
DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute Affiliated to VTU, Belagavi)

Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

RECORD BOOK

NAME OF STUDENT:

BRANCH: CSE (CYBER SECURITY)

USN:

SECTION:

SUBJECT: DATABASE MANAGEMENT SYSTEM

SUBJECT CODE: 22CY43

Course Objectives:

1. Understand fundamentals of database programming such as tables, constraints and queries.
2. Understand fundamentals of database programming using SQL, including Data definition languages, Data manipulation languages, Transaction control and data control.
3. A deep understanding of data retrieval language to solve complex queries.

Course Outcomes: At the end of the course, student will be able to:

CO1: Design and implement a database schema for a given problem statement.

CO2: Create the database using SQL commands and the database to meet the required query.

CO3: Develop and enforce integrity constraints on a designed database.

CO4: Design of ER diagram for database application.

CO5: Design the database to highest normalization system.

List of Programs

Sl. No	Name of the Experiments
1.	Department and Employee Database Management System
2.	Sailors Boats Database Management System
3.	Student Database Management System
4.	Banking Enterprise Database Management System
5.	Book Dealer database Management System
6.	Flight Database Management System
7.	Order Processing Database Management System

#No	DATABASE MANAGEMENT SYSTEM LAB PROGRAMS
1	<p>department & employee tables with the following information</p> <p>dept: (deptno, dname, dloc)</p> <p>emp: (empno, ename, job, hiredate, mgr, sal, comm, dno)</p> <p>write the following queries in sql</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples of values to each table display all the details of all managers list the empno, ename, sal, exp of all emps working for mgr 7839 list the 5 character names starting with 's' and ending with 'h' display the name of the employee who is drawing highest salary list the details of the emps whose salaries more than the employee blake display the employee's name department wise display the employee's name who are in research dept. <p>solution:</p> <p>create table dept(deptno number(2) primary key, dname varchar(12), dloc varchar(10));</p> <p>create table emp(empid number(4), ename varchar(12), job varchar(12), hiredate date, mgr number(4), salary number(5), comm number(5), dno number(2), foreign key(dno) references dept(deptno));</p> <p>insert into dept values(&deptno, '&dname', '&dloc');</p> <p>insert into emp values(&empno, '&ename', '&job', '&doj', &mgr, &salary, &comm, &dno);</p> <p>Display all the details of all managers</p> <p>select * from emp where job = 'manager';</p> <p>List the empno, ename, sal, exp of all emps working for mgr 7839.</p> <p>select empno, ename, sal, months_between(sysdate, hiredate)/12 exp from emp b where mgr = 7839 ;</p> <p>List the 5 character names starting with 's' and ending with 'h'</p> <p>select * from emp where ename like 's___h' ;</p> <p>Display the name of the employee who is drawing highest salary</p> <p>select ename from emp where salary = (select max(salary) from emp);</p> <p>List the details of the emps whose salaries more than the employee blake</p> <p>select a.* from emp a, emp b where a.sal > b.sal and b.ename = 'blake'</p> <p>or</p> <p>select * from emp where sal > (select sal from emp where ename = 'blake')</p>

	<p>List the names,job,sal , dname deptwise select e.ename, d.dname from emp e, dept d where e.deptno =d.deptno order by e.deptno;</p> <p>Display the employee's name who are in research dept. select e.ename, d.dname from emp e, dept d where e.deptno =d.deptno d.dname='research';</p>
2	<p style="text-align: center;">SAILORS DATABASE</p> <p>consider the following relations sailors(<u>sid</u>: number, sname: string, rating: number, age: real); boats(<u>bid</u>: number, bname: string, color: string); reserves(<u>sid</u>: number, <u>bid</u>: number, <u>day</u>: date).</p> <p>write the following queries in sql. no duplicates should be printed in any of the answers.</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples to each table. find all information of sailors who have reserved boat number 101 find the names of sailors who have reserved a red boat, and list in the order of age. find the names of sailors who have reserved at least one boat. find the ids and names of sailors who have reserved two different boats on the same day. <p>solution create table sailor(sid number(2) primary key, sname varchar(12), rating number(2), age number(2), check(rating between 1 and 10));</p> <p>create table boats(bid number(3) primary key, bname varchar(10), color varchar(10));</p> <p>create table res(sid number(2), bid number(3), day date, primary key(sid,bid), constraint fk1 foreign key(sid) references sailor(sid), constraint fk2 foreign key(bid) references boats(bid));</p> <p>insert into sailors values(&sid, '&sname',&rating, &age); insert into boats values(&bid, '&bname', '&color'); insert into res values(&sid, &bid, '&day');</p> <p>Find all information of sailors who have reserved boat number 101 select s.* from sailor s, res r where s.sid = r.sid and r.bid = 101;</p> <p>Find the names of sailors who have reserved a red boat, and list in the order of age. select s.sname, s.age from sailor s, res r, boats b where s.sid = r.sid and r.bid = b.bid and b.color = 'red' order by s.age;</p>

	<p>Find the names of sailors who have reserved at least one boat select sname from sailor s, res r where s.sid = r.sid;</p> <p>Find the ids and names of sailors who have reserved two different boats on the same day select distinct s.sid, s.sname from sailor s, res r1, res r2 where s.sid = r1.sid and s.sid = r2.sid and r1.day = r2.day and r1.bid <> r2.bid;</p>
3	<p style="text-align: center;">STUDENT DATABASE</p> <p>consider the following relations: student (snum: number, sname: string, major: string, level: string, age: number) class (name: string, meets at: string, room: string, fid: number) enrolled (snum: number, cname: string) faculty (fid: number, fname: string)</p> <p>The meaning of these relations is straightforward; for example, enrolled has one record per student-class pair such that the student is enrolled in the class. level is a two character code with 4 different values (example: junior: jr etc) design an er model and schema diagram for the relations.</p> <p>write the following queries in sql. no duplicates should be printed in any of the answers.</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples of values to each table. find the names of all juniors (level = jr) who are enrolled in a class taught by prof. ramesh. find the names of all classes that either meet in room r128 or have five or more students enrolled. find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five. <p>solution:</p> <p>create table student (snum number(4) primary key, sname varchar(20), major varchar(20), level1 varchar(2), age number(3));</p> <p>create table faculty (fid number(4) primary key, fname varchar(20));</p> <p>create table class (name varchar(20) primary key, meetsat varchar(10), room varchar(10), fid number(4), foreign key (fid) references faculty(fid));</p> <p>create table enrolled (snum number(4), cname varchar(20), primary key(snum,cname), foreign key (snum) references student(snum), foreign key (cname) references class(name));</p>

	<p>sql> insert into student values (&snum, '&sname', '&major', '&level1', &age); sql> insert into faculty values (&fid, '&fname'); sql> insert into class values ('&name', '&meetsat', '&room', &fid); sql> insert into enrolled values (&snum, '&cname');</p> <p>Find the names of all juniors (level = jr) who are enrolled in a class taught by prof. ramesh</p> <p>select distinct s.sname from student s, class c, enrolled e, faculty f where s.snum = e.snum and e.cname = c.name and c.d = f.fid and f.fname = 'prof. ramesh' and s.level = 'jr';</p> <p>Find the names of all classes that either meet in room r128 or have five or more students enrolled.</p> <p>select c.name from class c where c.room = 'r128' union c.name in (select e.cname from enrolled e group by e.cname having count (*) >= 5);</p> <p>Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.</p> <p>select distinct f.fname from faculty f where 5 > (select count (e.snum) from class c, enrolled e where c.cname = e.cname and c.fid = f.fid);</p>
4	<p style="text-align: center;">BANK DATABASE</p> <p>Consider the following database for a banking enterprise.</p> <p>branch (<u>branch-name</u>: string, branch-city: string, assets: real) accounts (<u>accno</u>: number(10), branch-name: string, balance: real) depositor (<u>customer-name</u>: string, <u>accno</u>: number(10)) customer (<u>customer-name</u>: string, customer-street: string, customer-city: string) loan (<u>loan-number</u>: number(10) , branch-name: string, amount: real) borrower (<u>customer-name</u>: string, <u>loan-number</u>: number(10))</p> <p>Write the following queries in sql</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples of values to each table. find all the customers who have at least two accounts at the <i>main</i> branch. find all the customers who have an account at <i>all</i> the branches located in a specific city. demonstrate how you delete all account tuples at every branch located in a specific city. <p>Solution:</p> <p>create table branch(branch_name varchar(20) primary key, branch_city varchar(10),</p>

	<p>assets real);</p> <p>create table account (accno number(6) primary key, branch_name varchar(20), balance real, foreign key(branch_name) references branch(branch_name));</p> <p>create table customer (customer_name varchar(20) primary key, customer_street varchar(20), cust_city varchar(20));</p> <p>create table depositor (customer_name varchar(20), accno number(6), primary key(customer_name, accno), foreign key(customer_name) references customer(customer_name), foreign key(accno) references account(accno)) on delete cascade;</p> <p>create table loan (loan_no number(5) primary key, branch_name varchar(20), amount real, foreign key(branch_name) references branch(branch_name));</p> <p>create table borrower (customer_name varchar(20), loan_no number(5), foreign key(customer_name) references customer(customer_name), foreign key(loan_no) references loan(loan_no));</p> <p>Insert five tuples of values to each table.</p> <p>insert into branch values('&branch-name','&branch-city',&assets);</p> <p>insert into accounts values(&accno,'&branch-name',&balance);</p> <p>insert into customer values ('&customer-name', '&customer-street', '&customer-city');</p> <p>insert into depositor values('&customer-name',&accno);</p> <p>insert into loan values(&loan-number,'&branch-name', &amount);</p> <p>insert into borrower values('&customer-name',&loan-number);</p> <p>Find all the customers who have at least two accounts at the <i>main</i> branch.</p> <p>select customer_name from depositor where accno in(select accno from depositor where accno in(select accno from account where branch_name in(select branch_name from account where branch_name='main sbi ' group by branch_name having count(*) > 1)))group by customer_name having count(*) > 1</p> <p>Find all the customers who have an account at <i>all</i> the branches located in a specific city.</p> <p>select customer_name from branch b,account a,depositor d where b.branch_name=a.branch_name and a.accno=d.accno and b.branch_city='mangalore' group by customer_name having count(distinct b.branch_name)=(select count(branch_name) from branch where branch_city='&city_name');</p> <p>Demonstrate how you delete all account tuples at every branch located in a specific city.</p>
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	delete from account where branch_name in (select branch_name from branch where branch_city='&city');
5	<p style="text-align: center;">BOOK DEALER DATABASE</p> <p>The following tables are maintained by a book dealer: author(author-id: int, name: string, city: string, country: string) publisher(publisher-id: int, name: string, city: string, country: string) catalog(book-id: int, title: string, author-id: int, publisher-id: int, category-id: int, year: int, price: int) category(category-id: int, description: string) order-details(order-no: int, book-id: int, quantity: int)</p> <p>design an er model and schema diagram for relations.</p> <p>write each of the following queries in sql.</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples of values to each table. give the details of the authors who have 2 or more books in the catalog and the price of the books in the catalog and the year of publication is after 2000 find the author of the book which has maximum sales. demonstrate how you increase the price of books published by a specific publisher by 10%. <p>solution:</p> <pre>create table author (authorid number(4) primary key, name varchar(15), city varchar(15), country varchar(5));</pre> <pre>create table publisher (publisherid number(4) primary key, pname varchar(15), pcity varchar(15), pcountry varchar(5));</pre> <pre>create table category (categoryid number(4) primary key, description varchar(15));</pre> <pre>create table catalog (bookid number(4) primary key, title varchar(15), authorid number(4), publisherid number(4),categoryid number(4), year number(4), price number(5), foreign key(authorid) references author(authorid), foreign key(publisherid) references publisher(publisherid), foreign key(categoryid) references category(categoryid));</pre> <pre>create table order_details (orderno number(5), bookid number(4), quantity number(3), primary key(orderno,bookid), foreign key(bookid) references catalog(bookid));</pre> <p>Insert five tuples of values to each table.</p> <pre>sql> insert into author values(&author-id,'&name','&city','&country')</pre>

	<p>sql> insert into publisher values(&publisher-id,'&name','&city','&country');</p> <p>sql> insert into category values(&category-id,'&description');</p> <p>sql> insert into catalog values(&book-id,'&title',&author-id,&publisher-id,&category-id,&year,&price)</p> <p>sql> insert into order_details values(&order-no,&book-id,&quantity);</p> <p>Give the details of the authors who have 2 or more books in the catalog and the price of the books in the catalog above avg and the year of publication is after 2000.</p> <p>select * from author where aid in (select aid from catalog group by aid having count(*) >=2 and aid in(select aid from catalog where price >(select avg(price) from catalog)) and year>=2000;</p> <p>Find the author of the book which has maximum sales.</p> <p>select a.name from author a, order_details o,catalog c where a.authorid=c.authorid and c.bookid=o.bookid and o.bookid =(select r1.bookid from orderdetails r1 group by r1.bookid having sum(quantity) = (select max(sum(quantity)) from orderdetails r2 groupby r2.bookid));</p> <p>Demonstrate how you increase the price of books published by a specific publisher by 10%.</p> <p>select bookid, title, price, price*1.1 from catalog;</p>
6.	<p style="text-align: center;">FLIGHT DATABASE</p> <p>The following relations keep track of airline flight information: flights(<u>no</u>: number, from1: string, to1: string, distance: number, departs: time, arrives: time, price: real) aircraft (<u>aid</u>: number, aname: string, cruisingrange: number) certified(<u>eid</u>: number, <u>aid</u>: number) employees (<u>eid</u>: number, ename: string, salary: number)</p> <p>note that the employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.</p> <p>design an er model and schema diagram for the relations.</p> <p>Write each of the following queries in sql.</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys. insert five tuples of values to each table. find the names of aircraft such that all pilots certified to operate them have salaries

	<p>more than rs.80, 000.</p> <p>d) for each pilot who is certified for more than three aircrafts, find the <i>eid</i> and the maximum <i>cruisingrange</i> of the aircraft for which she or he is certified.</p> <p>e) find the names of pilots whose <i>salary</i> is less than the price of the cheapest route from bengaluru to frankfurt.</p> <p>f) create the above tables for the schemas provided with primary keys and foreign keys.</p> <p>solution</p> <p>create table flight (fno number(10) primary key, from1 varchar(20), to1 varchar(20), distance number, departs date, arrives date, price real);</p> <p>create table aircraft (aid number(5) primary key, aname varchar2(15), cruisingrange number(4));</p> <p>create table employees(eid number(5) primary key, ename varchar2(15), salary real);</p> <p>create table certified (eid number(5), aid number(5), primary key(eid,aid), foreign key (eid) references employees(eid), foreign key (aid) references aircraft(aid));</p> <p>Insert five tuples of values to each table.</p> <p>sql> insert into flights values (&no, '&from1', '&to1', &distance, '&departs', '&arrives', &price);</p> <p>sql> insert into aircraft values (&aid, '&aname', &cruisingrange);</p> <p>sql> insert into employees values (&eid, '&ename', &salary);</p> <p>sql> insert into certified values (&eid, &aid);</p> <p>Find the names of aircraft such that all pilots certified to operate them have salaries more than rs.80, 000.</p> <p>select distinct a.aname from aircraft a where a.aid not in(select c.aid from certified c, employees e where c.eid=e.eid and e.salary<80000);</p> <p>For each pilot who is certified for more than three aircrafts, find the <i>eid</i> and the maximum <i>cruisingrange</i> of the aircraft for which she or he is certified.</p> <p>select c.eid, max(a.cruisingrange) from certified c, aircraft a where c.aid =a.aid group by c.eid having count(c.aid)>3;</p> <p>Find the names of pilots whose <i>salary</i> is less than the price of the cheapest route from bengaluru to frankfurt.</p>
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	select ename from employees where salary < (select min(price) from flight where from1='bangalore' and to1='frankfurt');
7	<p style="text-align: center;">ORDER PROCESSING DATABASE</p> <p>Consider the following relations for an order processing database application in a company.</p> <p>customer (cust #: int, cname: string, city: string) order (order #: int, odate: date, cust #: int, ord-amt: int) item (item #: int, unit-price: int) order-item (order #: int, item #: int, qty: int) warehouse (warehouse #: int, city: string) shipment (order #: int, warehouse #: int, ship-date: date)</p> <p>Design an ER model and schema diagram for the relations</p> <p>write each of the following queries in sql.</p> <ol style="list-style-type: none"> create the tables for the schemas provided with primary keys and foreign keys insert five tuples of values to each table. produce a listing: custname, #oforders, avg_order_amt, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer. list the order# for orders that were shipped from all warehouses that the company has in a specific city. demonstrate how you delete item# 10 from the item table and make that field <i>null</i> in the order_item table. <p>create the above tables for the schemas provided with primary keys and foreign keys.</p> <p>create table customer (cid number(4) primary key, cname varchar2(10), city varchar2(10));</p> <p>create table order(ono number(4) primary key , odate date, cid number(4), ord_amt number(4), primary key (ono), foreign key (cid) references customer (cid));</p> <p>create table item(ino number(4) primary key , unit_price number(4));</p> <p>create table order_item (ono number(4), ino number(4), qty number(4), primary key (ono,ino), foreign key (ono) references order(ono), foreign key (ino) references item (ino) on delete cascade);</p> <p>create table warehouse (wareno number(4) primary key, city varchar2(10));</p> <p>create table shipment (ono number(4), wareno number(4) , shipdate date, primary key (ono,wareno), foreign key (ono) references order(ono), foreign key (wareno) references warehouse wareno));</p>

Insert five tuples of values to each table.

```
sql> insert into customer values(&cid,&cname,&city');
sql> insert into order values (&ono,&odate,&cid,&ord_amt);
sql> insert into item values(&ino,&price);
sql> insert into order_item values(&ono,&ino,&qty);
sql> insert into warehouse values(&wareno,&city');
sql> insert into shipment values(&ono,&wareno,&shipdate');
```

Produce a listing: custname, #oforders, avg_order_amt, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer.

```
select c.cid, c.cname, count(*) as no_of_orders, avg(oi.qty*i.price)
from customer c, order ot, item i, order_item oi
where c.cid=ot.cid and ot.ono=oi.ono and oi.ino=i.ino
group by (c.cid, c.cname);
```

List the order# for orders that were shipped from all warehouses that the company has in a specific city.

```
select s.ono from shipment s, warehouse w where s.wareno=w.wareno and
city='&city';
```

Demonstrate how you delete item# 10 from the item table and make that field *null* in the order_item table.

```
delete from item where ino=10;

update order_item set in0=null where ino=10;
```

VIVA QUESTIONS

1. Characteristic of a database management system

- It represents complex relation relationship between data.
- Keep a tight control of data redundancy
- Ensures that data can be shared across the applications
- Enforces data access authorization
- Has automatic, intelligent back up and recovery procedure for data.

2. Characteristic of a Relational DBMS models

- The relationship data management model eliminate all parent –child relationships and instead represented al, data in the database as sample row/column tables of data values.
- Each table is a n independent entity and there is no physical relationship between tables.
- Most of the DBMS models based on the relational models.
- Relational model of data management is based on set theory. Built in query language is designed in the RDBMS, so that it can manipulates sets of data.
- The user interface used with relational models is non-procedural because only what needs to be done is specified and not how it has to be done. Using any of the other methods, you have not only to specify what needs to be done but how it has to be done as well.

3. Roles of DBA

- Updating the database.
- Retrieving information from the database.
- Accepting the query language statements
- Enforcing security specifications.
- Enforcing data integrity specifications.
- Enforcing transaction consistency.
- Managing data sharing.
- Optimizing queries.
- Managing system catalogs.
- All the permissions are granted by the DBA only

4.What is database?

A database is a logically coherent collection of data with some inherent meaning, representing some aspect of real world and which is designed, built and populated with data for a specific purpose.

5.What is DBMS?

It is a collection of programs that enables user to create and maintain a database. In other words it is general-purpose software that provides the users with the processes of *defining*, *constructing* and *manipulating* the database for various applications.

6. What is a Database system?

The database and DBMS software together is called as Database system.

7. Advantages of DBMS?

- Redundancy is controlled.
- Unauthorized access is restricted.
- Providing multiple user interfaces.
- Enforcing integrity constraints.
- Providing backup and recovery.

8. Disadvantage in File Processing System?

- Data redundancy & inconsistency.
- Difficult in accessing data.
- Data isolation.
- Data integrity.
- Concurrent access is not possible.
- Security Problems.

9. Describe the three levels of data abstraction?

The are three levels of abstraction:

- *Physical level*: The lowest level of abstraction describes how data are stored.
- *Logical level*: The next higher level of abstraction, describes what data are stored in database and what relationship among those data.
- *View level*: The highest level of abstraction describes only part of entire database.

10. Define the "integrity rules"

There are two Integrity rules.

- *Entity Integrity*: States that "Primary key cannot have NULL value"
- *Referential Integrity*: States that "Foreign Key can be either a NULL value or should be Primary Key value of other relation."

11. What is extension and intension?

Extension - It is the number of tuples present in a table at any instance. This is time dependent.

Intension - It is a constant value that gives the name, structure of table and the constraints laid on it.

12. What is System R? What are its two major subsystems?

System R was designed and developed over a period of 1974-79 at IBM San Jose Research Center. It is a prototype and its purpose was to demonstrate that it is possible to build a Relational System that can be used in a real life environment to solve real life problems, with performance at least comparable to that of existing system.

Its two subsystems are

- Research Storage
- System Relational Data System.

13. How is the data structure of System R different from the relational structure?

Unlike Relational systems in System R

- Domains are not supported
- Enforcement of candidate key uniqueness is optional
- Enforcement of entity integrity is optional
- Referential integrity is not enforced

14. What is Data Independence?

Data independence means that “the application is independent of the storage structure and access strategy of data”. In other words, The ability to modify the schema definition in one level should not affect the schema definition in the next higher level.

Two types of Data Independence:

- Physical Data Independence: Modification in physical level should not affect the logical level.
- Logical Data Independence: Modification in logical level should affect the view level.

NOTE: Logical Data Independence is more difficult to achieve

15. What is a view? How it is related to data independence?

A view may be thought of as a virtual table, that is, a table that does not really exist in its own right but is instead derived from one or more underlying base table. In other words, there is no stored file that directly represents the view instead a definition of view is stored in data dictionary.

Growth and restructuring of base tables is not reflected in views. Thus the view can insulate users from the effects of restructuring and growth in the database. Hence accounts for logical data independence.

16. What is Data Model?

A collection of conceptual tools for describing data, data relationships data semantics and constraints.

17. What is E-R model?

This data model is based on real world that consists of basic objects called entities and of relationship among these objects. Entities are described in a database by a set of attributes.

18. What is Object Oriented model?

This model is based on collection of objects. An object contains values stored in instance variables within the object. An object also contains bodies of code that operate on the object. These bodies of code are called methods. Objects that contain same types of values and the same methods are grouped together into classes.

19. What is an Entity?

It is a 'thing' in the real world with an independent existence.

20. What is an Entity type?

It is a collection (set) of entities that have same attributes.

21. What is an Entity set?

It is a collection of all entities of particular entity type in the database.

22. What is an Extension of entity type?

The collections of entities of a particular entity type are grouped together into an entity set.

23. What is Weak Entity set?

An entity set may not have sufficient attributes to form a primary key, and its primary key compromises of its partial key and primary key of its parent entity, then it is said to be Weak Entity set.

24. What is an attribute?

It is a particular property, which describes the entity.

25. What is a Relation Schema and a Relation?

A relation Schema denoted by $R(A_1, A_2, \dots, A_n)$ is made up of the relation name R and the list of attributes A_i that it contains. A relation is defined as a set of tuples. Let r be the relation which contains set tuples $(t_1, t_2, t_3, \dots, t_n)$. Each tuple is an ordered list of n -values $t=(v_1, v_2, \dots, v_n)$.

26. What is degree of a Relation?

It is the number of attribute of its relation schema.

27. What is Relationship?

It is an association among two or more entities.

28. What is Relationship set?

The collection (or set) of similar relationships.

29. What is Relationship type?

Relationship type defines a set of associations or a relationship set among a given set of entity types.

30. What is degree of Relationship type?

It is the number of entity type participating.

31. What is DDL (Data Definition Language)?

A data base schema is specifies by a set of definitions expressed by a special language called DDL.

32. What is VDL (View Definition Language)?

It specifies user views and their mappings to the conceptual schema.

33. What is SDL (Storage Definition Language)?

This language is to specify the internal schema. This language may specify the mapping between two schemas.

34. What is Data Storage - Definition Language?

The storage structures and access methods used by database system are specified by a set of definition in a special type of DDL called data storage-definition language.

35. What is DML (Data Manipulation Language)?

This language that enable user to access or manipulate data as organised by appropriate data model.

- *Procedural DML or Low level:* DML requires a user to specify what data are needed and how to get those data.
- *Non-Procedural DML or High level:* DML requires a user to specify what data are needed without specifying how to get those data.

36. What is DML Compiler?

It translates DML statements in a query language into low-level instruction that the query evaluation engine can understand.

37. What is Query evaluation engine?

It executes low-level instruction generated by compiler.

38. What is DDL Interpreter?

It interprets DDL statements and record them in tables containing metadata.

39. What is Record-at-a-time?

The Low level or Procedural DML can specify and retrieve each record from a set of records. This retrieve of a record is said to be Record-at-a-time.

40. What is Set-at-a-time or Set-oriented?

The High level or Non-procedural DML can specify and retrieve many records in a single DML statement. This retrieve of a record is said to be Set-at-a-time or Set-oriented.

41. What is Relational Algebra?

It is procedural query language. It consists of a set of operations that take one or two relations as input and produce a new relation.

42. What is Relational Calculus?

It is an applied predicate calculus specifically tailored for relational databases proposed by E.F. Codd. E.g. of languages based on it are DSL ALPHA, QUEL.

43. How does Tuple-oriented relational calculus differ from domain-oriented relational calculus

The tuple-oriented calculus uses a tuple variables i.e., variable whose only permitted values are tuples of that relation. E.g. QUEL

The domain-oriented calculus has domain variables i.e., variables that range over the underlying domains instead of over relation. E.g. ILL, DEDUCE.

44. What is normalization?

It is a process of analysing the given relation schemas based on their Functional Dependencies (FDs) and primary key to achieve the properties

- Minimizing redundancy
- Minimizing insertion, deletion and update anomalies.

45. What is Functional Dependency?

A Functional dependency is denoted by $X \rightarrow Y$ between two sets of attributes X and Y that are subsets of R specifies a constraint on the possible tuple that can form a relation state r of R. The constraint is for any two tuples t1 and t2 in r if $t1[X] = t2[X]$ then they have $t1[Y] = t2[Y]$. This means the value of X component of a tuple uniquely determines the value of component Y.

46. What is Lossless join property?

It guarantees that the spurious tuple generation does not occur with respect to relation schemas after decomposition.

47. What is 1 NF (Normal Form)?

The domain of attribute must include only atomic (simple, indivisible) values.

48. What is 2NF?

A relation schema R is in 2NF if it is in 1NF and every non-prime attribute A in R is fully functionally dependent on primary key.

49. What is 3NF?

A relation schema R is in 3NF if it is in 2NF and for every FD $X \rightarrow A$ either of the following is true

- X is a Super-key of R.
- A is a prime attribute of R.

In other words, if every non prime attribute is non-transitively dependent on primary key.

50. What is BCNF (Boyce-Codd Normal Form)?

A relation schema R is in BCNF if it is in 3NF and satisfies an additional constraint that for every FD $X \rightarrow A$, X must be a candidate key.

51. What is 4NF?

A relation schema R is said to be in 4NF if for every Multivalued dependency $X \twoheadrightarrow Y$ that holds over R, one of following is true

- X is subset or equal to (or) $XY = R$.
- X is a super key.

52. What is 5NF?

A Relation schema R is said to be 5NF if for every join dependency $\{R_1, R_2, \dots, R_n\}$ that holds R, one the following is true

- $R_i = R$ for some i.

➤ The join dependency is implied by the set of FD, over R in which the left side is key of R.

53. What is Domain-Key Normal Form?

A relation is said to be in DKNF if all constraints and dependencies that should hold on the the constraint can be enforced by simply enforcing the domain constraint and key constraint on the relation.

54. What are partial, alternate, artificial, compound and natural key?

Partial Key:

It is a set of attributes that can uniquely identify weak entities and that are related to same owner entity. It is sometime called as Discriminator.

Alternate Key:

All Candidate Keys excluding the Primary Key are known as Alternate Keys.

Artificial Key:

If no obvious key, either stand alone or compound is available, then the last resort is to simply create a key, by assigning a unique number to each record or occurrence. Then this is known as developing an artificial key.

Compound Key:

If no single data element uniquely identifies occurrences within a construct, then combining multiple elements to create a unique identifier for the construct is known as creating a compound key.

Natural Key:

When one of the data elements stored within a construct is utilized as the primary key, then it is called the natural key.

55. What is system catalog or catalog relation? How is better known as?

A RDBMS maintains a description of all the data that it contains, information about every relation and index that it contains. This information is stored in a collection of relations maintained by the system called metadata. It is also called data dictionary.

56. What is meant by query optimization?

The phase that identifies an efficient execution plan for evaluating a query that has the least estimated cost is referred to as query optimization.

57. What is durability in DBMS?

Once the DBMS informs the user that a transaction has successfully completed, its effects should persist even if the system crashes before all its changes are reflected on disk. This property is called durability.

58. What is a checkpoint and When does it occur?

A Checkpoint is like a snapshot of the DBMS state. By taking checkpoints, the DBMS can reduce the amount of work to be done during restart in the event of subsequent crashes.

59. What do you mean by flat file database?

It is a database in which there are no programs or user access languages. It has no cross-file capabilities but is user-friendly and provides user-interface management.

60. What is "transparent DBMS"?

It is one, which keeps its Physical Structure hidden from user.

61. Brief theory of Network, Hierarchical schemas and their properties

Network schema uses a graph data structure to organize records example for such a database management system is CTCG while a hierarchical schema uses a tree data structure example for such a system is IMS.

62. What is a query?

A query with respect to DBMS relates to user commands that are used to interact with a data base. The query language can be classified into data definition language and data manipulation language.

63. What is RDBMS KERNEL?

Two important pieces of RDBMS architecture are the kernel, which is the software, and the data dictionary, which consists of the system-level data structures used by the kernel to manage the database

You might think of an RDBMS as an operating system (or set of subsystems), designed specifically for controlling data access; its primary functions are storing, retrieving, and securing data. An RDBMS maintains its own list of authorized users and their associated privileges; manages memory caches and paging; controls locking for concurrent resource usage; dispatches and schedules user requests; and manages space usage within its table-space structures

64. Name the sub-systems of a RDBMS

I/O, Security, Language Processing, Process Control, Storage Management, Logging and Recovery, Distribution Control, Transaction Control, Memory Management, Lock Management

65. Not only RDBMS takes care of locating data it also _____
determines an optimal access path to store or retrieve the data

66. How do you communicate with an RDBMS?

You communicate with an RDBMS using Structured Query Language (SQL)

67. Define SQL and state the differences between SQL and other conventional programming Languages

SQL is a nonprocedural language that is designed specifically for data access operations on normalized relational database structures. The primary difference between SQL and other conventional programming languages is that SQL statements specify what data operations should be performed rather than how to perform them.

68. Name the three major set of files on disk that compose a database in Oracle

There are three major sets of files on disk that compose a database. All the files are binary. These are

- Database files
- Control files

➤ Redo logs

The most important of these are the database files where the actual data resides. The control files and the redo logs support the functioning of the architecture itself.

All three sets of files must be present, open, and available to Oracle for any data on the database to be useable. Without these files, you cannot access the database, and the database administrator might have to recover some or all of the database using a backup, if there is one.

69. Tables derived from the ERD

- a) Are totally unnormalised
- b) Are always in 1NF
- c) Can be further denormalised
- d) May have multi-valued attributes

(b) Are always in 1NF

70. In mapping of ERD to DFD

- a) entities in ERD should correspond to an existing entity/store in DFD
- b) entity in DFD is converted to attributes of an entity in ERD
- c) relations in ERD has 1 to 1 correspondence to processes in DFD
- d) relationships in ERD has 1 to 1 correspondence to flows in DFD
- e) entities in ERD should correspond to an existing entity/store in DFD

SQL

1. Which is the subset of SQL commands used to manipulate Oracle Database structures, including tables?
Data Definition Language (DDL)
2. What operator performs pattern matching?
LIKE operator
3. What operator tests column for the absence of data?
IS NULL operator
4. Which command executes the contents of a specified file?
START <filename> or @<filename>
5. What is the parameter substitution symbol used with INSERT INTO command?
&
6. Which command displays the SQL command in the SQL buffer, and then executes it?
RUN
7. What are the wildcards used for pattern matching?
_ for single character substitution and % for multi-character substitution

8. State true or false. EXISTS, SOME, ANY are operators in SQL.

True

9. State true or false. !=, <>, ^= all denote the same operation.

True

10. What are the privileges that can be granted on a table by a user to others?

Insert, update, delete, select, references, index, execute, alter, all

11. What command is used to get back the privileges offered by the GRANT command?

REVOKE

12. Which system tables contain information on privileges granted and privileges obtained?

USER_TAB_PRIVS_MADE, USER_TAB_PRIVS_RECD

13. Which system table contains information on constraints on all the tables created?

USER_CONSTRAINTS

14. TRUNCATE TABLE EMP;

DELETE FROM EMP;

Will the outputs of the above two commands differ?

Both will result in deleting all the rows in the table EMP.

15. What is the difference between TRUNCATE and DELETE commands?

TRUNCATE is a DDL command whereas DELETE is a DML command. Hence DELETE operation can be rolled back, but TRUNCATE operation cannot be rolled back. WHERE clause can be used with DELETE and not with TRUNCATE.

16. What command is used to create a table by copying the structure of another table?

CREATE TABLE .. AS SELECT command

Explanation :

To copy only the structure, the WHERE clause of the SELECT command should contain a FALSE statement as in the following.

```
CREATE TABLE NEWTABLE AS SELECT * FROM EXISTINGTABLE WHERE 1=2;
```

If the WHERE condition is true, then all the rows or rows satisfying the condition will be copied to the new table.

17. What will be the output of the following query?

```
SELECT REPLACE(TRANSLATE(LTRIM(RTRIM('!! A THEN !!,!'), '!'), 'AN', '**'), '*', 'TROUBLE') FROM DUAL;
TROUBLETHETROUBLE
```

18. What will be the output of the following query?

```
SELECT DECODE(TRANSLATE('A','1234567890','1111111111'), '1','YES', 'NO');
NO
```

Explanation :

The query checks whether a given string is a numerical digit.

19. What does the following query do?

```
SELECT SAL + NVL(COMM,0) FROM EMP;
```

This displays the total salary of all employees. The null values in the commission column will be replaced by 0 and added to salary.

20. Which date function is used to find the difference between two dates?

```
MONTHS_BETWEEN
```

21. Why does the following command give a compilation error?

```
DROP TABLE &TABLE_NAME;
```

Variable names should start with an alphabet. Here the table name starts with an '&' symbol.

22. What is the advantage of specifying WITH GRANT OPTION in the GRANT command?

The privilege receiver can further grant the privileges he/she has obtained from the owner to any other user.

23. What is the use of the DROP option in the ALTER TABLE command?

It is used to drop constraints specified on the table.

24. What is the value of 'comm' and 'sal' after executing the following query if the initial value of 'sal' is 10000?

```
UPDATE EMP SET SAL = SAL + 1000, COMM = SAL*0.1;  
sal = 11000, comm = 1000
```

25. What is the use of DESC in SQL?

DESC has two purposes. It is used to describe a schema as well as to retrieve rows from table in descending order.

Explanation :

The query `SELECT * FROM EMP ORDER BY ENAME DESC` will display the output sorted on ENAME in descending order.

26. What is the use of CASCADE CONSTRAINTS?

When this clause is used with the DROP command, a parent table can be dropped even when a child table exists.

27. Which function is used to find the largest number less than or equal to a specific value?

```
FLOOR
```

28. What is the output of the following query?

```
SELECT TRUNC(1234.5678,-2) FROM DUAL;  
1200
```

Text Book:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.