# UNIT 12: SYSTEM TESTING

## UNIT STRUCTURE


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## 12.1 LEARNING OBJECTIVES

After going through this unit, you will be able to –

- learn about system testing and its process
- understand the nature of test data
- explain test plan
- discuss activity network for system testing
- discuss types of system testing

## 12.2 INTRODUCTION

In the previous unit, we learned about the database design. We are acquainted with the objective of database and the various terms that are





| Stdid | StdPlace | StdDept | Stddepttype | Stddeptid |
|---|---|---|---|---|
| 10401 | A | CS | UG | CSUG1 |
| 10401 | A | IT | UG | ITUG1 |
| 10402 | B | CS | PG | CSPG1 |
| 10402 | B | IT | PG | CSPG 1 |

In the above table, Functional dependencies are as follows.

1. Stdid → StdPlace
2. StdDept → {Stddepttype, Stddeptid}

And the Candidate key is {Stdid, StdDept}. The table is not in BCNF because neither StdDept nor Stdid alone are keys. To convert the given table into BCNF, we decompose it into three tables:

a) Student Place table

| Stdid | StdPlace |
|---|---|
| 10401 | A |
| 10401 | A |
| 10402 | B |
| 10402 | B |

b) Student Department table

| StdDept | Stddepttype | Stddeptid |
|---|---|---|
| CS | UG | CSUG1 |
| IT | UG | ITUG1 |
| CS | PG | CSPG1 |
| IT | PG | CSPG 1 |

c) Student department mapping table.

| Stdid | StdDept |
|---|---|
| 10401 | CS |
| 10401 | IT |
| 10402 | CS |
| 10402 | IT |

In the above table, the Functional dependencies are as follows:

- Stdid → StdPlace
- Stddept → {Stddepttype, Stddeptid}

And the Candidate key is {Stdid, StdDept}

**v) 4NF:** A relation is said to be in 4NF if it is in BCNF and has no multi-valued dependency. For a dependency X '! Y, if for a single value of X, multiple values of Y exist, then the relationship will be a multi-valued dependency. Let's consider the following table STUDENT.

| Stdid | StdDept | Hobby |
|---|---|---|
| 10401 | CS | UG |
| 10402 | IT | UG |
| 10403 | CS | PG |
| 10404 | IT | PG |

The given STUDENT table is in 3NF, but the StdDept and Hobby are two independent entities. Hence, there is no relationship between StdDept and Hobby. So to make the above table into 4NF, we can decompose it into two tables:

| Stdid | StdDept |
|---|---|
| 10401 | CS |
| 10402 | IT |
| 10403 | CS |
| 10404 | IT |

| Stdid | Hobby |
|---|---|
| 10401 | UG |
| 10402 | UG |
| 10403 | PG |
| 10404 | PG |



**CHECK YOUR PROGRESS**

**Q 12:** What is data normalization?

**Q 13:** What is the 1 NF?

**Q 14:** State the definition of 2NF and 3NF.







## 11.15 MODEL QUESTIONS

**Q1.** What is a database system?

**Q2.** What is data? Give examples.

**Q3.** What are the objectives of a database?

**Q4.** What are the characteristics of a database?

**Q5.** Explain different normal forms with examples.

**Q6.** Explain the role of a database administrator.

**Q7.** What are the different types of databases? Explain it.

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It deals with how data are stored in the database, data accessed, or related to other data in storage.

**Ans. to Q No 7:** A database schema is the frame structure that denotes the logical view of the database. It represents how the data is stored and organized in a database. It also defines how the relations among dataare associated.

**Ans. to Q No 8:** A subschema provides a view of the database as seen by an application program. This view is often a subset of the complete schema definition. A subschema is used at runtime to provide the DBMS with a description of those portions of the database that are accessible to the application program.

**Ans. to Q No 9:** The one-to-many (1:M) is used to create a relationship between two tables. Any single row of the first table can be related to one or more rows of the second table. But, the rows of the second table can only relate to the only row in the first table. It is also known as a many-to-one relationship.

**Ans. to Q No 10:** Tables

**Ans. to Q No 11:** Rows.

**Ans. to Q No 12:** Normalization is a process of minimizing the redundancy from a database by minimizing the redundancy from the relations. Redundant data may cause insertion, deletion, and update anomalies.

**Ans. to Q No 13:** A relation is said to be in 1NF if it contains an atomic value. If a relation contains more than one value or composite or multi-valued attribute, it violates the first normal form. A relation is in first normal form if the relation has a single-valued attribute.

**Ans. to Q No 14:** A relation will be in 2NF if it is in 1NF and all non-key attributes are fully functional dependent on the primary key.Arelation will be in 3NF if it is in 2NF and does not contain any transitive partial dependency. It is used to reduce data duplication and achieve data integrity. A relation must be in third normal form if there is no transitive dependency for non-prime attributes.







## 11.12 LET US SUM UP

- A database is an organized collection of information or data. This information and data are stored in a computer system and can access digitally using another computer system. It is a method of storing, managing, and retrieving information.
- A database should have the following objectives.
  a. Data Availability
  b. Data Integrity
  c. Data independence
- A table in a database is a group of related records or information or data in a database. It consists of rows and columns.
- Record: A group of related fields in a table of a database is known as a record. Every record has the same fields.
- The logical views define the top-level design and are created at the requirements gathering, and system analysis. The logical view of data is what ta looks like.
- The physical view of a database is the way data or information exists in the physical storage of a database.
- A database schema is the frame structure that denotes the logical view of the database. It represents how the data is stored and organized in a database. It also defines how the relations among data are associated.
- A subschema provides a view of the database as seen by an application program. This view is often a subset of the complete schema definition.
- Three types of relations are present in the database:
  a. One to one
  b. One to many
  c. Many to many
- The followings are the types of databases.

a. Centralized Database
b. Distributed Database
c. Relational Database
d. NoSQL Database
e. Cloud Database
f. Object-oriented Databases
g. Hierarchical Databases
h. Network Databases

- The followings are the responsibilities of a DBA.
  a. A DBA works with a database and finds the best possible way to store, organize, and manage data in the database.
  b. A DBA handles the database troubleshooting.
  c. A DBA keeps the database update.
  d. A DBA manages the database access.
  e. A DBA ensures to meet the user demands during the query processing.
  f. A DBA backup the data of the database.
  g. A DBA writes the reports, documentation, and operation manuals of a database.
  h. A DBA implements the security measure of a database.
  i. A DBA achieves the data of a database.
- Normalization is a process of minimizing the redundancy from a database by minimizing the redundancy from the relations.
- A relation is said to be in 1NF if it contains an atomic value. If a relation contains more than one value or composite or multi-valued attribute, it violates the first normal form.
- A relation will be in 2NF if it is in 1NF and all non-key attributes are fully functional dependent on the primary key.
- Arelation will be in 3NF if it is in 2NF and does not contain any transitive partial dependency. It is used to reduce data duplication and achieve data integrity. A relation.
- The BCNF is the advanced version of 3NF. A relation is in BCNF if every functional dependency X → Y, X is the super key of the table.





For a BCNF, the relation should be in 3NF, and for every functional dependency, the Left-Hand Side should be super key.

- A relation is said to be in 4NF if it is in BCNF and has no multi-valued dependency. For a dependency X → Y, if for a single value of X, multiple values of Y exist, then the relationship will be a multi-valued dependency.



## 11.13 FURTHER READINGS

1. Fundamentals of Database Systems - RamezElmasri



## 11.14 ANSWERS TO CHECK YOUR PROGRESS

**Ans. to Q No 1:** A database is an organized collection of information or data. This information and data are stored in a computer system and can access digitally using another computer system. It is a method of storing, managing, and retrieving information.

**Ans. to Q No 2:** A data is a fact that relates to an object, such as name, age, father name, semester, branch, etc. The data may be numeric, text, image, video, etc. It may be in any format.

**Ans. to Q No 3:** The correctness, completeness, accuracy, and reliability of data define data integrity. It defines the authenticity and consistency of the data. The data integrity test is usually performed to check the quality of the data in the database, and also to verify the data, in the database.

**Ans. to Q No 4:** A table is a group of related records or information or data in a database. It consists of rows and columns.

**Ans. to Q No 5:** Metadata.

**Ans. to Q No 6:** The logical views define the top-level design and are created at the requirements gathering, and system analysis. The logical view of data is what data look like. The physical view of a database is the way data or information exists in the physical storage of a database.