



UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2011/2012 – 1st Year Examination – Semester 2

IT2304: Database Systems I
Multiple Choice Question Paper

29th July, 2012
(TWO HOURS)

Important Instructions :

- The duration of the paper is **2 (two) hours**.
- The medium of instruction and questions is English.
- The paper has **40 questions** and **14 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.**

1. What is the best definition for a 'Database'?

- (a) A software system that facilitates the management of databases
- (b) A collection of interrelated data items that can be processed by one or more application systems
- (c) A representation of facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing by human beings or by automatic means
- (d) Processed or organized or summarized data
- (e) A subsystem that keeps track of the definitions of data items

2. Consider following terms.

- (i) Information
- (ii) Databases
- (iii) Database Management System (DBMS)
- (iv) Hardware
- (v) Personnel

Among them, what are the components of a database system?

- | | |
|------------------------------|------------------------------|
| (a) (i) only | (b) (ii) and (iii) only |
| (c) (i), (ii) and (iii) only | (d) (iii), (iv) and (v) only |
| (e) All | |

3. Which of the following statement(s) is/are true with respect to the conceptual design in the database design approach?

- | |
|--|
| (a) Logical schema is the final result of the conceptual design phase. |
| (b) Entity Relationship Model is created in this phase. |
| (c) Entity types, attributes and relationships are modelled in this phase. |
| (d) Normalized tables will be created during this phase. |
| (e) Internal schema is a main part of this phase. |

4. What is meant by meta data in databases?

- | |
|--|
| (a) Elementary-level data items (fields/attributes) |
| (b) Different views and different representations of the same data |
| (c) Relationships that exists between various data structures |
| (d) Data that describe the properties or characteristics of data |
| (e) Indexes that are used to access data quickly |

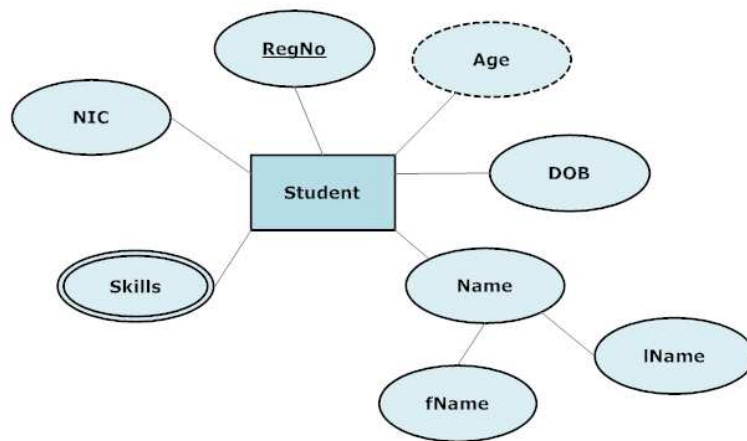
5. Consider the following data elements.

- (i) Course name = Database Systems
- (ii) Course number = IT2304
- (iii) Number of credits = 3
- (iv) Compulsory = yes

Select from the following, the best possible data type for each data element respectively

- | |
|---------------------------------------|
| (a) INTEGER, BOOLEAN, INTEGER, STRING |
| (b) VARCHAR, BYTE, BOOLEAN, INTEGER |
| (c) VARCHAR, CHAR, INTEGER, BOOLEAN |
| (d) TEXT, CHARACTER, NUMBER, BOOLEAN |
| (e) TEXT, TEXT, INTEGER, BOOLEAN |

6. Consider the following ER diagram fragment.



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

- | | |
|---|-------------------------------------|
| (a) "RegNo" is the key identifier. | (b) "Age" is a composite attribute. |
| (c) "Name" is a multi-valued attribute. | (d) "NIC" is a simple attribute. |
| (e) "Student" is a strong entity. | |

7. Consider the following statements about mapping many-to-many (M:N) binary relationships in an Entity Relationship Diagram (ERD).

- (i) A new relation will be created and primary keys of the entities will be copied to the new relation to act as foreign keys.
- (ii) Attributes which are parts of the relationship will be dropped.
- (iii) Primary keys of the entities will be combined to create the primary key in a new relation.

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

- | | | |
|------------------------|---------------|----------------|
| (a) (i) only | (b) (ii) only | (c) (iii) only |
| (d) (i) and (iii) only | (e) All | |

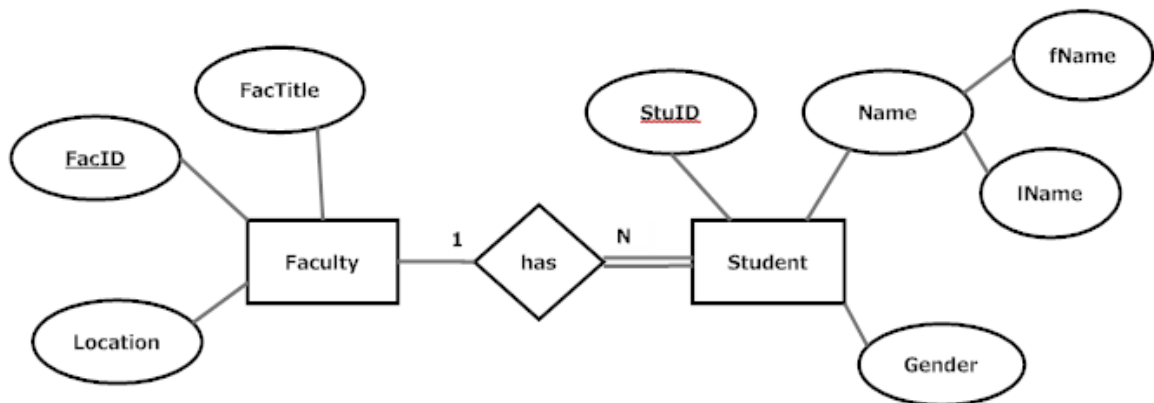
8. Which of the following statements is/are correct in relation to 3 Level ANSI/SPARC architecture?

- | |
|--|
| (a) External level is user's view of the database. |
| (b) External level describes what data is stored in the database and the relationships among the data. |
| (c) Conceptual level describes what data is stored in the database and the relationships among the data. |
| (d) Internal level describes how the data is stored in the database. |
| (e) Internal describes what data is stored in the database and the relationships among the data. |

9. Which of the following statements is/are **false** about relational database systems?

- | |
|--|
| (a) Each relation (or table) in a database has a unique name. |
| (b) Each attribute (or column) within a table has a unique name. |
| (c) An entry at the intersection of each row and column can be multi-valued. |
| (d) RDBMS can have multiple locations, all managed by the same database engine. |
| (e) Relational database systems must have only one location to store everything. |

Consider the following ER diagram fragment when answering question 10 and 11.



10. Which of the following statements is/are correct?

- (a) A Faculty may exist without any student.
- (b) A Student can be enrolled in to many Faculties.
- (c) Every student should have a Faculty.
- (d) Relationship between Faculty and Student is binary and one-to-many.
- (e) Faculty can be considered as the child entity.

11. Which of the following relations is/are possible if the above ERD fragment is mapped into a relational model?

- (a) Faculty (FacID, FacTitle, Location)
- (b) Student (StuID, Name, fName, lName, Gender, FacID)
- (c) Student (StuID, fName, lName, Gender, FacID)
- (d) Faculty (FacID, FacTitle, Location, StuID)
- (e) Student (StuID, fName, lName, Gender)

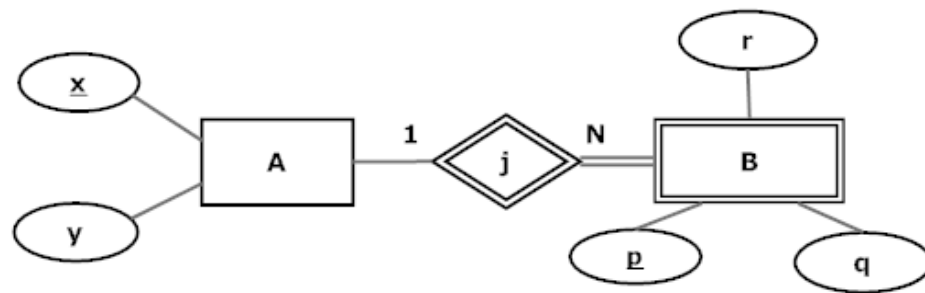
12. Consider the following statements about mapping sub-class super-class relationships.

- (i) A surrogate key will be defined when creating a relation to correspond to the category.
- (ii) Each super class will be mapped to separate relations with their own primary keys.
- (iii) Surrogate key will act as a foreign key in the separate relations for super classes.

Which of the above statements is/are correct?

- (a) (i) only
- (b) (ii) only
- (c) (ii) and (iii) only
- (d) (i) and (ii) only
- (e) All

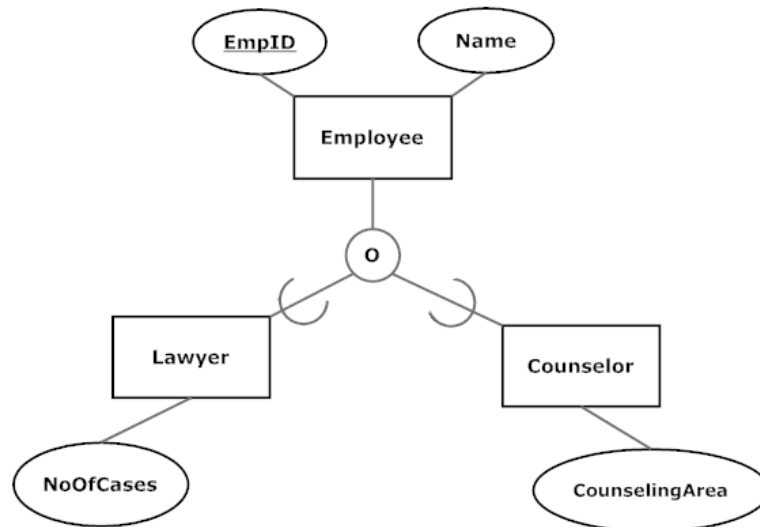
13. Consider the following ER diagram fragment.



What will be the resulting relation after the mapping of entity B?

- | | |
|--------------------|------------------------|
| (a) B (p, q, r) | (b) B (x, y, p, q, r,) |
| (c) B (x, p, q, r) | (d) B (x, p, y, q, r,) |
| (e) B (p, q, r, x) | |

Consider the following ER diagram fragment when answering question 14 and 15



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

- | |
|---|
| (a) This is a partial overlapping super class - sub class relationship. |
| (b) Every employee is either a Lawyer or a Counselor or both. |
| (c) A Lawyer may work as a Counselor. |
| (d) There can be Employees who are neither Lawyers nor Counselors. |
| (e) Employee is the super class. |

15. Which of the following relation(s) is/are possible if the above ERD fragment is mapped into a relational model?

- | |
|--|
| (a) Lawyer_Counselor (EmpID, NoOfCases, CounselingArea) |
| (b) Employee (EmpID, Name, NoOfCases, CounselingArea) |
| (c) Lawyer_Counselor (EmpID, NoOfCases, CounselingArea, LawyerFlag, CounselorFlag) |
| (d) Lawyer (EmpID, NoOfCases) |
| (e) Employee (EmpID, Name) |

16. Which of the following statement(s) is/are true with respect to relational database design?

- (a) It is advisable to have single-attribute identifiers for entities instead of composite identifiers as much as possible.
- (b) Key identifiers may contain NULL values.
- (c) Composite attributes will be broken down into its atomic sub-attributes.
- (d) A key identifier may change its value over the life of each instance of the entity type.
- (e) Each relationship instance should include exactly one entity instance from each participating entity type, in an association.

Consider the following relation tables when answering question 17 and 18

Employee		
E-No	E-Name	D-No
120	Silva	3
128	Cooray	1
254	Dias	3

Department		
D-No	D-Name	M-No
3	Marketing	128
1	Finance	120

Salary		
E-No	Eff-Date	Amt
120	2/1/2005	15000
128	14/5/2010	23000
120	11/8/2006	18000
254	21/2/2008	26500

17. The primary key is a column or combination of columns that uniquely identifies each row of the table. What can be the best primary key for Salary table?

- (a) Eff-Date
- (b) E-No
- (c) E-No, Eff-Date
- (d) Eff-Date, Amt
- (e) Amt, E-No

18. A foreign key is a set of columns in one table that serves as the primary key in another table. Which of the following statements is/are true in relation to foreign keys of the above tables?

- (a) D-No is the primary key of Department table and a foreign key of Employee table.
- (b) D-No is a foreign key of Department table and the primary key of Employee table.
- (c) E-No is the primary key and a foreign key of Salary table.
- (d) E-No is the primary key of Employee table, it is renamed as M-No and used as a foreign key of Department table.
- (e) E-No is a foreign key for all three tables.

19. Which of the following statement(s) is/are true with respect to relational algebra?

- (a) It has simple semantics compared to complicated semantics in SQL.
- (b) It is an end-user language.
- (c) It is used for reasoning and query optimization.
- (d) It is considered as an interface to access the data stored in the database itself.
- (e) It is a superset of SQL.

20. What statement(s) is/are true with regard to relational algebra equivalences if P, Q are relative?

- (a) $P \bowtie_c Q$ is equivalent to $\pi_{a_1, a_2, \dots, a_N}(\sigma_c(P \times Q))$ where c is the joining condition, and a_1, a_2, \dots, a_N are all the attributes of P and Q without repetition.
- (b) $(P - Q)$ is same as $(Q - P)$.
- (c) $\pi_{a_1}(P) \leq \pi_{a_1}(\pi_{a_1, \text{atr}}(P))$ where atr represents any other attributes of P.
- (d) $P \cap Q$ is not the same as $P - (P - Q)$.
- (e) $\sigma_{c_1}(\sigma_{c_2}(P))$ can be written as $\sigma_{c_2}(\sigma_{c_1}(P))$ where c_1, c_2 are the joining conditions.

21. Suppose relation P(A,C) and Q(B,C,D) have the following tuples.

P	A	C
	3	3
	6	4
	2	3
	3	5
	7	1

Q	B	C	D
	5	1	6
	1	5	8
	4	3	9

Perform the natural join of P and Q. Which of the following tuple(s) is/are in the result? Assume that each tuple has attributes (A, B, C, D).

- | | | |
|---------------|---------------|---------------|
| (a) (3,5,1,6) | (b) (7,1,5,8) | (c) (3,4,3,9) |
| (d) (3,1,5,8) | (e) (2,4,3,9) | |

22. Suppose relation R(A,B,C) and S(A,B,C) have the following tuples:

R	A	B	C
	1	2	3
	4	2	3
	4	5	6
	2	5	3
	1	2	6

S	A	B	C
	2	5	3
	2	5	4
	4	5	6
	1	2	3

Compute $(R-S) \cup (S-R)$ which is called the “Symmetric difference” of R and S. Which of the following tuple(s) is/are in the result?

- | | | |
|-------------|-------------|-------------|
| (a) (4,5,6) | (b) (1,2,6) | (c) (2,5,4) |
| (d) (2,5,3) | (e) (4,2,3) | |

23. Consider the following two relations.

Sailors	sid	sname	rating	age
	22	Sarath	7	45
	29	Nimal	1	33
	31	Gamini	8	55
	58	Ruvan	10	35
	64	Herath	7	36
	71	Bandara	3	65
	74	Herath	9	35

Reserves	sid	bid	day
	22	101	10/10/2011
	22	102	10/10/2011
	22	103	12/07/2011
	31	102	11/11/2011
	31	103	04/05/2011
	64	101	06/06/2011
	74	103	09/08/2011

Which of the following names can be expected after executing $\Pi_{\text{sname}}((\sigma_{\text{bid}=103} \text{ Reserves}) \bowtie \text{ Sailors})$ relational algebra query?

- | | |
|-----------------------------|----------------------------|
| (a) Sarath, Ruvan, Herath | (b) Sarath, Gamini, Herath |
| (c) Gamini, Herath, Bandara | (d) Herath, Nimal, Bandara |
| (e) Bandara, Ruvan, Nimal | |

Consider the following relation schema for a movie rating database and use those relations to answer questions 24 and 25.

movie(mID, title, year, director) - There is a movie with ID number mID, a title, a release year, and a director.

reviewer(rID, name) - The reviewer with ID number rID has a certain name.

rating(rID, mID, stars, ratingDate) - The reviewer rID gave the movie mID a number of stars rating (1-5) on a certain ratingDate.

24. Which of the following SQL statements would find all years that have a movie that received a rating of 4 or 5 in increasing order?

- (a) SELECT mov.year FROM movie AS mov, rating AS rat
WHERE mov.mID = rat.mID AND (stars = 4 OR stars = 5) ORDER BY year;
- (b) SELECT DISTINCT mov.year FROM movie AS mov, rating AS rat
WHERE mov.mID = rat.mID AND (stars = 4 OR stars = 5) ORDER BY year ASC;
- (c) SELECT DISTINCT mov.year FROM movie AS mov, rating AS rat
WHERE mov.mID = rat.mID AND (stars = 4 OR stars = 5) ORDER BY year;
- (d) SELECT UNIQUE (mov.year) FROM movie AS mov, rating AS rat
WHERE mov.mID = rat.mID AND (stars = 4 OR stars = 5) ORDER BY year ASC;
- (e) SELECT mov.year FROM movie AS mov, rating AS rat
WHERE mov.mID = rat.mID AND (stars = 4 OR stars = 5) ORDER BY UNIQUE (year) ASC;

25. There may be some reviewers who didn't provide a date with their ratings. If so, which of the following SQL statements would list out the names of all reviewers who have ratings with a NULL value for the date field?

- (a) SELECT name FROM reviewer WHERE rID in (SELECT rID FROM rating
WHERE ratingDate = 'NULL');
- (b) SELECT name FROM reviewer WHERE rID = (SELECT rID FROM rating
WHERE ratingDate = '0000-00-00');
- (c) SELECT name FROM reviewer WHERE rID in (SELECT rID FROM rating
WHERE ratingDate = '0000-00-00');
- (d) SELECT name FROM reviewer WHERE rID in (SELECT rID FROM rating
WHERE ratingDate IS NULL);
- (e) SELECT name FROM reviewer R, rating T WHERE R.rID=T.rID AND
T.ratingDate IS NULL;

26. Consider the following relational schema for a simplified movie-ratings database..

Movie(title, director) // title is a key

Rating(person, title, score) // <person,title> is a minimal key

Suppose the following query is to be executed over this database.

```
UPDATE Rating
SET score=5
WHERE person='Malik'
AND title IN (SELECT title FROM Movie WHERE director='Dias')
```

Which of the following privilege(s) is/are **not** needed for executing the above query?

- (a) SELECT on Rating(person)
- (b) SELECT on Movie(director)
- (c) UPDATE on Rating
- (d) SELECT on Rating(score)
- (e) SELECT on Movie(title)

27. Consider the following table declarations for given three tables T1(A), T2(B), and T3(C), including referential integrity in standard SQL.

```
CREATE TABLE T1(A PRIMARY KEY);
CREATE TABLE T2(B PRIMARY KEY references T1(A) on UPDATE CASCADE)
CREATE TABLE T3(C PRIMARY KEY references T2(B) on UPDATE CASCADE)
```

Let the initial contents of the tables be:

```
T1(A) = { (1), (2), (3), (4), (5), (6) }
T2(B) = { (1), (2), (4), (6) }
T3(C) = { (1), (2), (6) }
```

Suppose the following SQL modification command would be run:

```
UPDATE T1 SET A = A + 10 WHERE A < 5
```

After execution of this command and any resulting referential integrity actions, what would be the result for the query?

```
SELECT SUM(C) FROM T3 ?
```

- | | | |
|--------|--------|--------|
| (a) 29 | (b) 9 | (c) 50 |
| (d) 39 | (e) 23 | |

28. Consider the following two relations, Project and Allocation.

Project	prjNo	prjName	Head
	P11	ASP	Kamal
	P12	SAP	Sunil
	P13	SME	Sudath

Allocation	prjNo	empID	Hours
	P11	E1001	12
	P12	D1001	14
	P13	F1003	16

Which of the following SQL statement(s) successfully update(s) the duration of project named 'SME' to 20hrs?

- | |
|---|
| (a) UPDATE SET Hours=20 FROM Project, Allocation WHERE prjName='SME';
(b) UPDATE SET Hours=Hours+4 FROM Allocation AND prjName='SME' FROM Project;
(c) UPDATE Allocation SET Hours=20 WHERE prjNo='P13';
(d) UPDATE Allocation SET Hours=20 WHERE prjNo IN (SELECT prjNo FROM Project WHERE prjName='SME');
(e) UPDATE Allocation SET Proj_Name='SME' WHERE Hours=20; |
|---|

29. Consider following two relational schemas.

Works (person_name, company_name, salary)
Lives (person_name, street, city)

Which of the following relational algebra query will give the names of the persons who work for company 'CSC' along with cities where they live?

- (a) $R1 \leftarrow \text{PROJECT}_{\text{person_name}}(\text{SELECT}_{\text{company_name}='CSC'}(\text{Works}))$
 $R2 \leftarrow R1 \text{ UNION Lives}$
 $R3 \leftarrow \text{SELECT}_{\text{person_name,city}}(R2)$

(b) $R1 \leftarrow \text{PROJECT}_{\text{person_name}}(\text{SELECT}_{\text{company_name}='CSC'}(\text{Works}))$
 $R2 \leftarrow R1 \text{ JOIN Lives}$
 $R3 \leftarrow \text{PROJECT}_{\text{person_name,city}}(R2)$

(c) $R1 \leftarrow \text{SELECT}_{\text{person_name}}(\text{PROJECT}_{\text{company_name}='CSC'}(\text{Works}))$
 $R2 \leftarrow R1 \text{ JOIN Lives}$
 $R3 \leftarrow \text{PROJECT}_{\text{person_name,city}}(R2)$

(d) $R1 \leftarrow \text{PROJECT}_{\text{person_name}}(\text{SELECT}_{\text{company_name}='CSC'}(\text{Works}))$
 $R2 \leftarrow R1 \text{ PRODUCT Lives}$
 $R3 \leftarrow \text{PROJECT}_{\text{person_name,city}}(R2)$

(e) $R1 \leftarrow \text{PROJECT}_{\text{person_name}}(\text{SELECT}_{\text{company_name}='CSC'}(\text{Works}))$
 $R2 \leftarrow R1 \text{ INTERSECTION Lives}$
 $R3 \leftarrow \text{PROJECT}_{\text{person_name,city}}(R2)$

30. Which of the following statements(s) is/are true with respect to SQL?

- (a) SQL is declarative and is based on relational algebra.

(b) SQL is interactive via GUI or command prompt, or embedded in programs.

(c) SQL is supported by all major commercial relational database management systems.

(d) SQL is supported by all Object relational database management systems.

(e) SQL is a database programming language and not a database administration language.

31. Suppose there is a relation declared as follows.

CREATE TABLE Employee (empNo INT PRIMARY KEY,
Salary INT CHECK (Salary <= 40000));

Initially, the relation has three records:

empNo	Salary
1001	10000
1002	20000
1003	30000

Suppose the following set of instructions would be run on Employee relation. Some of them may be rejected due to the constraints in the relation.

- (i) INSERT INTO Employee VALUES (1004, 12000);
- (ii) UPDATE Employee SET Salary = Salary + 10000 WHERE empNo = 1003;
- (iii) INSERT INTO Employee VALUES (1001, 13000);
- (iv) DELETE FROM Employee WHERE empNo = 1002;

Which of the following is correct after executing the command

SELECT SUM (Salary) FROM Employee ?

- | | | |
|-----------|-----------|-----------|
| (a) 52000 | (b) 62000 | (c) 65000 |
| (d) 75000 | (e) 50000 | |

32. Consider the following Worker relation.

Worker	workerID	Designation	Salary	deptNo
	110	System Admin	25000	10
	111	Software Engineer	30000	10
	112	Quality Assurer	21000	20
	113	Technical writer	17000	30
	114	Support Engineer	20000	10

Which of the following statement(s) correctly give(s) the list of departments having average salary greater than 20000?

- | |
|--|
| (a) SELECT deptNo, AVG(Salary) FROM Worker ORDER BY deptNo HAVING AVG(Salary)>20000; |
| (b) SELECT deptNo, AVG(Salary) FROM Worker HAVING AVG(Salary)>20000; |
| (c) SELECT deptNo, AVG(Salary) FROM Worker GROUP BY deptNo HAVING AVG(Salary)>20000; |
| (d) SELECT deptNo, AVG(Salary) FROM Worker WHERE AVG(Salary)>20000; |
| (e) SELECT deptNo, AVG(Salary) FROM Worker GROUP BY deptNo WHERE AVG(Salary)>20000; |

33. Which of the following statement(s) correctly describe(s) the functionality of Query Language?

- | |
|---|
| (a) ODBC/JDBC Application programming interface allows SQL queries to be sent to a database. |
| (b) Writing SQL statements within codes written in a general programming language is called Embedded SQL. |
| (c) SQL aggregation functions cannot be used over values in multiple rows of a relation. |
| (d) DML also known as query language as SQL. |
| (e) Using a series of SQL statements in a stored procedure can improve the performance in a database operation. |

34. The conflicts between design efficiency, information requirements and processing speed are often resolved through

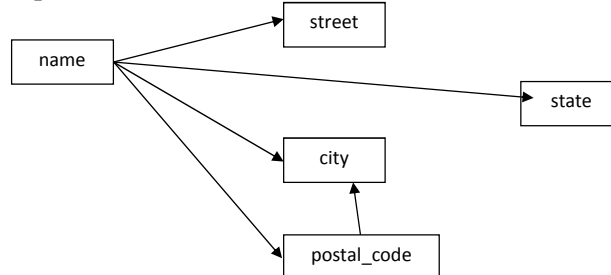
- | |
|---|
| (a) conversions from 1NF to 2NF. |
| (b) conversions from 2NF to 3NF. |
| (c) compromises that may include denormalization. |
| (d) conversions from 3NF to 4NF. |
| (e) resolving transitive dependencies. |

35. Consider a relation $NADDR = (name, street, city, state, postal_code)$ where name is unique, and for any given postal code, there is just one city and state .

Which of the following statement(s) is/are true with regard to the above relation?

(a) A table is in second normal form if it is in first normal form AND we need all the fields in the key to determine the values of the non-key fields.

(b) A possible set of FDs are as follows



(c) The candidate key is postal_code.

(d) NADDR is in 2NF as there is dependency between non-key attributes as postal_code determines city and state.

(e) $NADDR = (name, street, city, state, postal_code)$ will be decomposed into $NADDR1 = (name, street, postal_code)$ Postal = (postal_code, city, state) when represented in 2NF form.

36. In which normal form should a relation be to perform suitably in business transactional databases?

- | | | |
|---------|---------|---------|
| (a) 0NF | (b) 1NF | (c) 2NF |
| (d) 3NF | (e) 4NF | |

37. Consider the following SQL command for creating a view.

```
CREATE VIEW <view_name> [(<column_list>)] AS <SELECT statement>;
```

Which of the following statements is/are true with respect to the usage of the above command?

(a) It replicates the data on the base table(s) into a separate data entity named by the view_name.

(b) The number of columns in <column_list> must match the number of columns in the <SELECT statement>.

(c) This command should be issued prior to each time a particular view_name is queried.

(d) All views created with this command allow INSERT, UPDATE, and DELETE operations over them.

(e) Any view created with this command can be dropped with “DROP VIEW <view_name> RESTRICT” SQL command.

38. Consider the following set of SQL commands for creating views.

```
CREATE TABLE T1 (COL1 CHAR(10));

CREATE VIEW V1 AS SELECT COL1
FROM T1 WHERE COL1 LIKE 'A%';

CREATE VIEW V2 AS SELECT COL1
FROM V1 WHERE COL1 LIKE '%Z'
WITH LOCAL CHECK OPTION;

CREATE VIEW V3 AS SELECT COL1
FROM V2 WHERE COL1 LIKE 'AB%';

CREATE VIEW V4 AS SELECT COL1
FROM V3 WHERE COL1 LIKE '%YZ'
WITH CASCADED CHECK OPTION;

CREATE VIEW V5 AS SELECT COL1
FROM V4 WHERE COL1 LIKE 'ABC%';
```

Which of the following statements is/are true with respect to the usage of the above commands?

- (a) If V2 is operated on, COL1 must end in the letter Z, but it does **not** need to start with the letter A.
- (b) If V3 is operated on, COL1 must end in the letter Z, but it does **not** need to start with the letter A.
- (c) If V4 is operated on, COL1 need not start with 'AB', but must end with 'YZ'.
- (d) If V5 is operated on, COL1 must start with 'AB', but **not** necessarily 'ABC'.
- (e) If V1 is operated on, no conditions are checked because V1 does **not** have a WITH CHECK OPTION specified.

39. Which of the following statements is/are true about Data Security?

- (a) Database confidentiality refers to the requirement that information should be protected from improper modification. Modification of data includes creation, insertion, modification, changing the status of data and deletion.
- (b) Inference control and flow control can be suggested as two countermeasures that can be implemented against the threats to databases.
- (c) As part of a successful implementation of Data Security Mechanisms, decryption of data is performed before sensitive data (such as credit card numbers) is transmitted via some type of communications network.
- (d) Data Administrator is responsible for the overall security of the database system.
- (e) The Bell-LaPadula model, which classifies each subject (user, account, program) and object (relation, tuple, column, view, operation) into one of the security classifications: top secret (TS), secret (S), confidential (C), and unclassified (U), where TS is the highest level and U the lowest, is an example of a mandatory access control model.

40. Consider the following relations.

Stores (storeid, address, city, state, zip, manager)

Orders (orderid, itemid, price, time, linenumber, storeid)

Following access control implementation is carried for this restaurant administration database.

```
GRANT SELECT(storeid, itemid) ON ORDERS TO Sarath, Nimal;  
GRANT SELECT ON STORES TO Sarath, Nimal;  
GRANT SELECT ON ORDERS TO Gamini WITH GRANT OPTION;  
GRANT INSERT(manager), DELETE ON stores TO Ruwan;  
GRANT UPDATE(address, city, state, zip) ON stores TO Herath,  
Bandara;  
GRANT ALL PRIVILEGES ON stores TO Dias WITH GRANT OPTION;  
GRANT ALL PRIVILEGES ON orders TO Dias WITH GRANT OPTION;
```

Note: There is no default value for 'storeid'

Which of the following statements is/are true with regard to the above implementation?

- (a) Sarath and Nimal may only view which stores sold which items and the information about the stores.
- (b) Gamini can allow others to see the details of the orders placed.
- (c) Ruwan is allowed to successfully create new stores.
- (d) Herath and Bandara can change the name of the manager of a particular store.
- (e) It can be inferred from the implementation that Dias might be the owner of the company.
