

NOTE: These notes are considered as sample notes or questions, it may not be necessary to includes in any exam or quiz. But these help you how do you prepare course contents from a book. In this way, these notes help you for your preparation.

Introduction to Database Systems:

Three Level Schema Architecture

Draw a diagram with details of each level

Fig. is given in book or on slides

External Level: How user wants to see or use DB. Hide some of information using security and privileges. For example, using queries, interfaces and reports etc.

Conceptual Level: Structure of whole database includes Entities, data types, relationships, constraints and operations etc. For example, Implementation of data modelling.

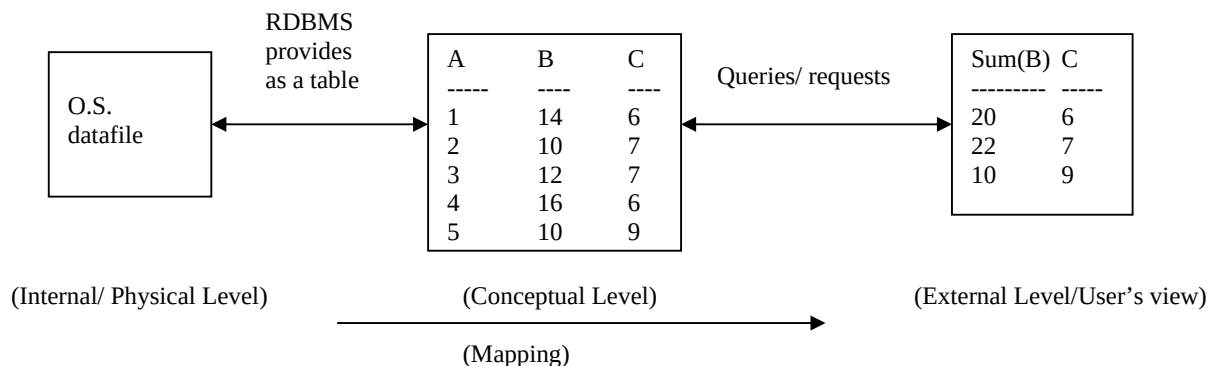
Internal and Physical Level: Physical Storage of the database and storage access path. For example, 200MB for buffer, 2GB for Data etc.

Note: The process of transforming requests and results between levels is called mapping.

Question: What do you mean by transforming results or mapping?

Solution: Internal schema contains an O.S. data files with certain size. In conceptual schema one or more tables including data are contained (or mapped) in data file(s). This means we can see or view the data in a transformed shape which is in the form of tables.

For example, a table contains following data as transformed form, then mapping can be presented as



Question: Where an actual data exists, internal/ physical level or at conceptual level?

Solution: Internal level

Question: If O.S. data file has size 20MB and if it is filled up and no more space exists then how to manage this problem.

Solution: Add another file of certain size, or make a file extendable.

Data Independence: The capacity to change the schema at one level of database system without having to change the schema at the next higher level.

(1) Logical Data Independence is the capacity to change the conceptual schema without having to change external schema or application programs.

Change: to expand database (Adding data)

To change constraints or restriction

To reduce database (removing data)

- (2) Physical Data Independence is the capacity to change the internal schema without having to change the conceptual schema. Hence, external schema needs not to be changed we well.
e.g., moving data from one data file to other, adding an additional files to increase space etc., performance

Question: Why do we need changes in physical level of RDBMS?

Solution: Performance issues, increase or decrease storage space.

Question: If we apply any change at conceptual level, do we need to do some changes all the time make better. **Yes** or No.

Question: Let's suppose we create 20 new tables with data at conceptual level.

- (1) Can all external users access them
Yes, if they have rights otherwise those new tables will be hidden
- (2) Do we need to do something at physical/ internal level. If data space problem found then expand datafile with more size otherwise, no need to do anything.

Question: What is Entity Integrity Constraints?

Referential Integrity Constraints (If two conditions of FK holds then referential Integrity Constraints holds)

Foreign Key

Semantic Integrity Constraints (Database procedure/ trigger)

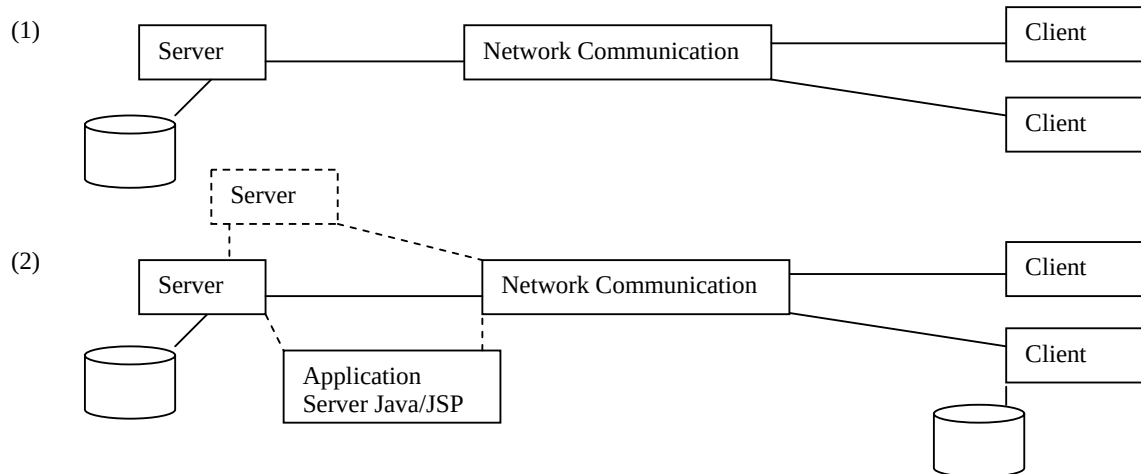
Question: How can you test PK, unique key, FK constraints and semantic integrity constraints?

Using Insert data, Update/ Modify data, Delete Data.

Question: Write down details about DBMS Interfaces.

1. Web Based Interfaces:
Includes menus, button, links etc., using internet/ web browsers. For ASP, JSP etc.
2. Form Based Interface:
Displays a form to each user, where it is installed Oracle Developer 9I, Visual Basic, Java etc.
3. Graphical User Interface(GUI):
Displaying in diagrammatically form, which click, choose, press operation can be performed.
4. Natural Language Interfaces:
Depends upon a specific language and has their own schema or dictionary. Developing new screens using some programming Developer 9I, Visual Basic etc.
5. Interfaces for Parametric Users
Such bank tellers, shops or restaurant counter's users. Have specific and limited set of operations. Using function keys or some other limited keys and their combinations. They are also using scanners to read barcode etc.
6. Interfaces for DBA:
Most database systems provides special interfaces for DBA users to manage easily every day tasks like create user, giving rights. Although, DBA are still user command line operations. Instead of using sophisticated screen/ interfaces.

Question: Give two examples of client-server based DBMS.



SQL Questions

Question: For the creation of a table in RDBMS, certain data type requires. Write down at least 8 of them.

Solution: CHAR, VARCHAR, NUMBER or INTEGER, NUMBER(x,y) or DECIMAL, DATE (includes data and times), LONG, CLOB, RAW, TimeStamp.

Question: How can you apply IF-THEN-ELSE logic in select SQL Command. Using DECODE, CASE and WHEN.

Question: What are the versions for SQL, SQL2 (SQL86), SQL3 (SQL92) normal query operation, SQL3 (SQL99)-Data warehouse and data mining OLAP.

Question: Difference between SQL and SQL2?

SQL: All tables and database objects are created or considered as a part of same schema.

SQL2: Group together tables and other constraints (DB Name, Schema name, with user authentication)

Question: Why Boolean is not used in SQL.

Solution:

Question: In SQL, what are the attribute constraints

Solution:

Relational Model Notes:

Domain: is a set of atomic values (indivisible values)

A domain name, data type and format is also specifying for each domain. Examples of domains are

1. Home_telno: set of 9 digit phone numbers
Data type: String or character
Format: (dd)ddd-dddd
e.g., (03)860-1141, stored as 038601141
2. Emp_age: Set of all employee's ages between 18 and 60 years
Data type: Number or Integer
Format: No particular format
e.g., 25, 36, 48 etc.
3. Family_name: Set of student's family or last names
Data type: String or character with max. length of 20 characters

Format: No particular format
e.g., Al-Muslem, Ahmed etc.

Question: What are the three basic requirements for a domain?

Solution: Domain name, Data type, Format

Definitions:

Relation: A *relation* is a subset of Cartesian product of all domains

$$R(r) \subseteq \text{Dom}(A1) \times \text{dom}(A2) \times \dots \times \text{Dom}(An)$$

Where $A1, A2, \dots, An$ represent attributes of a relation r .

Evaluation:

Given

$$A1 = \{1, 2\}, A2 = \{a\}, A3 = \{x, y\}$$

Then relation

$X = \{(1, a, y), (2, a, x), (2, a, y)\}$; 3 tuples of a relation
is a subset of

$$\begin{aligned} Y &= \text{Dom}(A1) \times \text{dom}(A2) \times \text{Dom}(A3) \\ &= \{(1, a, x), (1, a, y), (2, a, x), (2, a, y)\} \end{aligned}$$

Note: Degree of a relation is the number of attributes, in above case degree of relation is 3.

Alternative Definition of Relation

For each tuple t_i is a mapping from R to D

Where $D = \text{Dom}(A1) \cup \text{Dom}(A2) \cup \dots \cup \text{Dom}(An)$

And $t[A_i] \in \text{Dom}(A_i)$

Then a tuple can be considered as attribute and value.

For example: The following representation shows a tuple definition

$t = \langle (id, 21587), (Name, Muhammad), (Hphone, Null), Wphone, 866-1141 \rangle$

Question: How do you define a relation in terms of Cartesian product and in terms of tuple-mapping.

Question: Write down three relational model constraints.

Solution: Restrictions or constraints on the actual values in a database state.

1. Inherent model based constraints (No duplication of rows in a relation)
2. Schema-based constraints (defined in DDL, Domain constraints, Key constraints etc.)
3. Application based constraints (If current data is before June 2004 then value can be accepted in a relation. Client or database programs can be written for the category)

Question: Evaluate Cartesian product of the following:

$$A = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix} \quad B = \begin{matrix} a & b & c \\ x & y & z \end{matrix}$$

$$A \times B = \begin{matrix} 1 & 2 & 3 & a & b & c \\ 1 & 2 & 3 & x & y & z \\ 4 & 5 & 6 & a & b & c \\ 4 & 5 & 6 & x & y & z \\ 7 & 8 & 9 & a & b & c \\ 7 & 8 & 9 & x & y & z \end{matrix}$$

Question: Discuss the characteristics of relation that makes them different from ordinary tables or files.

Question: Define FK, identify foreign keys from the following schema. Underlined attributes represents primary keys. Do not assume data values other than the given data.

Student

<u>StuID</u>	Fname	Lname	Address	MajorDepartment
216891	ALI	AHMED	25 Main St.	10
214688	JAMAL	AL-MUSLEM	P.O. Box 254	30
216333	AZAM	JAN	223 PARK SQ	30

Department

<u>DeptNo</u>	Dname	Building
10	ICS	22
11	SE	22
12	COE	22
13	EE	19
40	D.COLLEGE	DAM

Semester

<u>SemID</u>	Session	B#	Description	Levels
030	2003-2004	21	Main Campus	9
031	2003-2004	22	Main Campus	5
41	2004-2005	19	Main Campus	3

CourseTaken

<u>StuID</u>	<u>CourseID</u>	SemCode	COURSE <u>CourseID</u>	Description
216891	ICS334	032	ICS334	DB Course in Univ.
214688	ICS334	032	ICS490	ADV. DB Course
216333	ICS490	041	ICS334	DB course in DAMMAM
			ICS125	Programming in C

Solution:

Exercise: Consider a relation

R: A	B	C
6	2	1
6	3	4
9	5	4

Evaluate

$$X = (\text{Dom}(A) \times \text{Dom}(B) \times \text{Dom}(C)) - R$$

Solution:	X:	A	B	C	
		---	---	---	
		6	3	1	
		6	5	1	
		9	2	1	
		9	3	1	
		9	5	1	
		6	2	4	
		6	5	4	
		9	2	4	
		9	3	4	(9 tuples)