOIN Movie M ON M.MovieID = C.MovieID
WHERE ReleaseDate < 'May-16-2003';
```

(d)
```
SELECT A.Name, AVG (M.Budget)
FROM Actor A
JOIN Acts_On C ON A.ActorID = C.ActorID
JOIN Movie M ON M.MovieID = C.MovieID
WHERE ReleaseDate < 'May-16-2003'
ORDER BY A.Name, M.Budget;
```

(e)
```
SELECT A.Name, AVG (M.Budget)
FROM Actor A
JOIN Acts_On C ON A.ActorID = C.ActorID
JOIN Movie M ON M.MovieID = C.MovieID
WHERE ReleaseDate < 'May-16-2003'
GROUP BY A.Name;
```

19) Which of the following SQL statements would return the names of all actors, and names of the movies they have acted only if the budget is over Rs.500,000 ?

(a)
```
SELECT A.Name, E_Movie.MovieName
FROM Actor A RIGHT OUTER JOIN
        (SELECT C.ActorID, M.MovieName
         FROM Movie M, Acts_On C
         WHERE M.MovieID = C.MovieID AND M.Budget > 500000) AS E_Movie
ON A.ActorID = E_Movie.ActorID;
```

(b)
```
SELECT A.Name, M.MovieName
FROM Actor A
LEFT OUTER JOIN Acts_On C ON A.ActorID = C.ActorID
LEFT OUTER JOIN Movie M ON M.MovieID = C.MovieID
WHERE M.Budget > 500000;
```

(c)
```
SELECT A.Name, E_Movie.MovieName
FROM Actor A LEFT OUTER JOIN
        (SELECT C.ActorID, M.MovieName
         FROM Movie M, Acts_On C
         WHERE M.MovieID = C.MovieID AND M.Budget > 500000) AS E_Movie
ON A.ActorID = E_Movie.ActorID;
```

(d)
```
SELECT A.Name, M.MovieName
FROM Actor A
JOIN Acts_On C ON A.ActorID = C.ActorID
LEFT OUTER JOIN Movie M ON M.MovieID = C.MovieID
WHERE M.Budget > 500000;
```

(e)
```
SELECT A.Name, M.MovieName
FROM Actor A
LEFT OUTER JOIN Acts_On C ON A.ActorID = C.ActorID
JOIN Movie M ON M.MovieID = C.MovieID
WHERE M.Budget > 500000;
```

20) Consider the following relation R (A, B);

A	B
4	300
6	240
4	300
2	100
2	350

Which of the given answers illustrate the outputs for the following SQL operations I, II, III, IV and V respectively?

I. SELECT A FROM R WHERE B = 100;
II. SELECT AVG(B) FROM R GROUP BY A;
III. SELECT A FROM R WHERE A = 4;
IV. SELECT MIN(B) FROM R;
V. SELECT DISTINCT B FROM R;

(a) {(2, 100)}, {258}, {4,4}, {100}, {300, 240, 100, 350}

(b) {2}, {225, 300, 240}, {4}, {100}, {300, 240, 100, 350}

(c) {(2, 100)}, {(2,225), (4,300), (6,240)}, {4}, {100}, {300, 240, 100, 350}

(d) {2}, {(2,225), (4,300), (6,240)}, {4,4}, {(2,100)}, {300, 240, 100, 350}

(e) {2}, {225, 300, 240}, {4,4}, {100}, {300, 240, 100, 350}

Refer the following IT Company schema and the given description to answer questions from 21- 22. Primary keys are underlined and Foreign keys are in italics.

Employees(EmpNo,Name,BirthDate,JoinedDate, StudiedInstitute, *AssignedTeamNo*)
Teams(TeamNo,*PManagerEmpNo*)
Projects(ProjNo,*TeamNo*)
Penalties(PaymentNo,*EmpNo*,Amount)

Each employee of the IT Company is assigned to a single team to work on projects. Each team is led by a Project Manager and he can manage several projects. The value for 'AssignedTeamNo' in the Employees relation is NULL for each Project Manager. Software product developed by a team might have several bugs and might incur a huge loss to the company. Hence, a penalty amount is deducted from the employee's salary who is responsible for the poorly written code snippet.

21) Which of the SQL queries would achieve the following task?

"For each team that has been led by a project manager who has studied from UCSC, retrieve the teamNo and the number of projects handled by that team."

(a)
```
SELECT TeamNo, COUNT(*)   FROM Projects
   WHERE TeamNo IN   (SELECT TeamNo FROM Teams INNER JOIN Employees
                        ON Teams. PManagerEmpNo = Employees.EmpNo
                          WHERE StudiedInstitute = 'UCSC')
   GROUP BY TeamNo
```

(b)
```
SELECT TeamNo, COUNT(*)   FROM Projects
   WHERE TeamNo IN   (SELECT Employees.TeamNo FROM Employees LEFT JOIN Teams
                        ON Teams. PManagerEmpNo = Employees.EmpNo
                          WHERE StudiedInstitute = 'UCSC')
   GROUP BY TeamNo
```

(c)
```
SELECT TeamNo, COUNT(ProjNo) FROM Projects WHERE TeamNo IN
            (SELECT TeamNo FROM Teams t WHERE t. PManagerEmpNo IN
                  (SELECT EmpNo FROM Employees WHERE StudiedInstitute =
            'UCSC'))
   GROUP BY TeamNo
```

(d)
```
SELECT DISTINCT TeamNo, COUNT(ProjNo) FROM Projects
   WHERE TeamNo IN
            (SELECT TeamNo FROM Teams t WHERE t. PManagerEmpNo IN
                  (SELECT EmpNo FROM Employees WHERE StudiedInstitute =
            'UCSC'))
   GROUP BY TeamNo
```

(e)
```
SELECT TeamNo, COUNT(ProjNo) FROM Projects WHERE TeamNo IN
      (SELECT TeamNo FROM Teams t WHERE t. PManagerEmpNo IN
            (SELECT EmpNo FROM Employees WHERE StudiedInstitute = 'UCSC'))
```

22) Consider the following query and the three claims about the results of the query;

```
SELECT EmpNo, Name FROM Employees WHERE EmpNo IN
   (SELECT  EmpNo FROM Penalties GROUP BY EmpNo
   HAVING SUM(Amount) >=  ALL (SELECT SUM(Amount) FROM Penalties
                                 GROUP BY EmpNo))
```

(I) The query can be used to find the EmpNos and Names of the employees whose total amount of penalty deducted from the salary is the highest.

(II) By changing 'HAVING SUM(Amount)' into 'WHERE SUM(Amount)', the query can be used to find the EmpIDs and Names of the employees whose total amount of penalty deducted from the salary is the highest.

(III) The result of the above query can also be obtained by the following query

```
SELECT EmpNo, Name FROM Employees INNER JOIN
    (SELECT EmpNo, SUM(Amount) as Tot FROM Penalties GROUP BY EmpNo) as
    temp ON Employees .EmpNo = temp.EmpNo
 WHERE Tot = MAX(Tot)
```

Which of the following statement(s) are correct with respect to the above claims?

(a) **Only claim (I) is correct**
(b) Only claim (I) and (III) are correct
(c) Only claim (II) and (III) are correct
(d) **Claim (II) is incorrect and will give a syntax error.**
(e) All claims are incorrect

Consider the data types and attributes of 'Employees' relation below to answer the questions 23-24.

Employees(<u>EmpNo</u> VARCHAR(05), Name CHAR(60), BirthDate DATE, JoinedDate DATE, StudiedInstitute CHAR(20), Salary REAL)

23) Which of the following SQL query(ies) will display the names and birthdays of the employees who joined the company on 2016-08-17, in the order which shows the older employees listed first?

(a) SELECT Name, BirthDate FROM Employees WHERE JoinedDate = '2016-08-17' ORDER BY BirthDate DESC
(b) SELECT Name, BirthDate FROM (SELECT Name, BirthDate FROM Employees WHERE JoinedDate = '2016-08-17') as temp ORDER BY BirthDate
(c) SELECT Name, BirthDate FROM Employees WHERE JoinedDate = '2016-08-17' ORDER BY BirthDate ASC
(d) SELECT Name, BirthDate FROM Employees WHERE JoinedDate = '2016-08-17'
(e) SELECT Name, BirthDate FROM (SELECT Name, BirthDate, (SYSDATE( ) - BirthDate) AS x FROM Employees WHERE JoinedDate = '2016-08-17' ORDER BY x DESC) AS temp

24) Which of the following SQL statement(s) will insert the below details about an employee to the Employees relation on the day the employee joined the company?

EmpNo →2435, Name→Kamal Perera, BirthDate→1980-09-20, JoinedDate→2016-10-13, StudiedInstitute→UCSC, Salary→30,000

(a) INSERT INTO Employees VALUES ('2435', 'Kamal Perera', '1980-09-20' , '2004-08-19', 'UCSC' ,30,000)
(b) INSERT INTO Employees(EmpNo,Name,BirthDate,JoinedDate, StudiedInstitute,salary) VALUES ('2435', 'Kamal Perera', '1980-09-20' , '2004-08-19', 'UCSC' ,30000)
(c) INSERT INTO Employees VALUES ('2435', 'Kamal Perera', '20-09-1980','13-10-2016', 'UCSC' ,30000)
(d) INSERT INTO Employees VALUES ('2435', 'Kamal Perera', '1980-09-20' , '2004-08-19', 'UCSC',30000)
(e) INSERT INTO Employees VALUES ('2435','Kamal Perera', '1980-09-20' , SYSDATE(), 'UCSC',30000)

25) Consider the following relation R1 and the SQL queries;

Name	Age	Salary
Kamal	30	5000
Amal	24	3000
Kamal	30	5000
Saman	19	2500
Amal	28	3000

I. DELETE FROM R1 WHERE Salary < 2900
II. SELECT Name, Age, Salary FROM R1 HAVING Salary >= AVG(Salary)
III. SELECT Name,Age,Salary FROM R1 WHERE Name LIKE '%amal%'
IV. SELECT Name,Age,Salary FROM R1 GROUP BY Salary HAVING Salary >= AVG(Salary)
V. SELECT DISTINCT Name,Age,Salary FROM R1 WHERE Age >= ALL (SELECT Age FROM R1)

Select the pair(s) of queries that would give the same result.

(a) I and III	(b) II and IV	(c) IV and V
(d) I and IV	**(e) II and V**	

26) Which of the insertion anomaly(ies) given below might occur with respect to the relation 'Teacher_Section';

Teacher_Section (TId,Tname,TAddress,SecId,SecName,SecLocation) where the primary key is TId.

(a) If there's only one teacher in a certain section and the tuple of that teacher is removed, data about the section is also lost.
(b) It is not possible to insert the teacher details if TAddress is not known.
(c) It is not possible to insert Section details of a new section, even by entering nulls to the teacher details columns (TId,Tname,TAddress), if the section doesn't have any teachers yet.
(d) It is not allowed to insert details of teachers with the same TId values.
(e) If the SecLocation of a section is changed, tuples of all the teachers working in that section needs to be modified.

27) Identify the candidate key(s) of the relation R1(A,B,C,D,E,F) based on the following functional dependencies.

$A \rightarrow B$ $B \rightarrow (C,D)$ $E, F \rightarrow D$ $F \rightarrow A$

(a) E	(b) A	**(c) (E,F)**
(d) (C,D)	(e) F	

28) Consider the relation Customer(Cid,CName, CAddress,SpouseName,SpousePhone) with the following functional dependencies;

Cid → CName, CAddress,SpouseName,SpousePhone
SpouseName → SpousePhone

What is the best Normal Form that the 'Customer' relation satisfies?

(a) 0NF	(b) 1NF	**(c) 2NF**
(d) 3NF	(e) BCNF	

Correct answer: **(c) or Blank**

29) Consider relation R1(A,B,C) with the following functional dependencies;

A,B → C C → B

Which of the following statement (s) is/are correct?

(a) The decomposition R2(A,C) , R3(C,B) satisfies BCNF.
(b) The decomposition R2(A,B) , R3(C,B) satisfies BCNF.
(c) R1 satisfies BCNF.
(d) Relation R1 has only one candidate key which is (A,B).
(e) Relation R1 has more than one candidate keys, which are (A,B) and (A,C).

30) Consider the following relation;
Book_Copies(BookId,DepartmentId,NumOfCopies,BookTitle,DeptName,DeptAddress)
with the following functional dependencies;

FD1 : BookId,DepartmentId → NumOfCopies
FD2 : BookId → BookTitle
FD3 : DepartmentId → DeptName,DeptAddress

Which of the following statement(s) is/are true?

(a) The functional dependency FD1 violates 1NF
(b) **The functional dependency FD2 violates 2NF**
(c) The functional dependency FD3 violates 3NF
(d) The best normal form Book_Copies satisfies is 2NF
(e) **The best normal form Book_Copies satisfies is 1NF**

Consider the following relation;

RepairBill_item(billId, itemId,itemName, procedure, discount,custName,custAddress)

and the following functional dependencies to answer questions 31-32.

FD1 : itemId →itemName
FD2 : custName→ custAddress
FD3 : billId → custName,custAddress, discount
(Discounts are given to randomly selected billIds)
FD4 : billId, itemId → procedure

31) Which of the following statement(s) is/are true?

(a) 2NF is not achieved due to FD3 only.
(b) The best normal form RepairBill_item satisfies is 2NF.
(c) 2NF is not achieved due to FD1 and FD3.
(d) 3NF is not achieved due to FD2 only.
(e) The best normal form RepairBill_item satisfies is 1NF.

32) Consider the decomposition of relation RepairBill_item given below;

Item(itemId,itemName)
Cust(custName,custAddress)
Bill(billId, custName, discount)
Bill_item(billId, itemId, procedure)

Which of the following statement(s) is/are true?

(a) The decomposition is in 3NF.
(b) The decomposition is in BCNF.
(c) Lossless-join and dependency preservation are both ensured in the decomposition.
(d) The best normal form satisfied by the decomposition is 2NF.
(e) The decomposition only ensures dependency preservation property.

33) Which of the following statement(s) is/are true regarding threats to database security?

(a) Loss of availability to a database can occur due to an incorrect configuration in access control.
(b) Encrypting data in a database is a way to ensure access control to different users in a DBMS.
(c) Creating views can help to ensure the integrity of a database.
(d) Providing GRANT OPTION to a user when granting privileges for a table prevents the propagation of privileges to other users.
(e) Revoking the privileges granted to the first user who caused a grant propagation will automatically revoke the privileges of other users who received privileges through propagation.

Consider the scenario given below to answer questions 34-35 (Note that these questions are independent from each other).

There are five users in a database system as A,B,C,D and E. User A creates a relation called R and grant SELECT and UPDATE privileges with GRANT OPTION to the two users B and C. The user B grants SELECT privilege of the relation R to the user D with GRANT OPTION while the user C grants the UPDATE privilege of the relation R *without* GRANT OPTION to the user D.

34) Which of the following actions are possible regarding the relation R?

(a) User A revokes the privileges granted to user B and then user D grants SELECT privilege of the relation R to user E.
(b) User A revokes the privileges granted to user C and then user D grants UPDATE privilege of the relation R to user E.
(c) User C revokes the privileges granted to user D and then user D executes a SELECT query on the relation R.
(d) User B grants UPDATE privilege of the relation R to user D and then user C revokes the UPDATE privilege from user D. Then user D executes an UPDATE query on the relation R.
(e) User B grants UPDATE privilege of the relation R to user D and then user C revokes the UPDATE privilege from user D. Then user D grants UPDATE privilege on the relation R to user E.

35) The user D creates a view called V which is defined over some attributes in the relation R. Then the user D grants the SELECT and UPDATE privileges of the view V to the user E. Which of the following statements can be considered as true?

(a) **In order for the user D to run an UPDATE query successfully on the view V, it should have defined with the clause WITH CHECK OPTION.**
(b) User D can grant the UPDATE privilege of the relation R to user E.
(c) User C revoking the granted privileges to D will not affect any privileges held by user E.
(d) User A revoking the granted privileges to B will not affect any privileges held by user E.
(e) **User A revoking the granted privileges to C will not affect any privileges held by user E.**

36) Consider the following SQL statement.

GRANT SELECT, INSERT, UPDATE(course) ON MaleStudents TO Name1, Namal WITH GRANT OPTION;
What would this SQL statement do?

(a) Grant UPDATE privilege of the 'course' table to the user 'Name1'.
(b) Grant privileges to the user 'Namal' to SELECT, INSERT and UPDATE the 'Name1' table.
(c) Grant SELECT and INSERT privileges of the 'MaleStudents' table and UPDATE privilege of the 'course' table to the user Namal.
(d) Grant SELECT and INSERT privileges of the 'MaleStudents' table to the user ‘Name1’.
(e) Grant UPDATE privilege of the 'course' attribute of 'MaleStudents' table to the user 'Namal'.

Consider the following scenario to answer the questions given from 37-39.

A research institute consists of scientists and a manager who takes care of supplying necessary equipment for the research projects of those scientists. A scientist may work on many research projects and may also request many equipment. The manager prepares a report in the beginning of every year with the scientist's name, research project name and the equipment that he/she has requested. Each report prepared by the manager has a reference number, date and the total number of equipment requested for that year. Both scientists and the manager are employees of the research institute with unique Emp_ids.

37) In the corresponding conceptual database model, how could the 'manager' be represented?

(a) As a weak entity and the scientist entity as its owner.
(b) As a weak entity and the research project as its owner.
(c) As an entity with 'Emp_id' as its unique identifier.
(d) As an attribute in the scientist entity.
(e) The manager does not need to be represented in this database conceptual model.

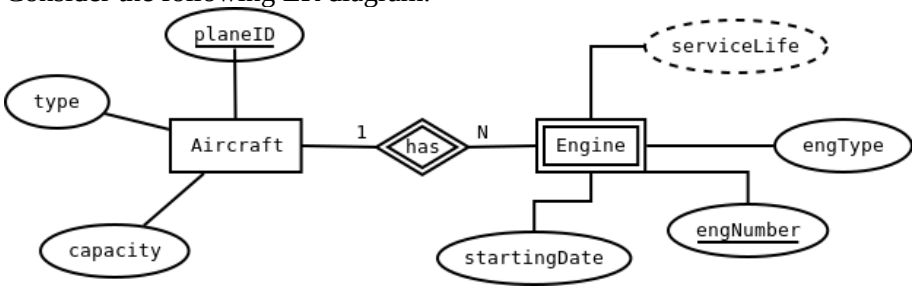
38) In the corresponding conceptual database model, how could the 'research project' be represented?

(a) As a weak entity and the scientist entity as its owner.
(b) As a weak entity and the equipment entity as its owner.
(c) As an entity which is uniquely identified using the project name.
(d) As an attribute of the scientist entity.
(e) As an attribute of the equipment entity.

39) In the corresponding conceptual database model, how could the total number of equipment requested for a year is represented?

(a) As an attribute of the scientist entity.
(b) As an attribute of the equipment entity.
(c) As an attribute in the relationship between scientist and equipment.
(d) This database cannot represent such an information in the conceptual model.
(e) It can be derived from the database by a query, so we do not have to represent it.

40) Consider the following ER diagram.



What would you get when the above diagram is mapped to corresponding relation(s)?

(a) Aircraft(planeID, type, capacity) and Engine(engNumber, engType, startingDate, serviceLife)

(b) Aircraft(planeID, type, capacity) and Engine(engNumber, engType, startingDate, planeID(FK))

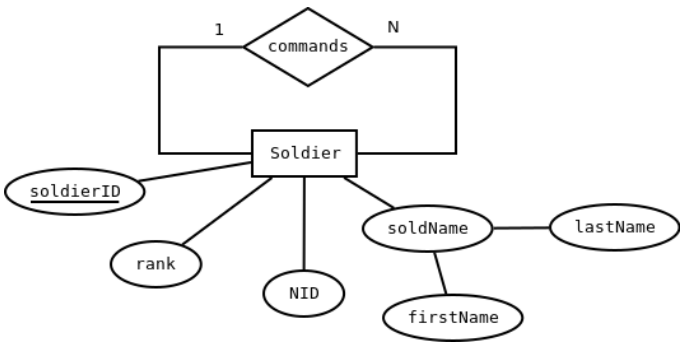
(c) Aircraft(planeID, type, capacity) and Engine(planeID, engNumber, engType, startingDate)

(d) Aircraft(planeID, type, capacity) and Engine(planeID, engNumber, engType, startingDate, serviceLife)

(e) Aircraft(planeID, type, capacity), Engine(engNumber, engType, startingDate) and PlaneEngine(planeID, engNumber)

Correct answer: **(c) or Blank**

41) Consider the following ER diagram.



What would you get when 'Soldier' in the above diagram is mapped to corresponding relation(s)?

(a) Soldier(SoldierID, NID, rank, firstName, lastName)

(b) Soldier(SoldierID, NID, rank, firstName, lastName, commanderID (FK))

(c) Soldier(soldierID, NID, rank, firstName, lastName, commanderID) and commander (commanderID)

(d) Soldier(soldierID, NID, rank, firstName, lastName, commanderID) and commander (soldierID, commanderID)

(e) Soldier(soldierID, NID, rank, firstName, lastName, commanderID) and commander (soldierID)

42) Following are three steps in the database design process.

i. Selecting a DBMS product.
ii. Identifying the requirements of the database.
iii. Logical database design.

Which of the following answers depict the correct order in designing a new database?

(a) (i), (ii), (iii)	(b) (i), (iii), (ii)	(c) (ii), (iii), (i)
(d) (ii), (i), (iii)	(e) (iii), (i), (ii)	

43) Which of the following statement(s) is/are true?

(a) Operations on Objects in Class diagrams can be used to specify functional requirements.

(b) Entity Relationship (ER) model is the only conceptual model used in database designing.

(c) There are other data models than 'Relational model' used in commercial DBMSs.

(d) Results of the physical design phase of a database should be used when selecting the DBMS software.

(e) The separation of logical and physical design of a database helps to improve the correctness of requirement analysis.

44) Which of the following statements are true about database views?

(a) Querying data over a view which is joined over multiple base tables makes the execution efficient than executing a query over the original base tables.

(b) A database view can be used to ease the life of users by combining frequency joined base tables together into a view.

(c) Since database views are virtual tables, they can only be queried but not updated.

(d) When a view is defined over three base tables, the data represented by the view are those were in the three base tables at the time of defining the view.

(e) A view can always be defined over base tables only.

45) Consider the three relations given below. A view called 'DivisionDetails' is created to display divID, CommanderName, HQlocation and NumberOfSoldiers over these relations.

Soldier(solID, solName, rank, joinedDate, regiID)
Division(divID, commandingSolID, HQlocation)
Regiment(regiID, regiName, divID)

Following SQL queries are going to be executed on the 'DivisionDetails' view created;

(i) SELECT COUNT(NumberOfSoldiers) FROM DivisionDetails;
(ii) CREATE VIEW DivisionStrength AS SELECT divID, NumberOfSoldiers FROM DivisionDetails;
(iii) SELECT * FROM DivisionDetails WHERE regiName='singha';

Which of the following statement(s) is/are true?

(a) Only (i) can be executed on 'DivisionDetails' view.

(b) Only (ii) can be executed on 'DivisionDetails' view.

(c) Only (iii) can be executed on 'DivisionDetails' view.

(d) Only (ii) and (iii) can be executed on 'DivisionDetails' view.

(e) None of the above queries can be executed on 'DivisionDetails' view.

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