SOFTENG 351: Test

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1

a)

Programs refer to data model constructs rather than data storage details.

Allowing a set of concurrent users to retrieve from and to update the database.

Recovery subsystem ensures each completed transaction has its effect permanently recorded in the database.

Controlling redundancy in data storage and in development and maintenance efforts.

Restricting unauthorized access to data. Only the DBA staff uses privileged commands and facilities.

Providing storage structures for efficient query processing.

Representing complex relationships among data.

b)

"Actors on the Scene" - Those who actually use and control the database content, and those who design, develop and maintain database applications.

Examples of this type are: database administrators, database designers, end-users, system analysts, application programmers and Business Analysts.

"Workers Behind the Scene" - Those who design and develop the DBMS software and related tools, and the computer systems operators

Examples of this type are: DBMS system designers and implementors, database tool developers, operators and maintenance personnel.

c)

The three-tier client/server architecture divides the system into three layers: client/presentation layer, application/web server, and the database server.

The client layer is responsible for accepting requests from the user and sending requests to the web server.

The web server integrates business logic to decide which data is required to fulfill the user request, and may reorganise such data. It connects to both the client and the database server. It may request data from the database server or from another system.

The database server manages data from different sources, which could be a relational database, a file database, or a cloud database. It manages such data and hides the details of the data storage from the web and client layers.

This architecture enhances security as neither the web or client layers know the details of how the data is stored. The web server can also perform additional permissions checking and other security features. The client only has access to the api of the web server, so they do not know how the web server handles their requests either.

2

a)

Assumptions:

- A member can put any amount of items for sale.
- An item has only one seller.
- An item does not need to be sold.
- A member can buy any amount of items.
- A member can bid on an item multiple times.

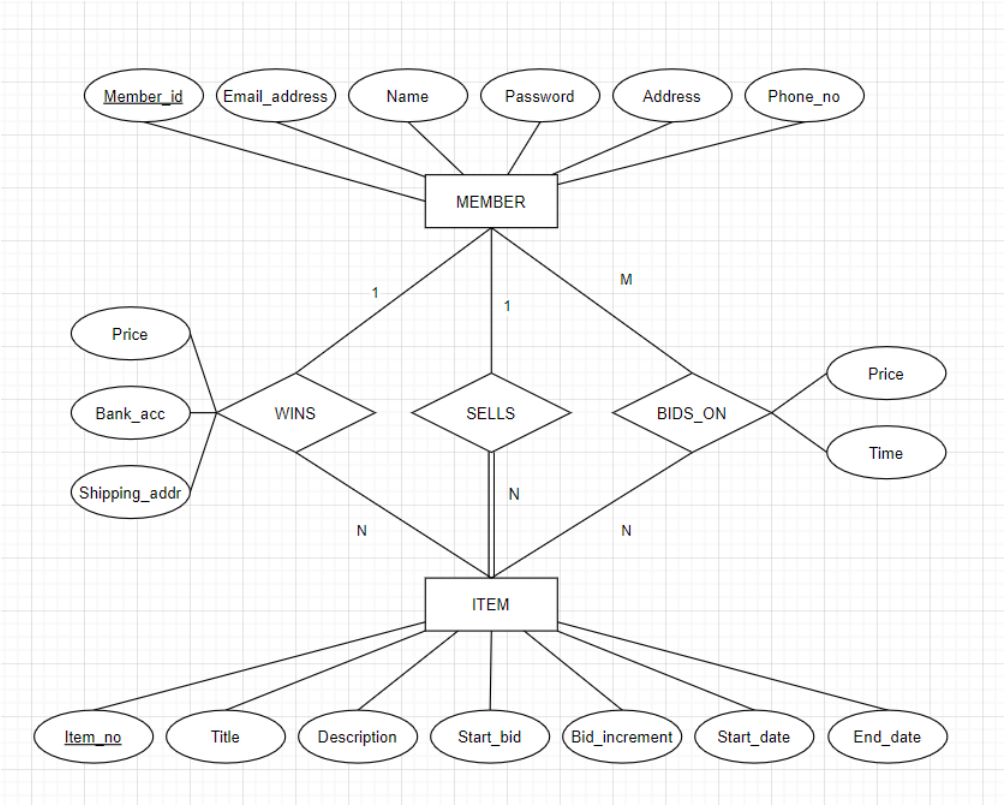

Figure 1: Entity-Relationship diagram for online auction database system

b)

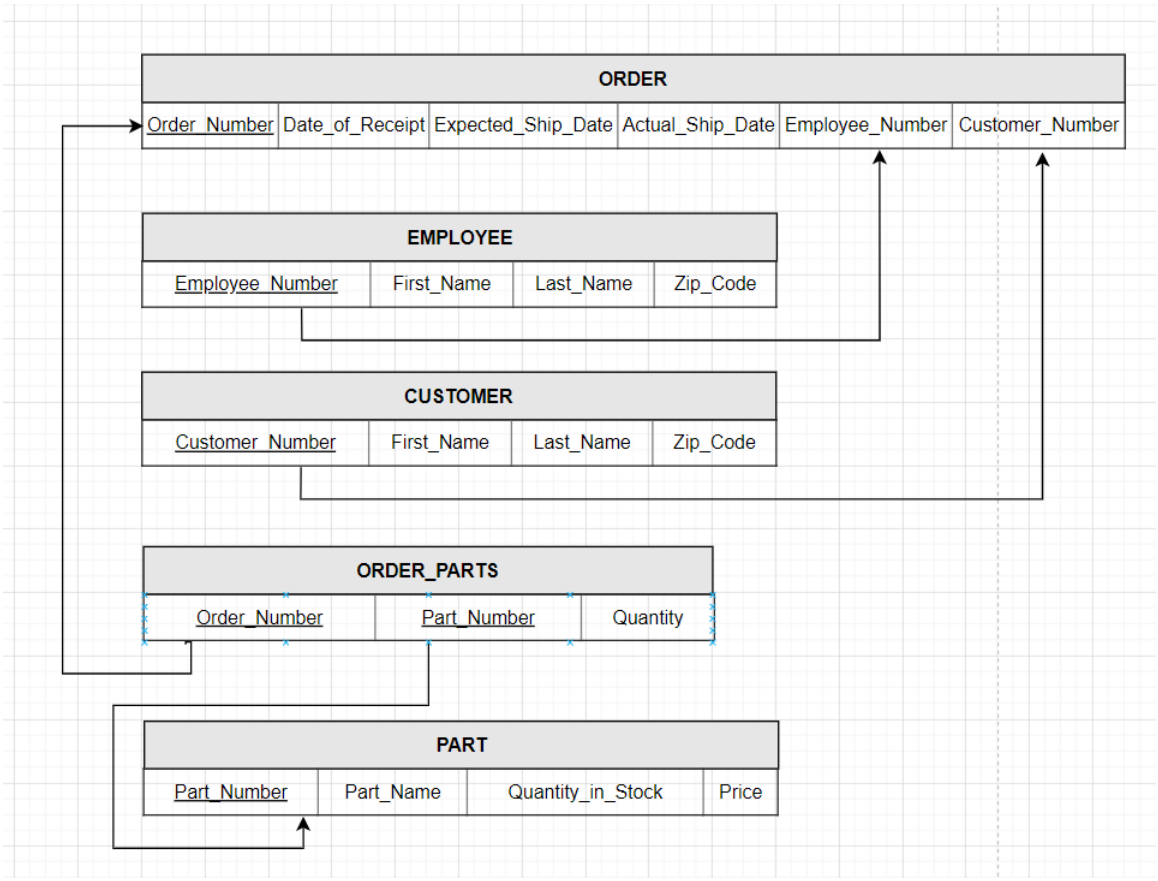

Figure 2: Relational database schema

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a)

i.

```
(SELECT Ssn, Fname, Lname
FROM EMPLOYEE
WHERE Dno=1)
UNION
(SELECT S.Ssn, S.Fname, S.Lname
FROM EMPLOYEE AS S, Employee AS E
WHERE E.Superssn=S.Ssn AND S.Dno=1)
```

ii.

```
SELECT Dnumber, Dname, AVG(Salary)AS AVG_Sal
FROM DEPARTMENT, EMPLOYEE
WHERE Dnumber=Dno
GROUP BY Dnumber
```

iii.

```
SELECT Ssn
FROM EMPLOYEE
LEFT JOIN DEPENDENT
ON DEPENDENT.Essn=EMPLOYEE.Ssn
WHERE Essn IS NULL
```

b)

i.

```
CREATE VIEW DEPARTMENT_MANAGERS
AS SELECT Dname, Fname, Lname, Salary
FROM DEPARTMENT, EMPLOYEE
WHERE Mgr_ssn=Ssn
```

ii.

```
CREATE VIEW ADMINISTRATION_EMPLOYEES
AS SELECT E.Fname, E.Lname, S.Fname AS Sup_Fname, S.Lname AS Sup_Lname, E.Salary
FROM EMPLOYEE AS E, EMPLOYEE AS S, DEPARTMENT AS D
WHERE S.Ssn=E.Super_ssn AND D.Dname = 'Administration' AND E.Dno=D.Dnumber
```

c)

i.

$$EMP\_PROJECT(Ssn) \leftarrow EMPLOYEE \bowtie_{Ssn=Essn} WORKS\_ON$$

$$EMP\_NO\_PROJECT \leftarrow \pi_{Ssn}(EMPLOYEE) - EMP\_PROJECT$$

$$RESULT \leftarrow \pi_{Fname,\,Lname}(EMP\_NO\_PROJECT * EMPLOYEE)$$

ii.

$$SSN\_ALL\_PROJECTS(Ssn) \leftarrow \pi_{Essn,Pno}(WORKS\_ON) \div \rho_{Pno}(\pi_{Pnumber}(PROJECT))$$

$$RESULT \leftarrow \pi_{Fname,\,Lname}(SSN\_ALL\_PROJECTS * EMPLOYEE)$$

iii.

$RESULT(Gender, Average\_Salary) \leftarrow {}_{Sex}\Im_{AVERAGE\ Salary}(EMPLOYEE)$

4

1NF Check

Each attribute value appears to be single atomic, therefore the relation satisfies 1NF.

2NF Check

Every non-prime attribute must be fully functionally dependent on (Car_no, Salesman_id). This is clearly not true as Date_sold is only functionally dependent on Car_no. Therefore, the relation is not 2NF.

3NF Check

The relation is not 3NF as it is not 2NF.

Normalize to 2NF

All non-prime attributes are associated only with the part of the original primary key on which they are fully functionally dependent in the decomposed 2NF relations.

i.e.

SALE_DISCOUNT(Car_no, Salesman_id, Discount_amt)

SALE_DATE(Car_no, Date_sold)

COMMISION(Salesman_id, Commision)

Normalize to 3NF

No more steps need to be completed as the result of 2NF normalization is also 3NF. If there were any transitive dependencies between a non prime attribute and the primary key of any relation then this would need to be removed.

5

a)

An accountant at a trading company wants to give each trading employee a raise of a certain percentage each year, depending on how the company performed that year. PSM can simplify this process - which would be tedious to do manually - into a single command with a percentage as an input. The procedure could contain logic functionality, raising different employees and managers salaries at different rates.

b)

Page	A	B	C
Last Use	5	6	4

Figure 3: Buffer pool after request f

Page	A	B	D
Last Use	5	6	7

Figure 4: Buffer pool after request g

Page	A	B	D
Last Use	5	6	8

Figure 5: Buffer pool after request h

Page	C	B	D
Last Use	9	6	8

Figure 6: Buffer pool after request i

c)

i.

$Time = 5ms + 5ms + \frac{1MB}{100MB/s} = 20ms$

ii.

$Time = 5ms + 5ms + \frac{1B}{1 \times 10^6 B/s} = 10.001ms$

iii.

Less space is wasted than larger block sizes when storing small files, as the lowest amount of space a block can contain is 1KB. Less I/Os are needed to be executed for large files as each block is large.