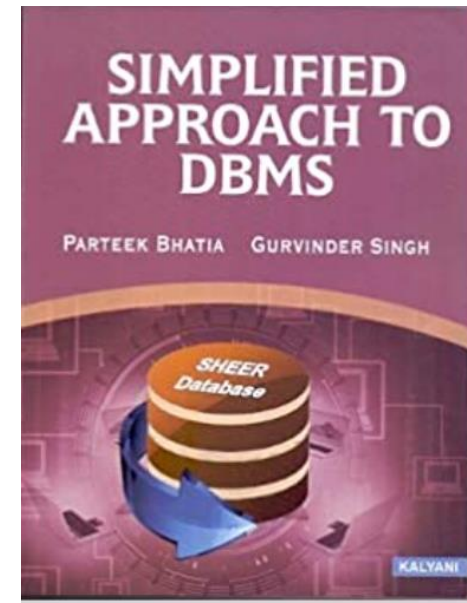

Chapter: 3

Data Models

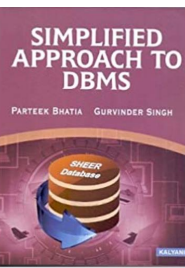


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Parateek Bhatia
Associate Professor
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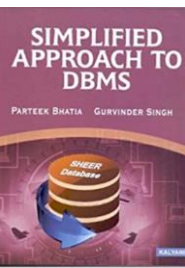
Data Models

- ▶ A model is a representation of reality, 'real world' objects and events, and their associations.
- ▶ It is an abstraction that concentrates on the essential.



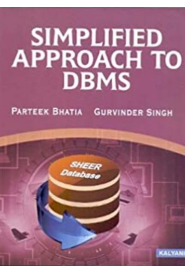
Types of Data Models

- ▶ Hierarchical Model
- ▶ Network Model
- ▶ Relational Model

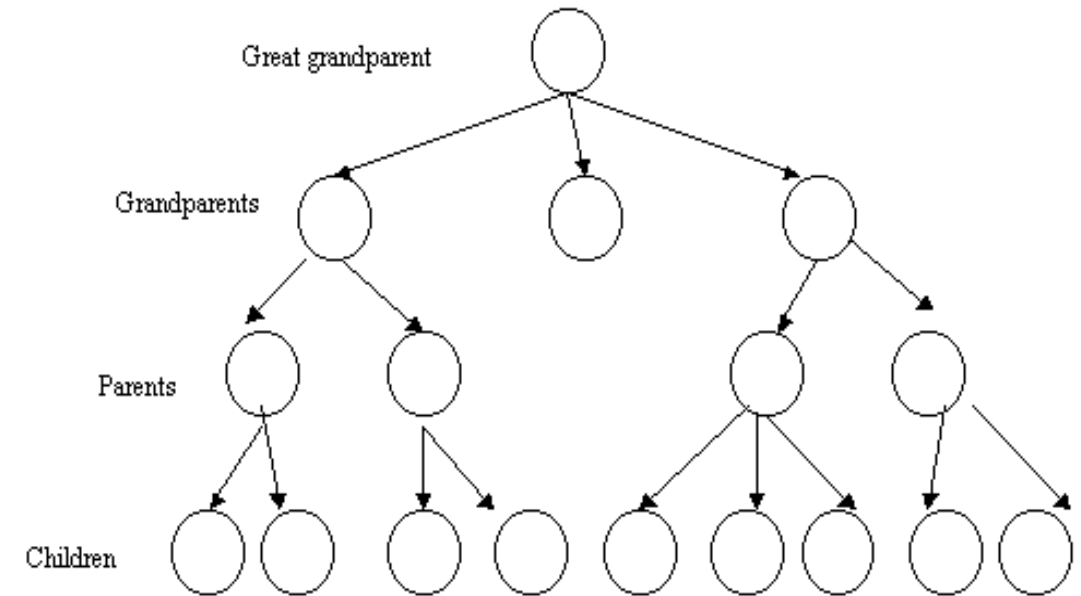
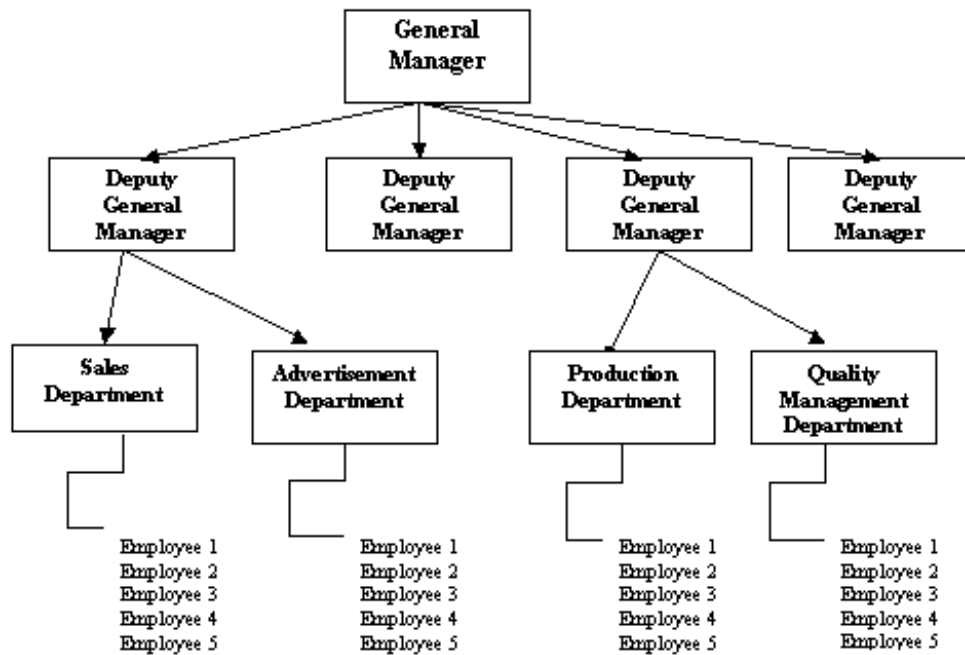


Hierarchical Model

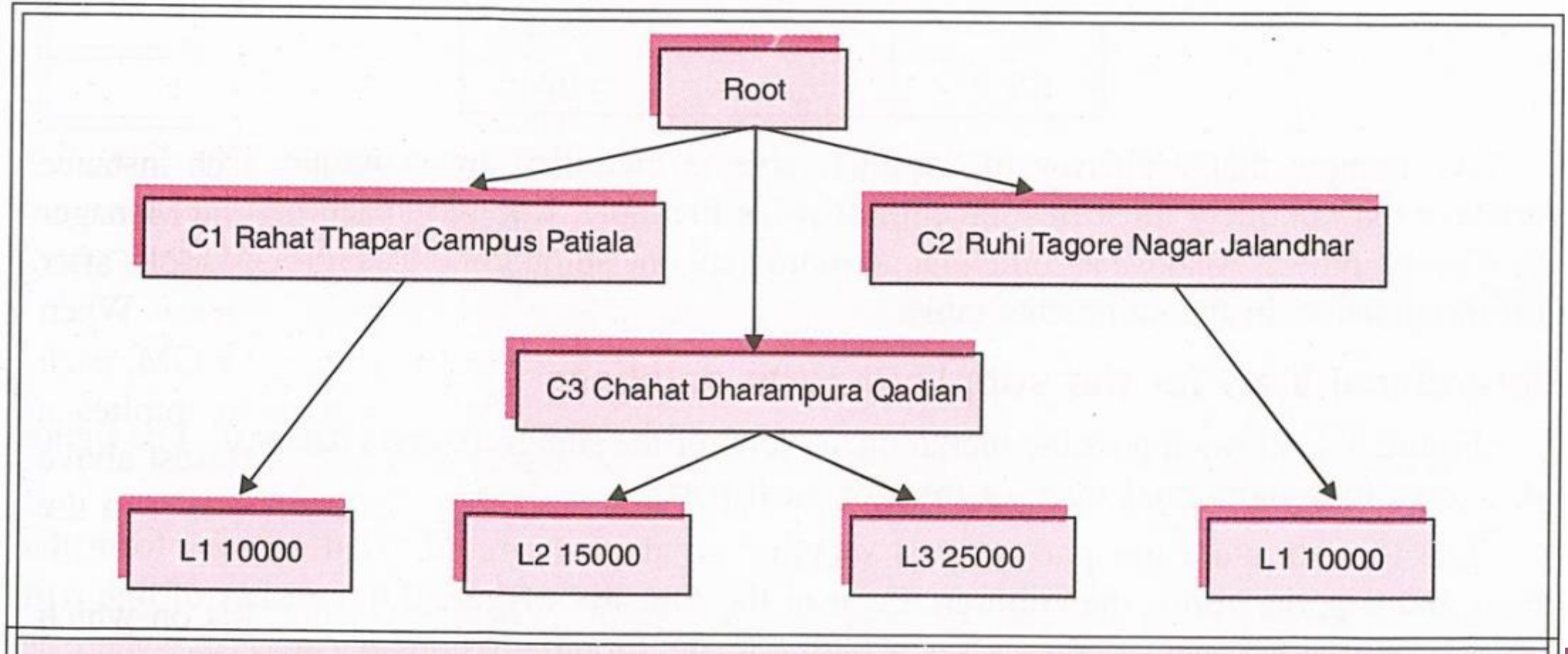
- ▶ Hierarchical Database model is one of the oldest database models, dating from late 1950s.
- ▶ One of the first hierarchical databases Information Management System (IMS).
- ▶ This model is based on tree data structure.



Hierarchical Model: An Example



Hierarchical Model: An Example



Hierarchical Model: Supplier-Part Database

The Supplier records

| Sno | Name | Status | City |
|-----|--------|--------|----------|
| S1 | Suneet | 20 | Qadian |
| S2 | Ankit | 10 | Amritsar |
| S3 | Amit | 10 | Amritsar |

The Part records

| Pno | Name | Color | Weight | City |
|-----|-------|-------|--------|-----------|
| P1 | Nut | Red | 12 | Qadian |
| P2 | Bolt | Green | 17 | Amritsar |
| P3 | Screw | Blue | 17 | Jalandhar |
| P4 | Screw | Red | 14 | Qadian |

The Shipment records

| Sno | Pno | Qty |
|-----|-----|-----|
| S1 | P1 | 250 |
| S1 | P2 | 300 |
| S1 | P3 | 500 |
| S2 | P1 | 250 |
| S2 | P2 | 500 |
| S3 | P2 | 300 |

Hierarchical Model: Supplier-Part Database

The Supplier records

| Sno | Name | Status | City |
|-----|--------|--------|----------|
| S1 | Suneet | 20 | Qadian |
| S2 | Ankit | 10 | Amritsar |
| S3 | Amit | 10 | Amritsar |

The Part records

| Pno | Name | Color | Weight | City |
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| P4 | Screw | Red | 14 | Qadian |

The Shipment records

| Sno | Pno | Qty |
|-----|-----|-----|
| S1 | P1 | 250 |
| S1 | P2 | 300 |
| S1 | P3 | 500 |
| S2 | P1 | 250 |
| S2 | P2 | 500 |
| S3 | P2 | 300 |

| | | | | |
|----|--------|-------|----------|-----------|
| P3 | Screw | Blue | 17 | Jalandhar |
| S1 | Suneet | 20 | Qadian | 500 |
| P2 | Bolt | Green | 17 | Amritsar |
| S1 | Suneet | 20 | Qadian | 300 |
| S2 | Ankit | 10 | Amritsar | 500 |
| S3 | Amit | 10 | Amritsar | 300 |
| P1 | Nut | Red | 12 | Qadian |
| S1 | Suneet | 20 | Qadian | 250 |
| S2 | Ankit | 10 | Amritsar | 250 |
| P4 | Screw | Red | 14 | Qadian |

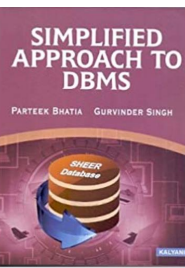
Operations at Hierarchical Model

| | | | | |
|----|--------|-------|----------|-----------|
| P3 | Screw | Blue | 17 | Jalandhar |
| S1 | Suneet | 20 | Qadian | 500 |
| P2 | Bolt | Green | 17 | Amritsar |
| S1 | Suneet | 20 | Qadian | 300 |
| S2 | Ankit | 10 | Amritsar | 500 |
| S3 | Amit | 10 | Amritsar | 300 |

| | | | | |
|----|--------|-----|----------|--------|
| P1 | Nut | Red | 12 | Qadian |
| S1 | Suneet | 20 | Qadian | 250 |
| S2 | Ankit | 10 | Amritsar | 250 |
| P4 | Screw | Red | 14 | Qadian |

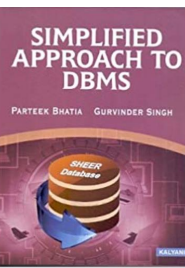
Insert Operation

- ▶ Cannot insert data of child without parent.



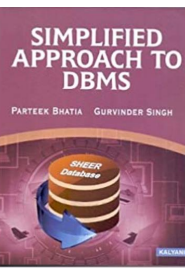
Update Operation

- ▶ The data of child record requires multiple update operations as their data is repeated.



Delete Operations

- ▶ Parent removal causes deletion of child data.



Retrieval Operations are Asymmetric

- ▶ **Query I:** Find part numbers for parts supplied by supplier S2.
- ▶ **Algorithm**
- ▶ do until no more parts;
- ▶ get next part;
- ▶ get [next] supplier under this part where $SNO=S2$;
- ▶ if found then print PNO;
- ▶ end;

▶ **Query I:** Find supplier numbers who supply part P2.

▶ **Algorithm**

▶ get [next] part where PNO=P2;

▶ do until no more shipments under this part;

▶ get next supplier under this part;

▶ print SNO;

▶ end;

▶

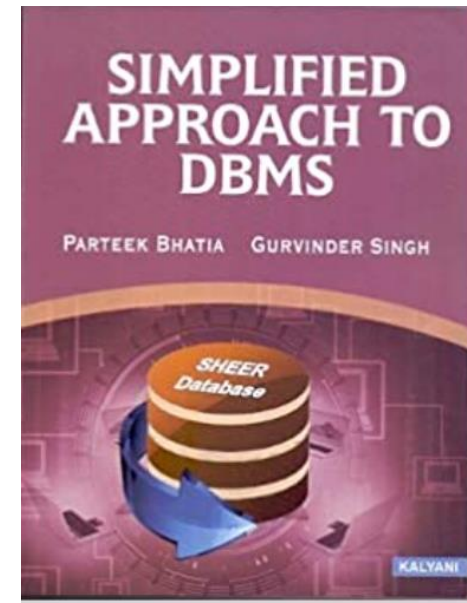
Network Data Model

By

Parteek Bhatia

Associate Professor

Department of Computer Science & Engineering
Thapar Institute of Engineering and Technology
Patiala



Network Model

- ▶ The Network model replaces the hierarchical tree with a graph thus allowing more general connections among the nodes.
- ▶ The main difference of the network model from the hierarchical model, is its ability to handle many to many (M:M) relations.
- ▶ A network structure allows 1:1 (one:one), 1:M (one:many), M:1 (many: one), M:M (many:many) relationships among entities.
- ▶ The network model was evolved to specifically handle non-hierarchical relationships.

Network Model: Supplier-Part Database

The Supplier records

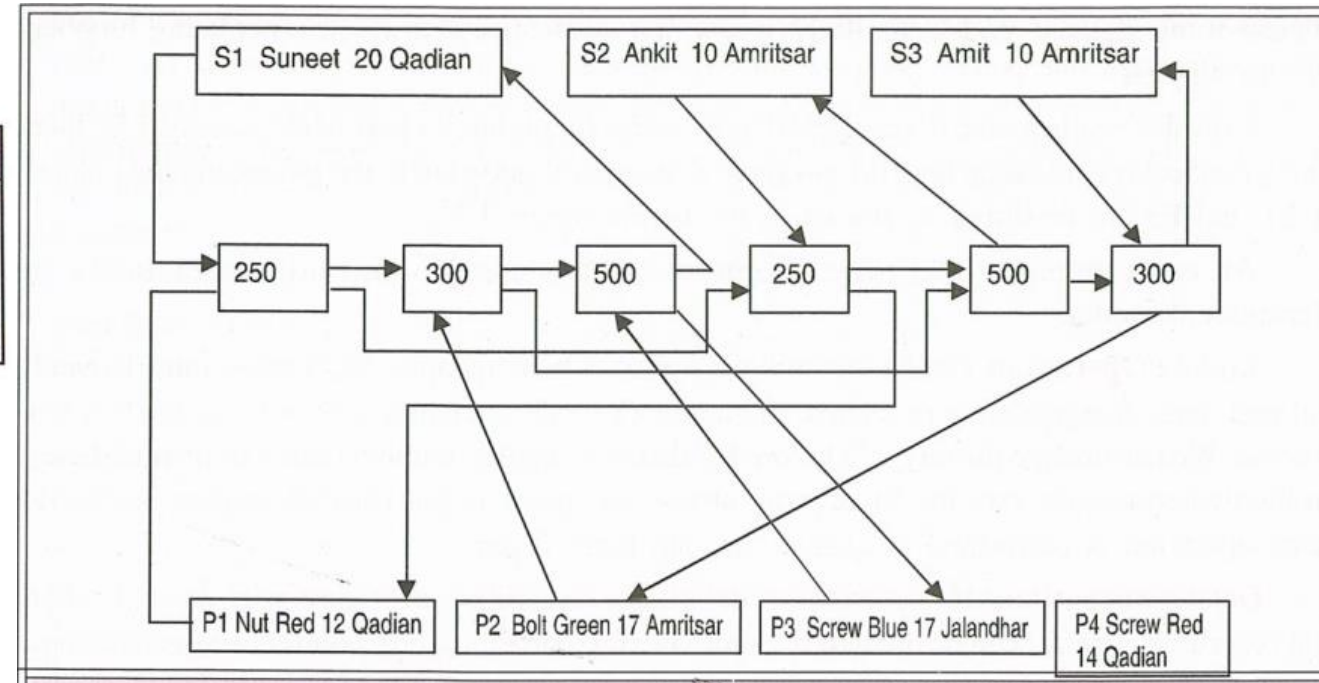
| Sno | Name | Status | City |
|-----|--------|--------|----------|
| S1 | Suneet | 20 | Qadian |
| S2 | Ankit | 10 | Amritsar |
| S3 | Amit | 10 | Amritsar |

The Part records

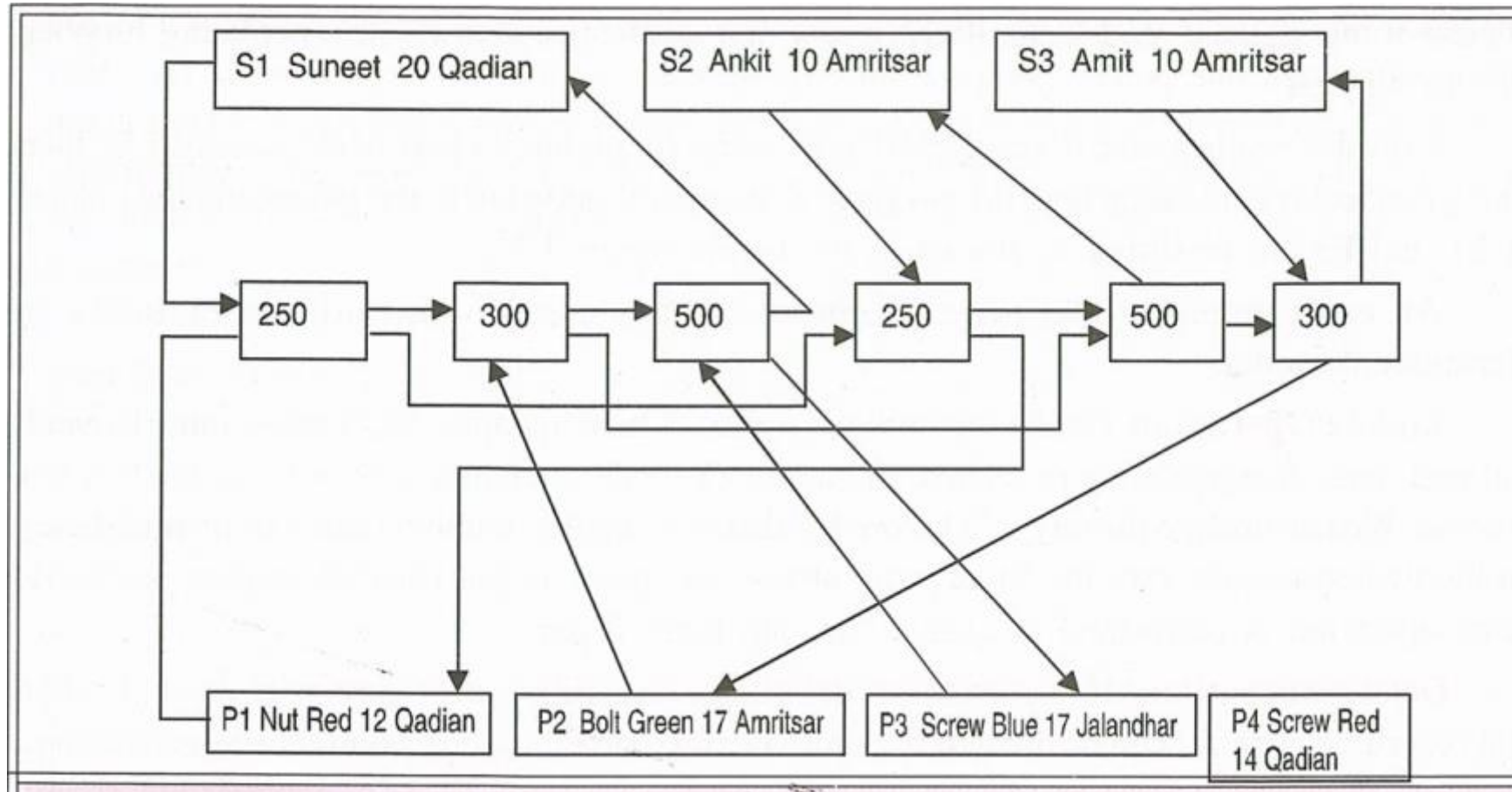
| Pno | Name | Color | Weight | City |
|-----|-------|-------|--------|-----------|
| P1 | Nut | Red | 12 | Qadian |
| P2 | Bolt | Green | 17 | Amritsar |
| P3 | Screw | Blue | 17 | Jalandhar |
| P4 | Screw | Red | 14 | Qadian |

The Shipment records

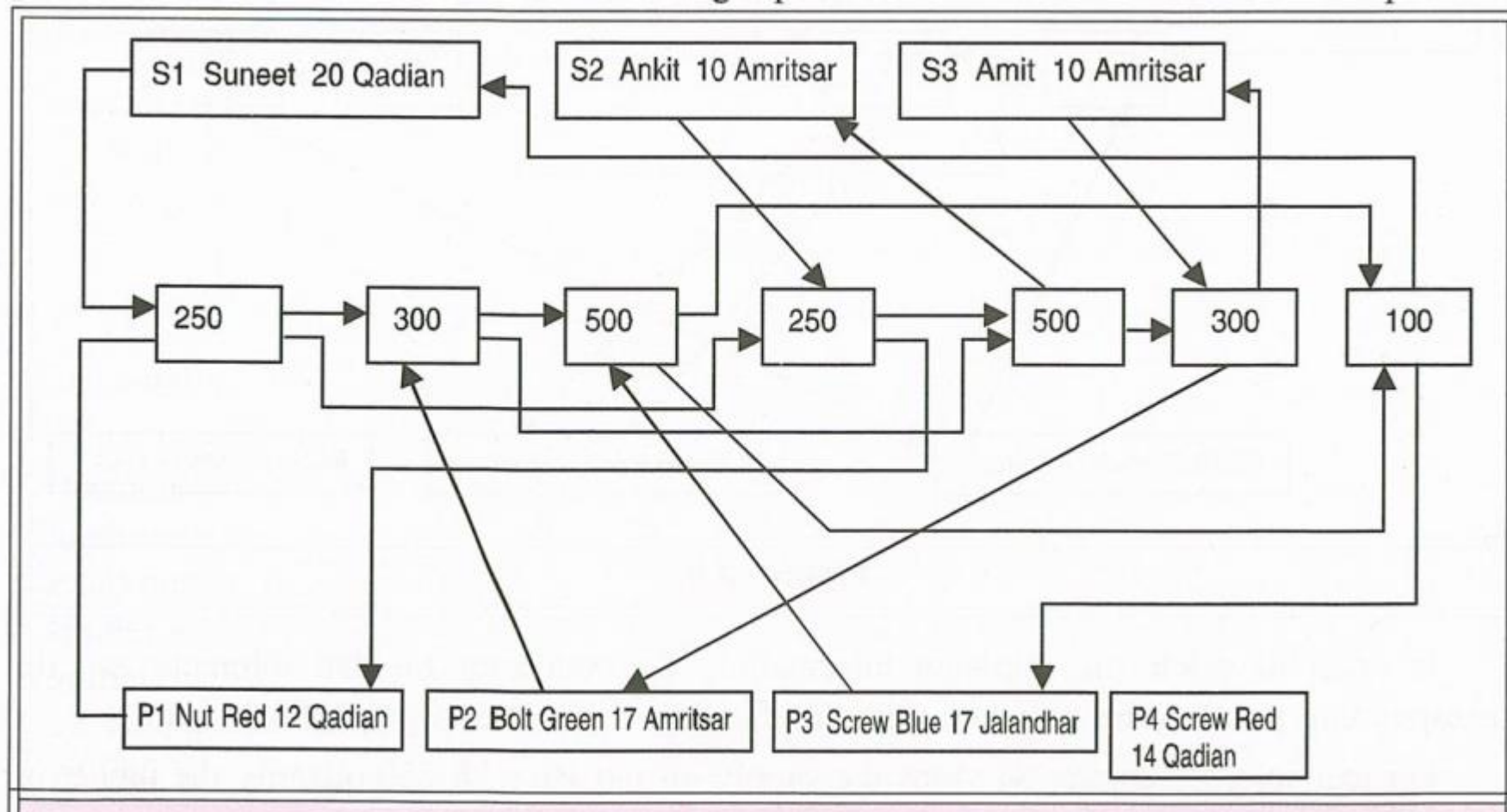
| Sno | Pno | Qty |
|-----|-----|-----|
| S1 | P1 | 250 |
| S1 | P2 | 300 |
| S1 | P3 | 500 |
| S2 | P1 | 250 |
| S2 | P2 | 500 |
| S3 | P2 | 300 |



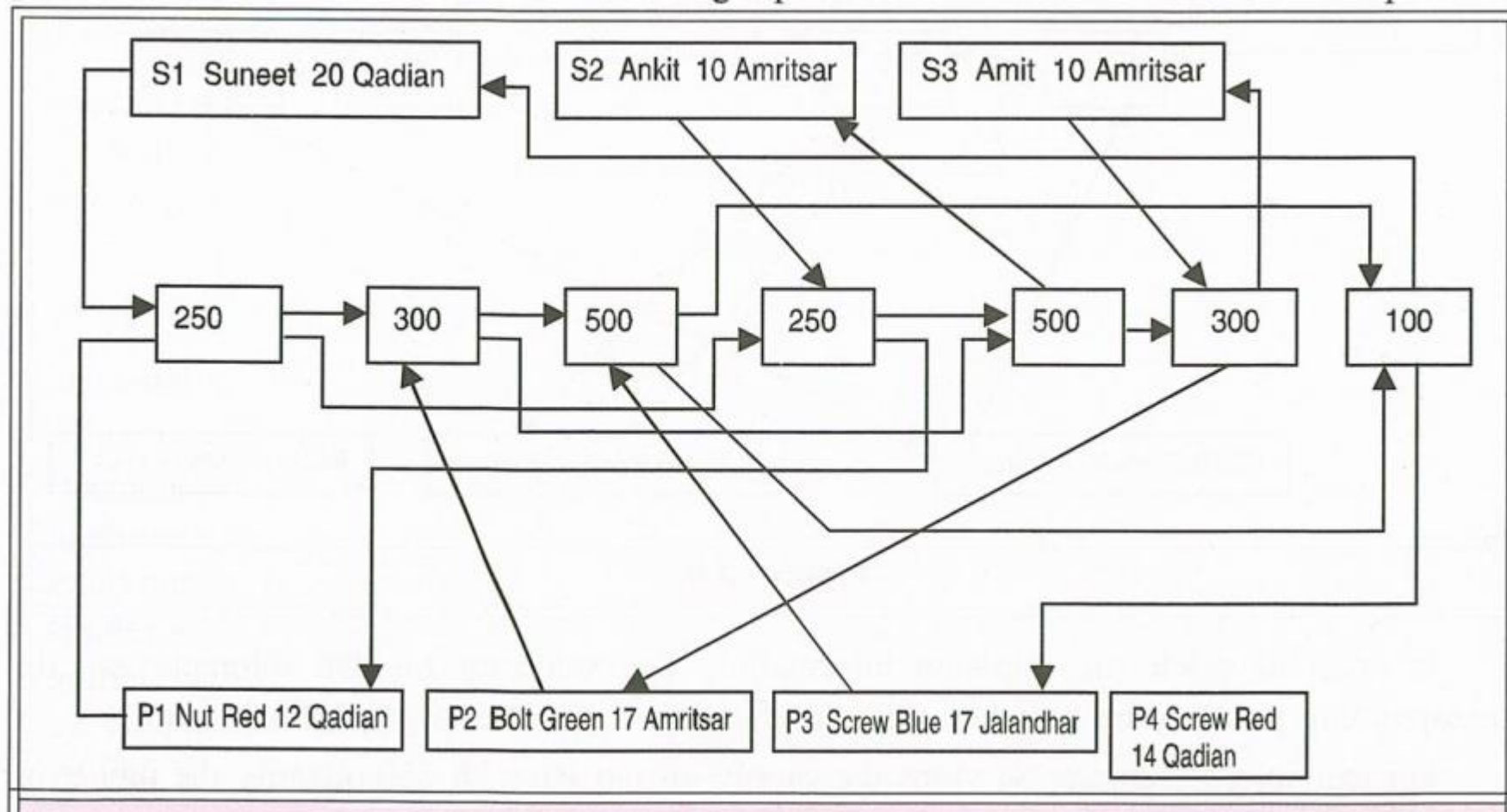
Network Model: Supplier-Part Database



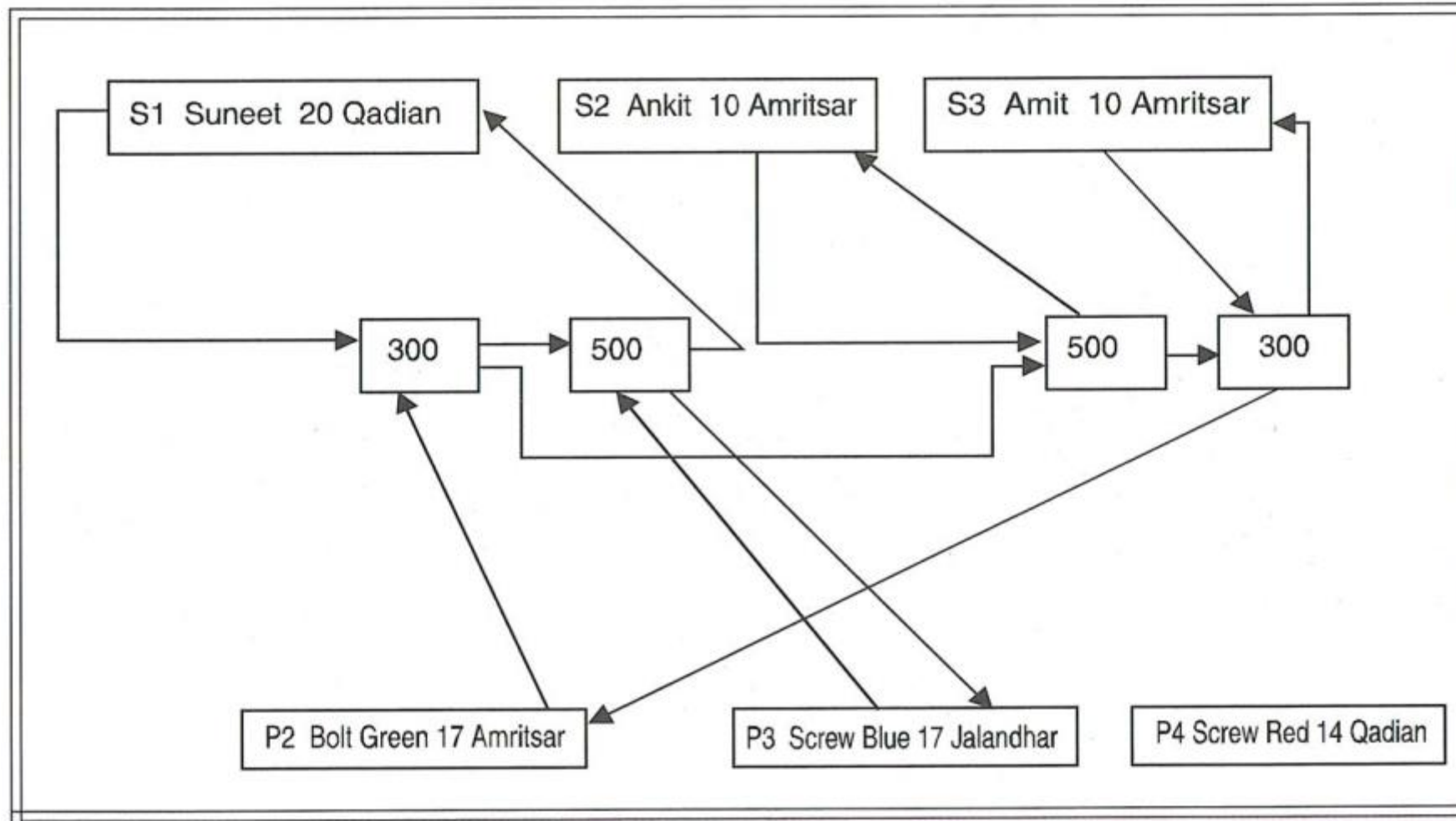
Insert Operation



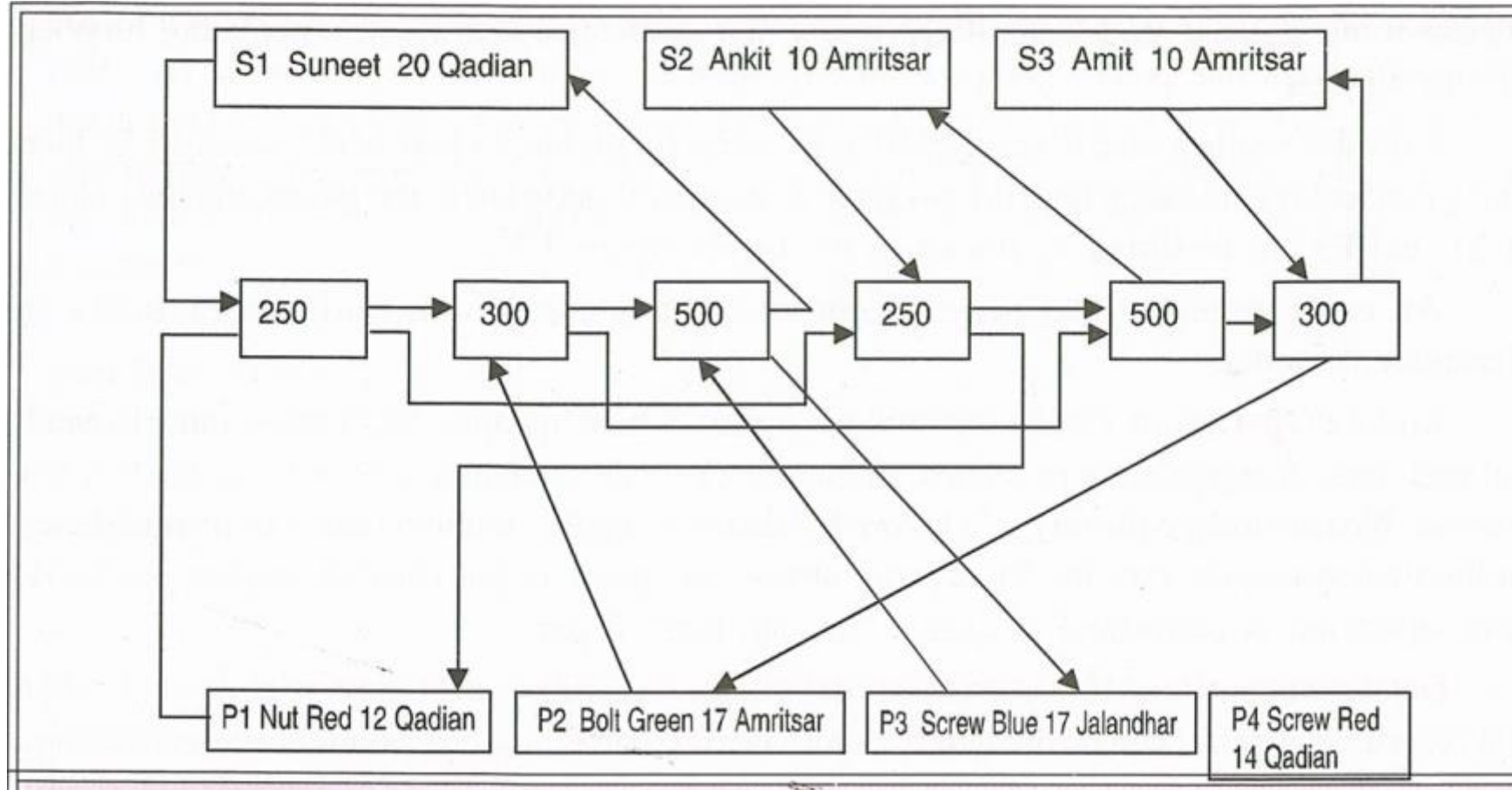
Update Operation



Delete Operation

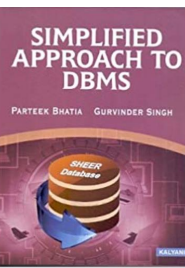


Retrieve Operation



Operations over Network Model

- ▶ **Insert**
 - ▶ There is no anomaly.
- ▶ **Update**
 - ▶ There is no anomaly.
- ▶ **Delete**
 - ▶ There is no anomaly.
- ▶ **Retrieve**
 - ▶ There is no anomaly, retrieval operations are symmetric.
- ▶ **Limitation of Network Model**
 - ▶ The only limitation of network model is its complexity.



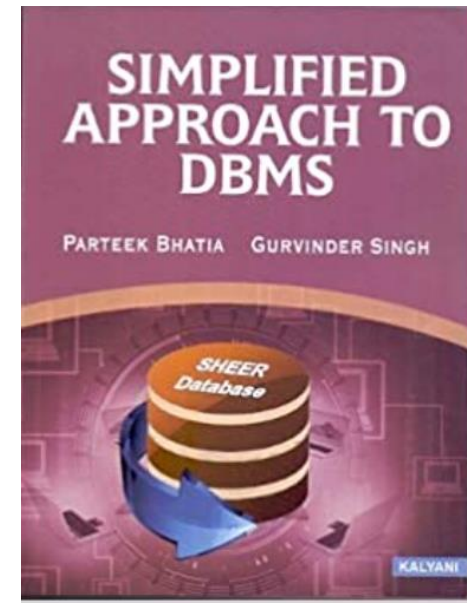
Relational Data Model

By

Parteek Bhatia

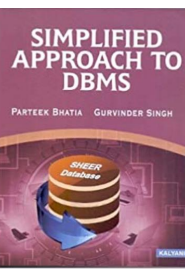
Associate Professor

Department of Computer Science & Engineering
Thapar Institute of Engineering and Technology
Patiala



Relational Model

- ▶ Relational model stores data in the form of tables. This concept purposed by Dr. E.F. Codd, a researcher of IBM in the year 1960s. The relational model consists of three major components:
- ▶ A relational model database is defined as a database that allows you to group its data items into one or more independent tables that can be related to one another by using fields common to each related table.



Relational Model: An Example

| Attributes | Emp_Code | Name | Year |
|------------|----------|------------|------|
| Tuples | 21130 | Amar Jain | 1 |
| | 30143 | Kuldeep | 3 |
| | 41894 | Manoj | 2 |
| | 51207 | Rita Bajaj | 6 |

Relational Model: Customer Loan Database

| Customer Table | | | |
|----------------|--------|---------------|-----------|
| CNO | NAME | ADDRESS | CITY |
| C1 | Rahat | Thapar Campus | Patiala |
| C2 | Ruhi | Tagore Nagar | Jalandhar |
| C3 | Chahat | Dharampura | Qadian |
| C4 | Pooja | GNDU | Amritsar |

| Customer_Loan Table | | |
|---------------------|-----|--------|
| CNO | LNO | AMOUNT |
| C1 | L1 | 10000 |
| C2 | L1 | 10000 |
| C3 | L2 | 15000 |
| C3 | L3 | 25000 |
| C4 | L4 | 35000 |

Relational Model: Supplier Part Database

The Supplier records

| Sno | Name | Status | City |
|-----|--------|--------|----------|
| S1 | Suneet | 20 | Qadian |
| S2 | Ankit | 10 | Amritsar |
| S3 | Amit | 10 | Amritsar |

The Part records

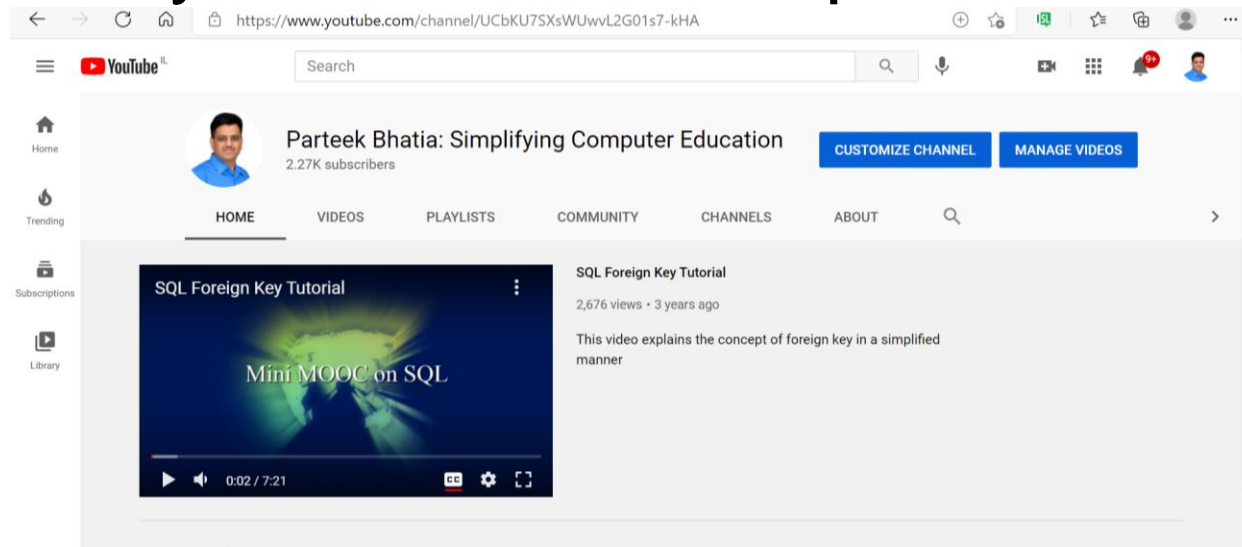
| Pno | Name | Color | Weight | City |
|-----|-------|-------|--------|-----------|
| P1 | Nut | Red | 12 | Qadian |
| P2 | Bolt | Green | 17 | Amritsar |
| P3 | Screw | Blue | 17 | Jalandhar |
| P4 | Screw | Red | 14 | Qadian |

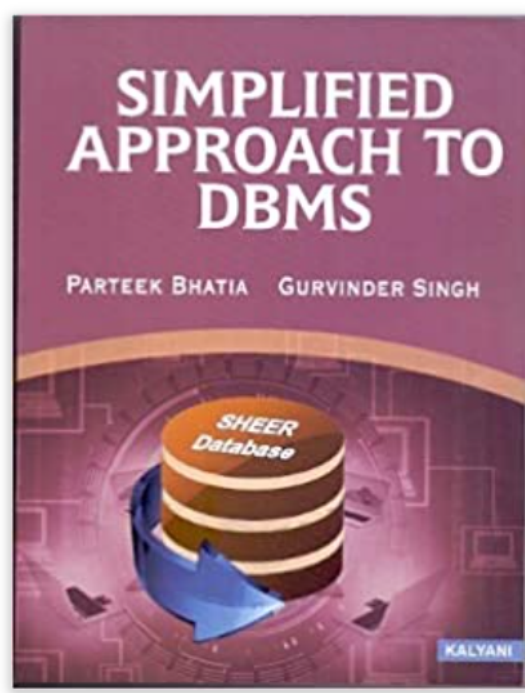
The Shipment records

| Sno | Pno | Qty |
|-----|-----|-----|
| S1 | P1 | 250 |
| S1 | P2 | 300 |
| S1 | P3 | 500 |
| S2 | P1 | 250 |
| S2 | P2 | 500 |
| S3 | P2 | 300 |

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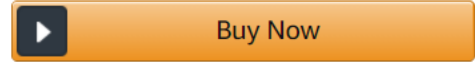
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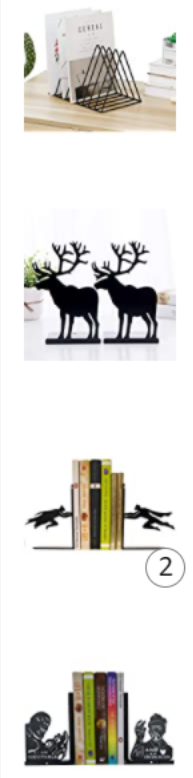
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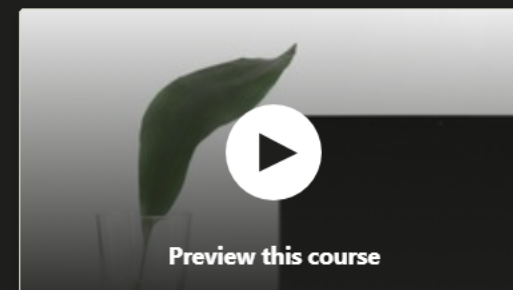
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ABOUT THE INSTRUCTOR

Dr. Parteek Bhatia is Associate Professor in the Department of Computer Science and Engineering at Thapar Institute of Engineering and Technology, Patiala. He has more than 18 years of academic experience. He has authored several books in various areas of computer science. His book - Simplified approach to DBMS is one of the bestseller. Currently, he is working on plethora of Projects which are funded by Department of Science and Technology, CSIR and other funding agencies of India.

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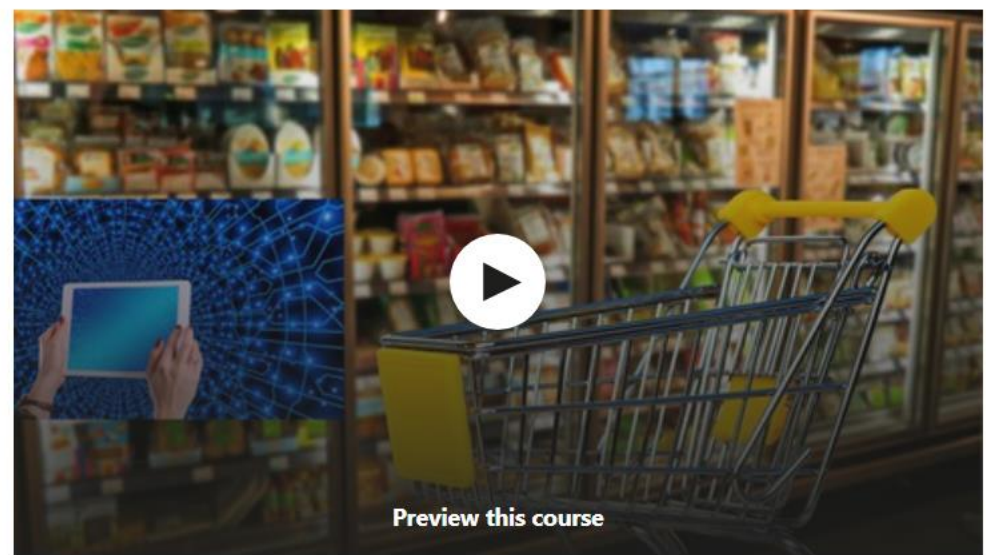
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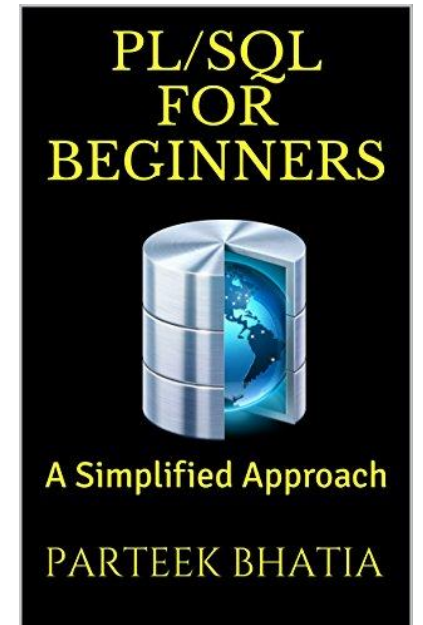
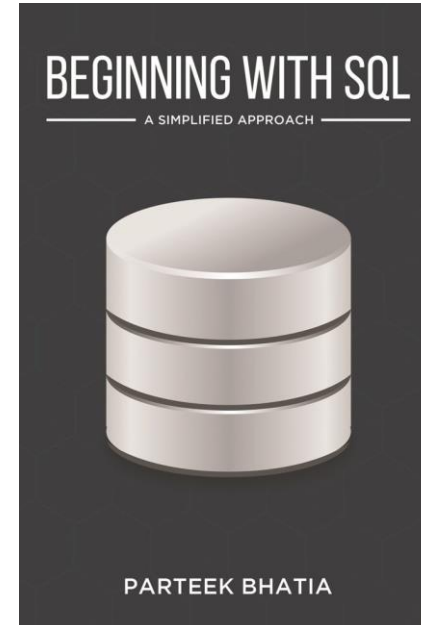
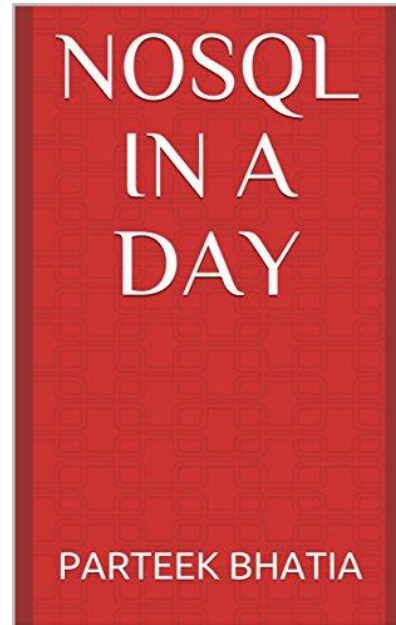
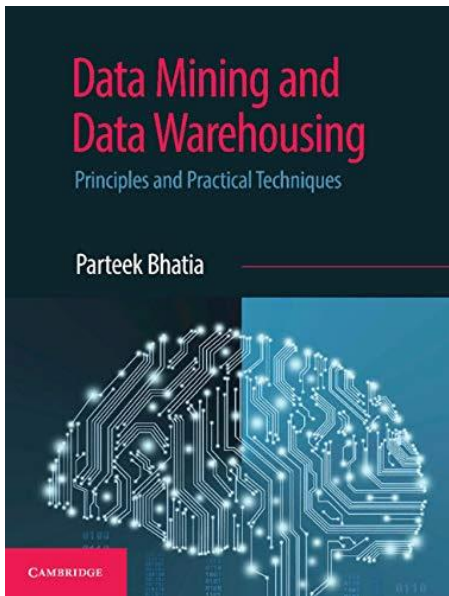
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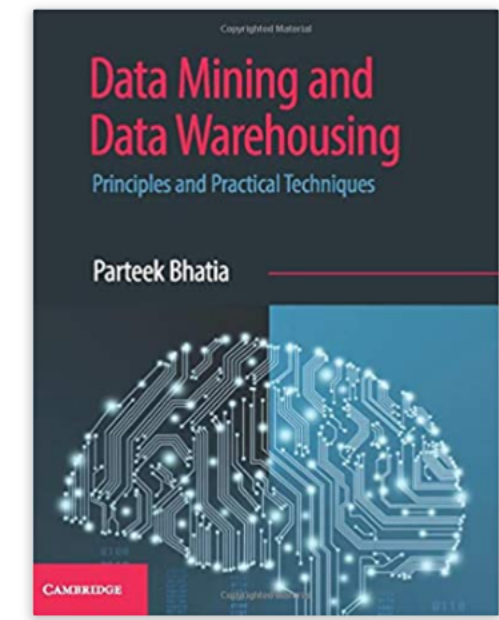
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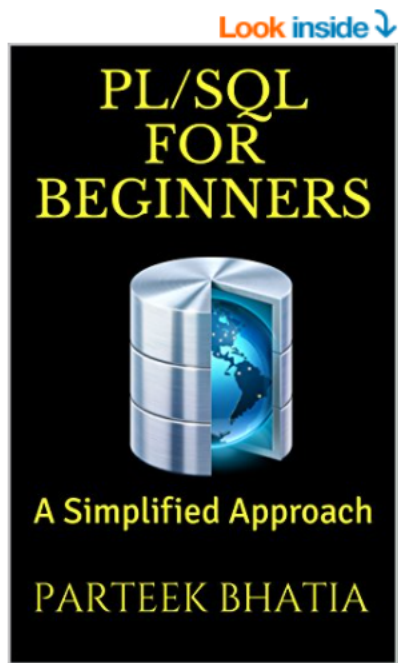
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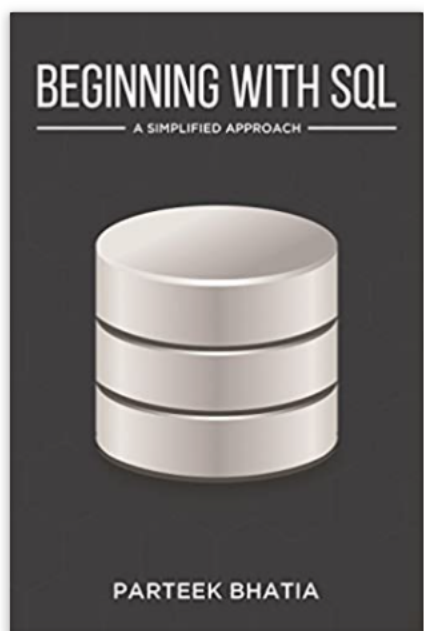
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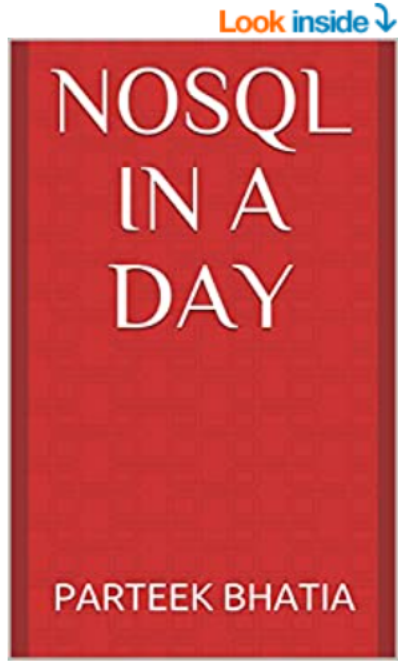
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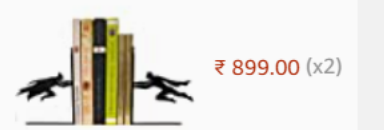
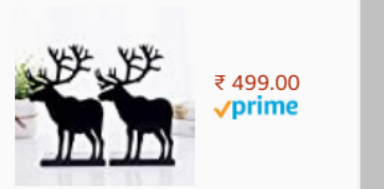
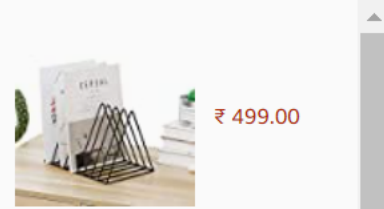
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