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Questions

**Volume-9**

Data Base Management System  
Software Engineering  
Data and Computer Networks



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To reach heights one must start climbing and if the journey is difficult then perseverance is the key to success. As a teacher we have realized over past years that success in any competitive exam requires hard work and proper guidance. **Engineers Academy** with its unique teaching methodologies has always proved that we meet the expectations of thousands of students and parents to make their dreams come true. With changing patterns, we have adapted ourselves to deliver the best and ensure better results.

This book has been organized and executed with a lot of care, dedication and passion for lucidity. A conscious attempt has been made to simplify the concepts to facilitate better understanding of the subject.

Engineers Academy has many successful stories of students who secured All India Rank in ESE, GATE, PSUs and JEn. Now we invite you to become a part of Engineers Academy to explore and achieve ultimate goal of your life. We promise to provide you quality guidance with competitive environment which is far advanced and ahead than the reach of other institution.

We would feel satisfied if the book meets the needs of the students for whom it is meant.

Lastly, we are thankful to all the engineers, authors whose work has been the source of enlightenment, inspiration and guidance in presenting this book.

It is hoped that the book in its new form will enjoy its ever increasing popularity.

Regards

Dr. Pankaj Goyal



# Preface

✍ This book has been written to meet the growing requirements of candidates appearing for Senior Computer Instructor and other competitive Examinations. Though every candidate has ability to succeed but competitive environment, in-depth knowledge, quality guidance, time management and good source of study is required to achieve goals.

This book includes Multiple Choice Questions (MCQ's) which works as a mock exam practice for the reader. Questions of all the subject have been organized in systematic, concepts oriented and error less manner so that it become easy and interesting for even a beginner to understand. It is a very convenient book and must be solved by candidate aiming for competitive exams.

After solving this booklet students can feel encouraged and develop confidence to attempt each and every type of numerical as well as theoretical problems. Each problems explains solving approach so that at the end, so the reader is well equipped to be able to apply any type of problem solving requirement and distinctly choose one strategy or type from the other.

We hope this book will be proved an important tool to succeed in Basic and Senior Computer Instructor and other competitive Examinations.

Even though, enough readings were given for correcting the error and printing mistakes, due to human tendency there could be some minor typos in the book. If any such typos found, they will be highly appreciated and in corporated in the next edition. Also, please provide your valuable suggestions at :[engineers.academy.india@gmail.com](mailto:engineers.academy.india@gmail.com)

Wish you all the best. Have a nice reading.

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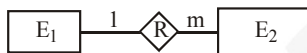
# 1

# Database Management System

## OBJECTIVE QUESTION

### ER-Model

1. Consider the following entity relationship diagram (ERD), where two entities  $E_1$  and  $E_2$  have a relation  $R$  of cardinality 1:m.



The attributes of  $E_1$  are  $A_{11}$ ,  $A_{12}$  and  $A_{13}$  where  $A_{11}$  is the key attribute. The attribute of  $E_2$  are  $A_{21}$ ,  $A_{22}$  and  $A_{23}$  where  $A_{21}$  is the key attribute and  $A_{23}$  is a multi-valued attribute. Relation  $R$  does not have any attribute. A relational database containing minimum number of tables with each table satisfying the requirements of the third normal form (3NF) is designed from the above ERD. The number of tables in the database is.

- (a) 2      (b) 3      (c) 5      (d) 4
2. Consider the entities 'hotel room', and 'person' with a many to many relationship 'lodging'



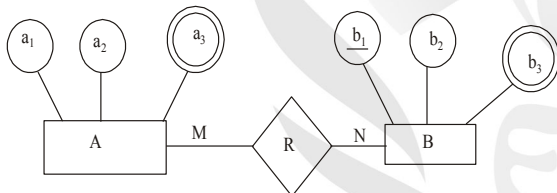
If we wish to store information about the rent payment to be made by person(s) occupying different hotel rooms, then this information should appear as an attribute of

- (a) person      (b) Hotel Room  
 (c) Lodging      (d) None of these
3. An entity set that does not have sufficient attributes to form a primary key is a
- (a) strong entity set      (b) weak entity set  
 (c) simple entity set      (d) primary entity set
4. A logical schema
- (a) is the entire database.  
 (b) is a standard way of organizing information into accessible parts.  
 (c) describes how data is actually stored on disk.  
 (d) both (a) and (c)
5. Tree structures are used to store data in ?
- (a) Network model      (b) Relational model  
 (c) Hierarchical model      (d) File based system

6. The rule that a value of a foreign key must appear as a value of some specific table is called a ?
- (a) Referential constraint      (b) Index  
 (c) Integrity constraint      (d) Functional dependency
7. According to the levels of abstraction, the schema at the intermediate level is called ?
- (a) View schema.      (b) Physical schema.  
 (c) Subschema.      (d) conceptual schema
8. It is an abstraction through which relationships are treated as higher level entities ?
- (a) Generalization      (b) Specialization  
 (c) Aggregation      (d) Inheritance
9. What are the desirable properties of a decomposition ?
- (a) Partition constraint      (b) Dependency preservation  
 (c) Redundancy      (d) Security
10. Consider the following assumptions for the relation employee (eid, ename, dept, grade, sal, age, address) and find the candidate key of the relation.
- I. Each employee has unique id  
 II. An employee can work on one dept only  
 III. Employees salary depends on his age and grade  
 IV. Each employee has unique age and address  
 V. More than one employee can have the same salary or can be of same age
- (a) eid only      (b) eid, (age, address)  
 (c) (grade, age)      (d) eid dept
11. Which of the following statements is True ?
- (a) The Entity-Relationship data model is an example of implementation data models  
 (b) A conceptual schema can be defined using an E-R model  
 (c) E-R model is used in a phase called physical database design  
 (d) E-R model is used in a phase called conceptual database design

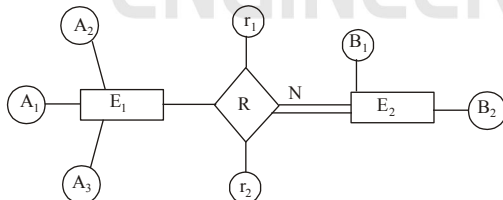
12. Match the following with most appropriate types of attributes.
- List-I**
- P. Name of the dependent      Q. Degree of a person  
R. Telephone number          S. Date of birth
- List-II**
1. Stored attribute                  2. Composite attribute  
3. Multi-valued attribute      4. Discriminator attribute
- Codes :**
- (a) P-4, Q-3, R-2, S-1      (b) P-4, Q-2, R-3, S-1  
(c) P-4, Q-1, R-2, S-3      (d) P-4, Q-1, R-3, S-2
13. The collection of information stored in a database of a particular moment is \_\_\_\_\_
- (a) view                                  (b) schema  
(c) instance                              (d) subschema
14. The number of rows in a table is known as
- (a) attribute  
(b) tuple  
(c) cardinality  
(d) doesn't describe anything
15. Match the following
- List-I**
- A. A database schema is  
B. A data model is  
C. A database instance is  
D. A database extension is
- List-II**
1. The state of the database  
2. The collection of data stored.  
3. A set of concepts used to describe database  
4. A description of database using a specific data model.
- Codes :**
- (a) P-3, Q-1, R-4, S-2      (b) P-1, Q-3, R-3, S-3  
(c) P-2, Q-2, R-2, S-1      (d) P-4, Q-4, R-1, S-4
16. Descriptive attributes are used to
- (a) Record information about participating entities  
(b) Record information about relationships  
(c) Record information about data  
(d) Record information about aggregation
17. A minimum cardinality of zero specifies
- (a) No participation                  (b) Partial participation  
(c) Total participation              (d) Zero participation
18. The way a particular application views the data from the database that the application uses is a
- (a) module                              (b) relational model  
(c) schema                              (d) sub schema
19. Conceptual design
- (a) is a documentation technique  
(b) needs data volume and processing frequencies to determine the size of the database  
(c) involves modelling independent of the DBMS  
(d) is designing the relational model
20. A subschema expresses
- (a) the logical view  
(b) the physical view  
(c) the external view  
(d) all of the above
21. Which one of the following statements is false?
- (a) The data dictionary is normally maintained by the database administrator.  
(b) Data elements in the database can be modified by changing the data dictionary.  
(c) The data dictionary contains the name and description of each data element.  
(d) The data dictionary is a tool used exclusively by the database administrator.
22. An advantage of the database management approach is ?
- (a) data is dependent on programs.  
(b) data redundancy increases.  
(c) data is integrated and can be accessed by multiple programs.  
(d) none of the above.
23. Which one of the following is not true for a view:
- (a) View is derived from other tables.  
(b) View is a virtual table.  
(c) A view definition is permanently stored as part of the database.  
(d) View never contains derived columns.
24. An advantage of views is ?
- (a) Data security  
(b) Derived columns  
(c) Hiding of complex queries  
(d) All of the above
25. An abstract data type is used to:
- (a) link data from remote databases  
(b) prevent users from getting to database security information  
(c) provide a conceptual view of the data so it is easier to understand  
(d) store complex data structure to represent the properties of objects
26. Which of the following items is not the advantage of a DBMS?
- (a) Improved ability to enforce standards  
(b) Improved data consistency  
(c) Local control over the data  
(d) Minimal data redundancy

27. The property (or set of properties) that uniquely defines each row in a table is called the:
- (a) identifier (b) index  
(c) primary key (d) symmetric key
28. A domain is atomic if elements of the domain are considered to be \_\_\_\_\_ units.
- (a) Different (b) Indivisible  
(c) Constant (d) Divisible
29. Consider a business rule such as “an employee supervises” other employees.  
What kind of relationship exist in the above scenario?
- (a) Mandatory relationship  
(b) Identifying relationship  
(c) Non-identifying relationship  
(d) Recursive relationship
30. A prime attribute of a relation schema R is an attribute that appears
- (a) In all candidate keys of R  
(b) In some candidate keys of R  
(c) In a foreign key of R  
(d) Only in the primary key of R
31. Let the relation R(A, B, C, D, E, F) and candidate keys are {AB, AE}, then number of superkeys are \_\_\_\_\_.
- (a) 20 (b) 21 (c) 22 (d) 24
32. Consider the following E-R model :



The minimum number of relations in the relational model for the given E-R model is \_\_\_\_\_

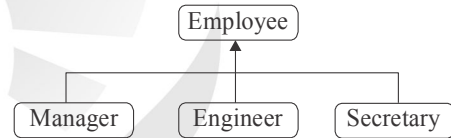
- (a) 5 (b) 6 (c) 7 (d) 8
33. In an entity-relationship (ER) model, suppose R is one to one relationship from entity  $E_1$  to entity  $E_2$  as following.



Which one of the following is true about R when relational model will be formed ?

- (a) Every attribute of  $E_1$  will be associated with  $E_2$ .  
(b) Every attribute of  $E_2$  will be associated with  $E_2$ .  
(c) Only primary key of  $E_1$  will be associated with  $E_2$ .  
(d) Both primary key of  $E_1$  and all attributes ( $r_1, r_2$ ) of R will be associated with  $E_2$ .

34. All one to many (1–N) relationships in E-R model is implemented in relational model as
- (a) Relation corresponding to ‘1’ side is modified to include foreign key of the relation on the ‘N’ side.  
(b) Relation corresponding to ‘N’ side is modified to include foreign key of the relation on the ‘1’ side.  
(c) Primary keys are added on both sides.  
(d) Foreign keys are added on both sides.
35. It is desired to design an object-oriented employee record system for a company. Each employee has a name, unique id and salary. Employee belong to different categories and their salary is determined by their category. The functions getName, getId and computerSalary are required. Given the class hierarchy below, possible location for these functions are
- (i) getId is implemented in the superclass  
(ii) getId is implemented in the subclass  
(iii) getName is an abstract function in the superclass  
(iv) getName is implemented in the superclass  
(v) getName is implemented in the subclass  
(vi) getSalary is an abstract function in the superclass  
(vii) getSalary is implemented in the superclass  
(viii) getSalary is an implemented in the subclass



Choose the best design

- (a) (i), (iv), (vi), (viii)  
(b) (i), (iv), (vii)  
(c) (i), (iii), (v), (vi), (viii)  
(d) (ii), (v), (viii)
36. Consider the following entity relationship diagram (ERD), where two entities  $E_1$  and  $E_2$  have a relation R of cardinality 1: m



The attributes of  $E_1$  are  $A_{11}, A_{12}$  and  $A_{13}$  where  $A_{11}$  is the key attribute. The attributes of  $E_2$  are  $A_{21}, A_{22}, A_{23}$  where  $A_{21}$  is the key attribute and  $A_{23}$  is a multi-valued attribute. Relation R does not have any attribute. A relational database containing minimum number of tables with each table satisfying the requirements of the third normal form (3NF) is designed from the above ERD. The number of tables in the database is

- (a) 2 (b) 3 (c) 5 (d) 4
37. Let  $E_1$  and  $E_2$  be two entities in an E/R diagram with simple single-valued attributes.  $R_1$  and  $R_2$  are two relationship between  $E_1$  and  $E_2$ , where  $R_1$  is one-to many and  $R_2$  is many-to-many.  $R_1$  and  $R_2$  do not have any

attributes of their own. What is the minimum number of tables required to represent this situation in the relational model?

- (a) 2 (b) 3  
(c) 4 (d) 4

38. The following table has two attributes A and C where A is the primary key and C is the foreign key referencing A with on-delete cascade.

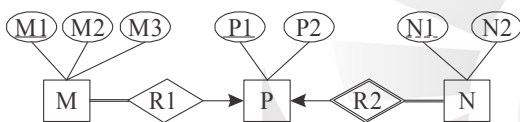
A	C
2	4
3	4
4	3
5	2
7	2
9	5
6	4

The set of all tuples that must be additionally deleted to preserve referential integrity when the tuple (2,4) is deleted is:

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

**Common Data for (Questions 39 and 40)**

Consider the following ER diagram



39. The minimum number of tables needed to represent M, N, P, R1, R2 is

- (a) 2 (b) 3 (c) 4 (d) 5

40. Which of the following is a correct attribute set for one of the table for the correct answer to the above question?

- (a) {M1, M2, M3, P1} (b) {M1, P1, N1, N2}  
(c) {M1, P1, N1} (d) {M1, P1}

41. Given the basic ER and relational models, which of the following is INCORRECT?

- (a) An attribute of an entity can have more than one value  
(b) An attribute of an entity can be composite  
(c) In a row of a relational table, an attribute can have more than one value  
(d) In a row of a relational table, an attribute can have exactly one value or a NULL value

42. Consider an Entity-Relationship (ER) model in which entity sets  $E_1$  and  $E_2$  are connected by an  $m:n$  relationship  $R_{12}$ .  $E_1$  and  $E_3$  are connected by a  $1:n$  (1 on the side of  $E_1$  and  $n$  on the side of  $E_3$ ) relationship  $R_{13}$ .

$E_1$  has two single-valued attributes  $a_{11}$  and  $a_{12}$  of which  $a_{11}$  is the key attribute.  $E_2$  has two single-valued attributes  $a_{21}$  and  $a_{22}$  of which  $a_{21}$  is the key attribute.  $E_3$  has two single-valued attributes  $a_{31}$  and  $a_{32}$  of which  $a_{31}$  is the key attribute. The relationship do not have any attributes.

If a relational model is derived from the above ER model, then the minimum number of relations that would be generated if all the relations are in 3NF is

- (a) 1 (b) 2 (c) 3 (d) 4

43. An ER model of a database consists of entity types A and B. These are connected by a relationship R which does not have its own attribute. Under which one of the following conditions, can the relational table for R be merged with that of A?

- (a) Relationship R is one-to-many and the participation of A in R is total.  
(b) Relationship R is one-to-many and the participation of A in R is partial.  
(c) Relationship R is many-to-one and the participation of A in R is total.  
(d) Relationship R is many-to-one and the participation of A in R is partial.

44. In an Entity-relationship (ER) model, suppose R is a many-to one relationship from entity set  $E_1$  to entity set  $E_2$ . Assume that  $E_1$  and  $E_2$  participate totally in R and that the cardinality of  $E_1$  is greater than the cardinality of  $E_2$ .

Which one of the following is true about R ?

- (a) Every entity in  $E_1$  is associated with exactly one entity in  $E_2$ .  
(b) Some entity in  $E_1$  is associated with more than one entity in  $E_2$ .  
(c) every entity in  $E_2$  is associated with exactly one entity in  $E_1$ .  
(d) Every entity in  $E_2$  is associated with at most one entity in  $E_1$ .

45. Which one of the following is used to represent the supporting many-one relationships of a weak entity set in an entity-relationship diagram?

- (a) Ovals that contain underlined identifiers  
(b) Diamonds with double/bold border  
(c) Ovals with double/bold border  
(d) Rectangles with double/bold border

46. Consider the following statements  $S_1$  and  $S_2$  about the relational data model:

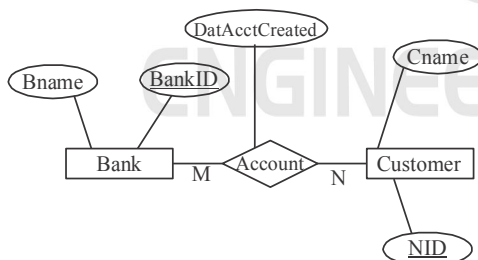
$S_1$ : A relation scheme can have at most one foreign key.

$S_2$ : A foreign key in a relation scheme R cannot be used to refer to tuples of R.

Which one of the following choices is correct?

- (a) Both  $S_1$  and  $S_2$  are true  
(b)  $S_1$  is true and  $S_2$  is false  
(c)  $S_1$  is false and  $S_2$  is true  
(d) Both  $S_1$  and  $S_2$  are false

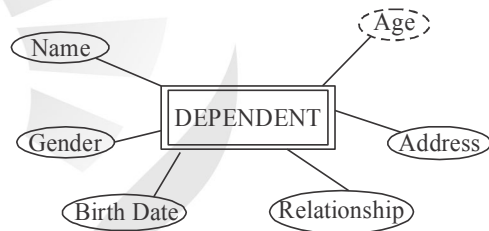
47. Which one of the following NULL values can not be used in the relational model ?
- To fill a column in tuple when that column does not really exist for that particular tuple.
  - To leave columns in a tuple marked as 'unknown' when the actual value is unknown.
  - To allow duplicate tuples in the table by filling the primary key column(S) with NULL.
  - To opt a tuple out of enforcement of a foreign key.
48. A weak entity\_\_\_\_\_.
- is an entity with no attributes beside its key.
  - inherits part of its key from the 'parent' entities to which it is related.
  - is an entity with no key.
  - None of these.
49. In the relational Model, the number of attributes and number of tuples in a relation are termed as\_\_\_and\_\_\_respectively.
- Cardinality, domain
  - Degree, cardinality
  - Domain, degree
  - Cardinality, degree
50. Making a change to the conceptual schema of a database but not affecting the existing external schemas is an example of
- Physical data independence
  - Logical data independence
  - Concurrency control
  - Integrity control
51. The data base administrator is, in effect, the coordinator between the\_\_\_and the\_\_\_.
- DBMS, data base
  - application program, data base
  - data base, users
  - application programs, users.
52. Consider the following ERD diagram illustrating the relationship of customers and banks.



Select from among the following, candidates for relations, if the above ERD is mapped in to relational model.

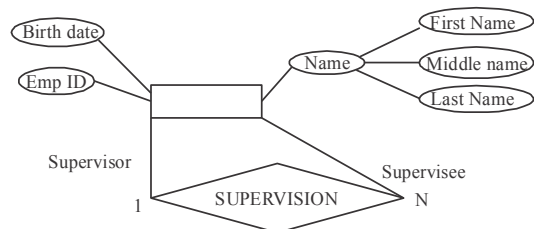
- Customer (NID CName)
- Account (DateAcctCreated, BName, CName)
- Bank (BankID, NID, BName)
- Bank (BankID, BName)
- Account (BankID, NID, DateAcctCreated)

- 1, 2 and 4
  - 1, 4 and 5
  - 1, 3 and 5
  - 1, 2 and 4
53. Choose the incorrect statements.
- In network model, data is represented by a collection of records, and relationship among data are represented by links.
  - In hierarchical model, data and relationships among data are represented by records and links respectively.
  - In hierarchical model, the records are organized as a collection of arbitrary graphs.
  - In network model, the records are organized as a collection of trees.
- 1 and 3 only
  - 2 and 3 only
  - 3 and 4 only
  - All are correct
54. Manager's salary details are hidden form the employee. This is
- conceptual level data hiding
  - physical level data hiding
  - external level data hiding
  - none of the above
55. The following diagram represents the dependent entity from an Entity Relationship Diagram.



Select the characteristics which are not represented by the above diagram.

- Birth date is a derived attribute.
  - Gender is an atomic attribute
  - Address is a multivalued attribute
  - Name is a key attribute.
56. Consider the following ERD diagram depicting the relationship of an employee and supervisor.

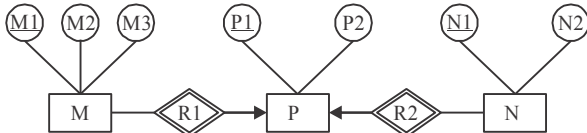


Which is the possible relations if the above ERD is mapped into a relational model ?

- Employee (EmpID, BirthDate, Salary, Name(FirstName, Middle Name, LastName))
- Supervision (EmpID, BirthDate, Salary, Name(FirstName, MiddleName, Last Name) EmpId).

- (c) Supervisor (SupervisorID, BirthDate, Salary, Name(FirstName, MiddleName, LastName), Empld).  
 (d) Employee (EmpID, BirthDate, Salary, Name(FirstName, MiddleName, LastName), SupervisorID)

57. Consider the following ER diagram

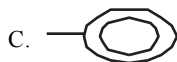
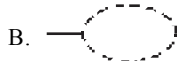


The minimum number of table needed to represent M, N, P, R1, R2 is

- (a) 2 (b) 3 (c) 4 (d) 5

58. Match List-I with List-II and select the correct answer using the codes given below the lists :

List-I



List-II

1. Identifying relationship
2. Weak entity
3. Derived attribute
4. Multivalued attribute

Codes :

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 3 | 4 | 2 |
| (b) | 2 | 4 | 3 | 1 |
| (c) | 2 | 3 | 4 | 1 |
| (d) | 1 | 4 | 3 | 2 |

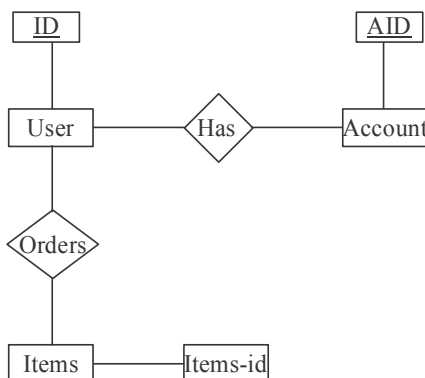
59. Which of the following is true with respect to generalization :

1. It is the process of identifying subsets of an entity set that share some common characteristics but still contains some differences.

2. It tells that a class inherits properties of base class.

- (a) Only 1 (b) Only 2  
 (c) Both 1 and 2 (d) None of these

60. Consider the following ER model :



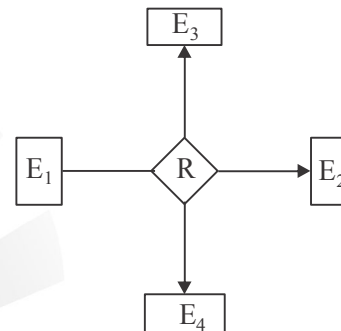
How many minimum tables are required for this ER model?

- (a) 4 (b) 2 (c) 5 (d) 3

61. R is relationship with 1 : 1 cardinality, 30% participation at  $E_1$  and 70% participation at  $E_2$  end which is the best possible design ?

- (a)  $E_1$  and  $E_2$  kept separate with foreign key at  $E_1$  end  
 (b)  $E_1$  and  $E_2$  kept separate with foreign key at  $E_2$  end  
 (c)  $E_1$  and  $E_2$  kept separate with foreign key at  $E_1$  as well as  $E_2$   
 (d)  $E_1$  and  $E_2$  merges into a single table with no foreign key

62. Consider the following ER diagram with three entity sets  $E_1$ ,  $E_2$ ,  $E_3$  and relationship set R



If  $E_1$ ,  $E_2$  and  $E_3$  has 50, 30, 100 and 400 records respectively. What is the maximum number of records of entities that could be in the relationship set R ?

- (a) 70 (b) 60 (c) 40 (d) 50

**Relational Model : Relational Algebra and Tuple Calculus**

63. Consider the relations  $R_1$  (P, Q, R) and  $R_2$  (R, S, T) with primary keys P and R respectively. The relation  $R_1$  contains 2000 tuples and  $R_2$  contains 2500 tuples. The maximum size of the join  $R_1 \bowtie R_2$  is ?

- (a) 2000 (b) 2500 (c) 4500 (d) 5000

64. Which of the following relational query languages have the same expressive power?

- I. Relational algebra  
 II. Tuple relational calculus restricted to safe expressions  
 III. Domain relational calculus restricted to safe expressions  
 (a) II and III only (b) I and II only  
 (c) I and III only (d) I, II and III

65. Consider a selection of the form  $\sigma_{A \leq 100}(r)$ , where r is a relation with 1000 tuples. Assume that the attribute values for A among the tuples are uniformly distributed in the interval [0, 500]. Which one of the following options is the best estimate of the number of tuples returned by the given selection query?

- (a) 50 (b) 100 (c) 150 (d) 200

66. Consider the following relation schemas:

b-Schema = (b-name, b-city, assets)

a-Schema = (a-num, b-name, bal)

d-Schema = (c-name, a-number)

Let branch, account and depositor be respectively instances of the above schemas.

Assume that account and depositor relations are much bigger than the branch relation.

Consider the following query.

$\Pi_{c-name} (\sigma_{b-city="Agra" \wedge bal < 0} (branch \bowtie (account \bowtie depositor)))$

Which one of the following queries is the most efficiently version of the above query?

- (a)  $\Pi_{c-name} (S_{bal < 0} (S_{b-city="Agra"} \text{branch} \bowtie \text{account}) \bowtie \text{depositor})$
- (b)  $\Pi_{c-name} (S_{b-city="Agra"} \text{branch} \bowtie (S_{bal < 0} \text{account} \bowtie \text{depositor}))$
- (c)  $\Pi_{c-name} (S_{b-city="Agra"} \text{branch} \bowtie S_{b-city="Agra"} \wedge bal < 0 \text{account} \bowtie \text{depositor})$
- (d)  $\Pi_{c-name} (S_{b-city="Agra"} \text{branch} \bowtie S_{b-city="Agra"} \wedge bal < 0 \text{account} \bowtie \text{depositor})$

- 67. SET concept is used in :
  - (a) Network Model      (b) Hierarchical Model
  - (c) Relational Model    (d) None of these
- 68. Relational Algebra is ?
  - (a) Data Definition Language
  - (b) Meta Language
  - (c) Procedural query Language
  - (d) None of the above
- 69. Key to represent relationship between tables is called ?
  - (a) Primary key            (b) Secondary Key
  - (c) Foreign Key            (d) None of these
- 70. \_\_\_\_\_ produces the relation that has attributes of R1 and R2
  - (a) Cartesian product    (b) Difference
  - (c) Intersection          (d) Product
- 71. Consider the join of relation R with a relation S. If R has m tuples and S has n tuples, then the maximum and minimum size of the join respectively are
  - (a) m+n and 0            (b) m+n and |m-n|
  - (c) mn and 0              (d) mn and m-n
- 72. If an entity can belong to only one lower level entity then the constraint is?
  - (a) disjoint (b) partial    (c) overlapping    (d) single
- 73. A relational database developer refers to a record as ?
  - (a) a criteria                (b) a relation
  - (c) a tuple                    (d) an attribute
- 74. The operation which is not considered a basic operation of relational algebra is ?
  - (a) Join                      (b) Selection
  - (c) Union                    (d) Cross product
- 75. As per equivalence rules for query transformation, selection operation distributes over ?
  - (a) Union                    (b) Intersection
  - (c) Set difference        (d) All of the above

- 76. When  $R \cap S = \phi$ , then the cost of computing  $R \bowtie S$  is
  - (a) the same as  $R \times S$     (b) greater the  $R \times S$
  - (c) less than  $R \times S$       (d) cannot say anything
- 77. The natural join is equal to :
  - (a) Cartesian Product
  - (b) Combination of Union and Cartesian product
  - (c) Combination of selection and Cartesian product
  - (d) Combination of projection and Cartesian product
- 78. In tuple relational calculus P1 AND P2 is equivalent to ?
  - (a)  $(\neg P1 \text{OR} \neg P2)$       (b)  $\neg(P1 \text{OR} \neg P2)$
  - (c)  $\neg(\neg P1 \text{OR} P2)$       (d)  $\neg(\neg P1 \text{OR} \neg P2)$
- 79. Which of the following constitutes a basic set of operations for manipulating relational data?
  - (a) Predicate calculus    (b) Relational calculus
  - (c) Relational algebra    (d) SQL
- 80. In relational database model, after conceptually designing your database, the information contained in a single class would be stored in a:
  - (a) database                (b) field
  - (c) property                (d) table
- 81. Relational calculus is a
  - (a) Procedural language
  - (b) Non-Procedural language
  - (c) Data definition language
  - (d) High level language.
- 82. Cartesian product in relational algebra is
  - (a) a unary operator      (b) a binary operator
  - (c) a ternary operator    (d) not defined.
- 83. Which of the following relational algebra operations do not require the participating tables to be union-compatible?
  - (a) Union                    (b) Intersection
  - (c) Difference              (d) Join
- 84. Relational Algebra does not have
  - (a) Selection operator    (b) Projection operator
  - (c) Aggregation operators (d) Division operator
- 85. Which of the following is a false statement ?
  - (a) Relational algebra is a procedure language
  - (b) Tuple relational calculus and domain relational calculates are non procedural languages
  - (c) RAE is based on domain relational calculus
  - (d) None
- 86. Consider the following three relations.

Jno	Sno	Jno	Sno	Jno	Sno
J2	S1	J2	S1	J2	S1
J1	S1	J1	S1	J1	S1
J1	S2	J1	S2	J1	S2

Query :  $(R \bowtie Q \bowtie S)$

Find out the number of rows results comes as output for the above Query.

- (a) 4  
 (b) 5  
 (c) 6  
 (d) None of the above values

87. Customer

cname	st	City
-------	----	------

Account

acno	cname	bal	bname
------	-------	-----	-------

Loan

Ino	cname	amt	bname
-----	-------	-----	-------

**Query (i)** : Select cname from customer where cname in (select cname from account where cname = any(select cname From loan)) ;

**Query (ii)** :  $(\Pi_{\text{cname}}((\text{Customer} \bowtie (\text{Account} \bowtie \text{loan})))$

**Query (iii)** :  $(\Pi_{\text{cname}}((\text{Customer} \bowtie (\text{Account} \bowtie \text{loan})))$

**Query (iv)** : Select cname from Customer C where exists (Select cname from loan) Intersect (select cname from account where cname = C.cname);

Which of the following is false statement ?

- (a) Query (i) and query (iv) gives the same result  
 (b) Query (ii) and query (iii) gives the same result  
 (c) Query (i) and query (iii) gives the different result  
 (d) Query (iii) and query (iv) gives the same result

88. Find equivalent Relational Algebra (RA) expression for the following SQL query.

Select C.Sid from catalog C, parts P

where  $(P.\text{color} = \text{red or } P.\text{color} = \text{green})$  and  $P.\text{pid} = C.\text{pid}$

- (a)  $\Pi_{\text{sid}} (\sigma_{\text{color} = \text{red or color} = \text{green}} (\text{parts} \bowtie \text{catalog}))$   
 (b)  $\Pi_{\text{sid}} (\sigma_{\text{color} = \text{red or color} = \text{red}} (\text{parts} \bowtie \text{catalog}))$   
 (c)  $\Pi_{\text{pid}} (\sigma_{\text{color} = \text{red or color} = \text{green}} (\text{parts} \bowtie \text{catalog}))$   
 (d)  $\Pi_{\text{pid}} (\sigma_{\text{color} = \text{red or color} = \text{green}} (\text{parts} \bowtie \text{catalog}))$

89. The following two question involve the three relations below :

- $R(a,b) = \{(0,1), (4,5), (8,9)\}$
- $S(b,c) = \{(1, 2), (5,2), (5,6), (5, 10), (13, 10)\}$
- $T(c,d) = \{(2,3), (6,7), (10,11), (10, 3),\}$

The number of tuples in  $R \bowtie S \bowtie T$ , where  $\bowtie$  is the natural join is :

- (a) 5      (b) 8      (c) 10      (d) 13

90. Which of the following query transformations (i.e. replacing the LHS expression by the RHS expression) is incorrect ?  $R_1$  and  $R_2$  are relations,  $C_1, C_2$  are selection conditions and  $A_1, A_2$  are attributes of  $R_1$ ?

- (a)  $\sigma_{C_1}(\sigma_{C_2}(R_1)) \rightarrow \sigma_{C_2}(\sigma_{C_1}(R_1))$   
 (b)  $\sigma_{C_1}(\pi_{A_1}(R_1)) \rightarrow \pi_{A_1}(\sigma_{C_1}(R_1))$   
 (c)  $\sigma_{C_1}(R_1 \cup R_2) \rightarrow \sigma_{C_1}(R_1) \cup \sigma_{C_1}(R_2)$   
 (d)  $\pi_{A_1}(\sigma_{C_1}(R_1)) \rightarrow \sigma_{C_1}(\pi_{A_1}(R_1))$

91. The relational algebra expression equivalent to the following tuple calculus expression :

$\{t | t \in r \wedge (t[A] = 10 \wedge t[B] = 20)\}$  is

- (a)  $\sigma_{(A = 10, B = 20)}(r)$   
 (b)  $\sigma_{(A = 10)}(r) \cup \sigma_{(B = 20)}(r)$   
 (c)  $\sigma_{(A = 10)}(r) \cap \sigma_{(B = 20)}(r)$   
 (d)  $\sigma_{(A = 10)}(r) - \sigma_{(B = 20)}(r)$

92. Given the relations

employee (name, salary, deptno), and department (deptno, deptname, address)

Which of the following queries cannot be expressed using the basic relational algebra operations

$(\sigma, \pi, \times, \bowtie, \cup, \cap, -)$ ?

- (a) Department address of every employee  
 (b) Employees whose name is the same as their department name  
 (c) The sum of all employees salaries  
 (d) All employees of a given department

93. Which of the following relational calculus expressions is not safe ?

- (a)  $\{t | \exists u \in R_1 (t[A] = u[A]) \wedge \neg \exists s \in R_2 (t[A] = s[A])\}$   
 (b)  $\{t | \forall u \in R_1 (u[A] = "x" \Rightarrow \exists s \in R_2 (t[A] = s[A] \wedge s[A] = u[A]))\}$   
 (c)  $\{t | \neg (t \in R_1)\}$   
 (d)  $\{t | \exists u \in R_1 (t[A] = u[A]) \wedge \exists s \in R_2 (t[A] = s[A])\}$

94. With regard to the expressive power of the formal relational query languages, which of the following statement is true/

- (a) Relational algebra is more powerful than relational calculus  
 (b) Relational algebra has the same power as relational calculus  
 (c) Relational algebra has the same power as safe relational calculus  
 (d) None of the above

95. Let  $R_1 (A, B, C)$  and  $R_2 (D, E)$  be two relation schema, where the primary keys are shown underlined, and let C be a foreign key in  $R_1$  referring to  $R_2$ . Suppose there is no violation of the above referential integrity constraint in the corresponding relation instances  $r_1$  and  $r_2$ . Which one of the following relational algebra expressions would necessarily produce an empty relation?

- (a)  $\Pi_D (r_2) - \Pi_C(r_1)$
- (b)  $\Pi_C (r_1) - \Pi_D(r_2)$
- (c)  $\Pi_D (r_1 \bowtie_{C \neq D} R_2) - \Pi_C (r_1)$
- (d)  $\Pi_C (r_1 \bowtie_{C = D} R_2)$

96. Consider the relation Student (name, sex, marks), where the primary key is shown underlined, pertaining to students in a class that has at least one boy and one girl. What does the following relational algebra expression produce? (Note:  $\rho$  is rename operator)

$$\Pi_{name} (\sigma_{sex=female} (Student)) - \Pi_{name}(Student) \bowtie_{(sex = female \wedge x = male \wedge marks \leq m)} \rho^{n,x,m}(student)$$

- (a) name of girl students with the highest marks
- (b) names of girl students with more marks than some boy student
- (c) names of girl students with marks not less than some boy student
- (d) names of girl students with more marks than all the boy students

97. Let r be a relation instance with schema

$R=(A, B, C, D)$ . We define  $r_1 = \Pi_{A, B, C}(r)$  and  $r_2 = \Pi_{A, D}(r)$ . let  $S = r_1 * r_2$  where \* denotes natural join. Given that the decomposition of r into  $r_1$  and  $r_2$  is lossy, which one of the following is TRUE?

- (a)  $s \subset r$
- (b)  $r \cup s = r$
- (c)  $r \subset s$
- (d)  $r * s = s$

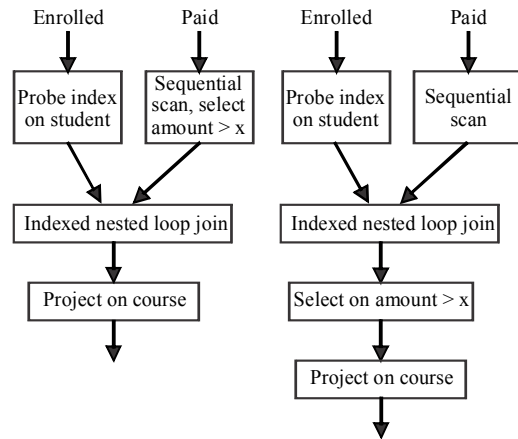
98. A DBMS query language is designed to

- (a) support end users who use English-like commands
- (b) support in the development of complex applications software
- (c) specify the structure of a database
- (d) all of the above

99. Which of the following relational query languages have the same expressive power?

- I. Relational algebra.
- II. Tuple relational calculus restricted to safe expressions.
- III. Domain relational calculus restricted to safe expressions.
- (a) II and III only
- (b) I and II only
- (c) I and III only
- (d) I, II and III

100. Consider the relation enrolled (student, course) in which (student, course) is the primary key, and the relation paid (student, amount) where student is the primary key. Assume no null values and no foreign keys or integrity constraints. Assume that amounts 6000, 7000, 8000, 9000 and 10000 were each paid by 20% of the students. Consider these query plans (Plan 1 on left, Plan 2 on right) to “list all courses taken by students who have paid more than x.”



A disk seek takes 4 ms. disk data transfer bandwidth is 300 MB/s and checking a tuple to see if amount is greater than x takes 10  $\mu$  s. Which of the following statements is correct?

- (a) Plan 1 and Plan 2 will not output identical row sets for all databases
- (b) A course may be listed more than once in the output of Plan 1 for some databases
- (c) For  $x = 5000$ , Plan 1 executes faster than plan 2 for all databases
- (d) For  $x = 9000$ , Plan 1 executes slower than plan 2 for all databases

101. Consider a selection of the form  $\sigma_{A \leq 100} (r)$ , where r is a relation with 1000 tuples. Assume that the attribute values for A among the tuples are uniformly distributed in the interval [0,500].

Which one of the following options is the best estimate of the number of tuples returned by the given selection query?

- (a) 50
- (b) 100
- (c) 150
- (d) 200

102. Information about a collection of students is given by the relation studInfo (studId, name, sex). The relation enroll (studId, CourseId) gives which student has enrolled for (or taken) what course(s). Assume that every course is taken by at least one male and at least one female student. What does the following relational algebra expression represent?

$$\Pi_{courseId} ((\Pi_{studId} (\sigma_{sex = \text{female}} (studInfo)) \times \Pi_{courseId} (enroll)) - enroll)$$

- (a) Courses in which all the female students are enrolled
- (b) Courses in which a proper subset of female students are enrolled
- (c) Courses in which only male students are enrolled
- (d) None of the above

103. Consider the relation employee (name, sex, supervisor Name) with name as the key. supervisor Name gives the name of the supervisor of the employee under consideration. What does the following Tuple Relational calculus query produce?

$$\{e.name \mid employee (e) \wedge (\forall x) [\neg employee (x) \vee x.supervisorName \neq e.name \vee x.sex = \text{male}]\}$$

- (a) Name of employee with a male supervisor  
 (b) Name of employee with no immediate male subordinates  
 (c) Name of employee with no immediate female subordinates  
 (d) Name of employee with a female supervisor
- 104.** Let R and S be two relations with the following schema  
 $R(P, Q, R_1, R_2, R_3)$   
 $S(P, Q, S_1, S_2)$   
 where  $\{P, Q\}$  is the key for both schemas. Which of the following queries are equivalent?  
 I.  $\Pi_P (R \bowtie S)$   
 II.  $\Pi_P (R) \bowtie \Pi_P (S)$   
 III.  $\Pi_P (\Pi_{P,Q} (R) \cap \Pi_{P,Q} (S))$   
 IV.  $\Pi_P (\Pi_{P,Q} (R) - \Pi_{P,Q} (S)) - \Pi_{P,Q} (S)$   
 (a) Only I and II (b) Only I and III  
 (c) Only I, II and III (d) Only I, III and IV
- 105.** Let R and S be relational schemes such that  $R = \{a, b, c\}$  and  $S = \{c\}$ . Now consider the following queries on the database :  
 I.  $\pi_{R-S}(r) - \pi_{R-S} (\pi_{R-S} (r) \times S - \pi_{R-S, S}(r))$   
 II.  $\{t \mid t \in \pi_{R-S} (r) \wedge \forall u \in S (\exists v \in r (u=v[s] \wedge t = v[R-S]))\}$   
 III.  $\{t \mid t \in \pi_{R-S} (r) \wedge \forall u \in r (\exists u \in S (u=v[s] \wedge t = v[R-S]))\}$   
 IV. Select R.a, R.b  
 from R, S  
 where R.c = S.c  
 Which of the above queries are equivalent?  
 (a) I and II (b) I and III  
 (c) II and IV (d) III and IV
- Common Data for Questions 106 and 107**  
 Consider the following relational schema:  
 Suppliers(sid: integer, sname: string, city: string, street: string)  
 Parts(pid:integer, pname:string, color:string)  
 Catalog(sid:integer, pid:integer, cost:real)
- 106.** Consider the following relational query on the above database:  
 SELECT S.sname  
 FROM Suppliers S  
 WHERE S.sid NOT IN (SELECT C.sid  
 FROM Catalog C  
 WHERE C.pid NOT IN (SELECT p.pid  
 FROM Parts P  
 WHERE P.color <> 'blue'))  
 Assume that relation corresponding to the above schema are not empty. Which one of the following is the correct interpretation of the above query?
- (a) Find the names of all suppliers who have supplied a non-blue part  
 (b) Find the names of all suppliers who have supplied a non-blue part  
 (c) Find the names of all suppliers who have supplied only blue part  
 (d) Find the names of all suppliers who have not supplied only blue parts
- 107.** Assume that, in the suppliers relations above, each supplier and each street within a city has a unique name and (sname, city) forms a candidate key. No other functional dependencies are implied other than those implied by primary and candidate keys. Which one of the following is TRUE about the above schema?  
 (a) The schema is in BCNF  
 (b) The schema is in 3NF but not in BCNF  
 (c) The schema is in 2NF but not in 3NF  
 (d) The schema is in not in 2NF
- 108.** Suppose  $R_1 (A, B)$  and  $R_2 (C, D)$  are two relation schemes. Let  $r_1$  and  $r_2$  be the corresponding relations instances. B is a foreign key that refers to C in R2. If data in  $r_1$  and  $r_2$  satisfy referential integrity constraints, which of the followings is always true  
 (a)  $\Pi_B(r_1) - \Pi_C(r_2) = E$   
 (b)  $\Pi_C(r_2) - \Pi_B(r_1) = E$   
 (c)  $\Pi_B(r_1) = \Pi_C(r_2)$   
 (d)  $\Pi_B(r_1) - \Pi_C(r_2) \neq E$
- 109.** Consider the following relational schema. Student (rollno: integer: sname string)  
 Courses (courseno: integer, cname: string)  
 Registration (rollno; integer, courseno; integer, percent: real)  
 Which of the following queries are equivalent to this query in English?  
 "Find the distinct names of all students who score more than 90% in the course numbered 107"  
 (I) SELECT DISTINCTS .sname  
 FROM Students as S, Registrations as R  
 WHERE R.rollno=S.Roll.no AND  
 R.courseno= 107 and R.percent>90  
 (II)  $P_{sname} (S_{courseno=107} \wedge P_{percent>90} (Registration \bowtie Student))$   
 (III)  $\{T \in SS \mid Students, SR \hat{=} Registration (S.Rollno=R.rollno \wedge R.courseno=107 \wedge R.percent>90 \wedge T.sname=S.sname)\}$   
 (IV)  $\{<S_N> \hat{=} \{S_R, S_P\} (<S_R, S_N> \hat{=} Student \wedge <S_R, 107, R_P> \hat{=} Registration \wedge R_P > 90)\}$   
 (a) I, II, III and IV  
 (b) I, II, and III only  
 (c) I, II, and IV only  
 (d) I, III, and IV only