

Functional Dependencies and Normalization

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Functional Dependency

FD : $X \rightarrow Y$

If $t_1.X = t_2.X$ then $t_1.Y = t_2.Y$

- Jika kita tahu nilai X maka kita bisa dapat nilai Y
- Jika X unik, maka $X \rightarrow Y$ pasti FD
- X dan Y bisa lebih dari 1 atribut

| X | Y |
|---|---|
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |

| X | Y |
|---|---|
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |
| 2 | 3 |

Functional Dependency

| RNo | Name | Scores | Dept | Course |
|-----|------|--------|------|--------|
| 1 | A | 78 | CS | C1 |
| 2 | B | 60 | DS | C1 |
| 3 | A | 78 | CS | C2 |
| 4 | B | 60 | DS | C3 |
| 5 | C | 80 | IT | C3 |
| 6 | D | 80 | SA | C2 |

$RNo \rightarrow Name$



$Name \rightarrow RNo$



$RNo \rightarrow Scores$



$Dept \rightarrow Course$



$Name \rightarrow Course$



$(RNo, Name) \rightarrow Scores$



$(Name, Scores) \rightarrow (Dept, Course)$



Need of Normalization in DBMS

| SID | Sname | Credits | DeptName | Building | Room_No |
|-----|--------|---------|----------|----------|---------|
| 1 | Rahul | 5 | CSE | B1 | 101 |
| 2 | Jiya | 8 | CSE | B1 | 101 |
| 3 | Jenny | 9 | FDG | B2 | 201 |
| 4 | Elita | 9 | CVL | B2 | 115 |
| 5 | Vania | 7 | CSE | B1 | 101 |
| 6 | Tanaka | 7 | CVL | B2 | 115 |

- Deletion Anomaly

Bagaimana jika departemen MNM hanya terdapat 1 mahasiswa dan mahasiswa tersebut ingin dihapus dari database?

- Insertion Anomaly

Apa terjadi jika terdapat departemen baru bernama MNM?

- Updation Anomaly

Apa yang terjadi jika Departemen CSE dipindahkan ke Gedung B3 room 301?

Need of Normalization in DBMS

| SID | Sname | Credits | DeptName |
|-----|--------|---------|----------|
| 1 | Rahul | 5 | CSE |
| 2 | Jiya | 8 | CSE |
| 3 | Jenny | 9 | FDG |
| 4 | Elita | 9 | CVL |
| 5 | Vania | 7 | ECE |
| 6 | Tanaka | 7 | CVL |

| DeptName | Building | Room_No |
|----------|----------|---------|
| CSE | B1 | 101 |
| FDG | B2 | 201 |
| CVL | B2 | 115 |

Normalization

| Normal Form | Test | Remedy (Normalization) |
|--------------|---|--|
| First (1NF) | Relation should have no composite and multivalued attributes or nested relations. | Form new relations for each multivalued attribute or nested relation. |
| Second (2NF) | For relations where primary key contains multiple attributes, no nonkey attribute should be functionally dependent on a part of the primary key. | Decompose set up a new relation for each partial key with its dependent attribute(s). Make sure to keep a relation with the original primary key and any attributes that are fully functionally dependent on it. |
| Third (3NF) | Relation should not have a nonkey attribute functionally determined by another nonkey attribute (or by a set of nonkey attributes). That is, there should be no transitive dependency of a nonkey attribute on the primary key. | Decompose and set up a relation that includes the nonkey attribute(s) that functionally determine(s) other nonkey attribute(s). |

FIGURE 4-25 INVOICE data (Pine Valley Furniture Company)

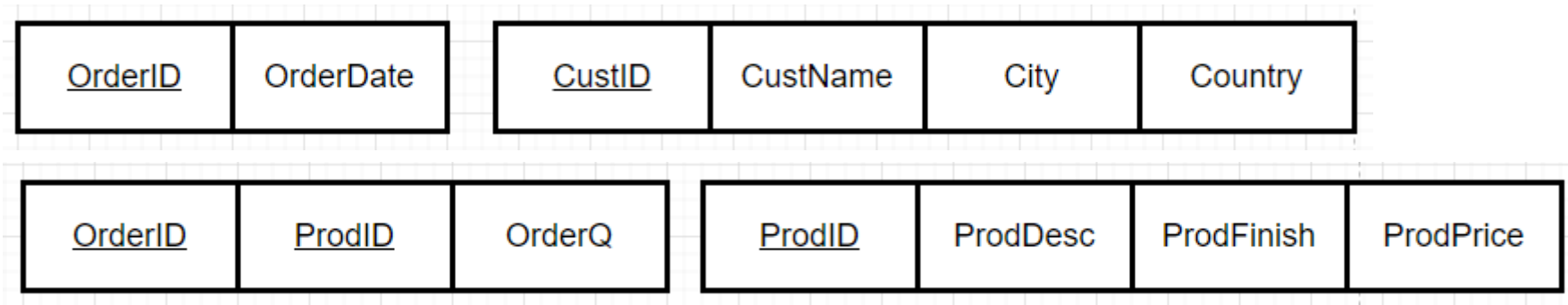
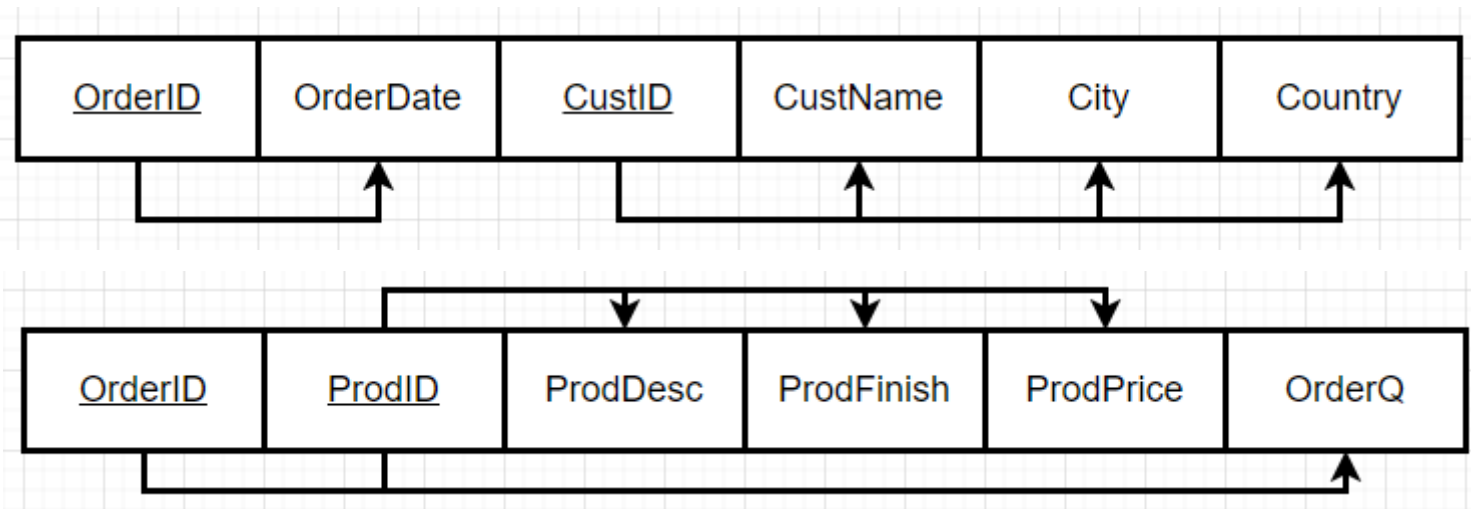
| <u>OrderID</u> | Order Date | Customer ID | Customer Name | Customer Address | <u>ProductID</u> | Product Description | Product Finish | Product StandardPrice | Ordered Quantity |
|----------------|------------|-------------|-------------------|------------------|------------------|----------------------|----------------|-----------------------|------------------|
| 1006 | 10/24/2010 | 2 | Value Furniture | Plano, TX | 7 | Dining Table | Natural Ash | 800.00 | 2 |
| | | | | | 5 | Writer's Desk | Cherry | 325.00 | 2 |
| | | | | | 4 | Entertainment Center | Natural Maple | 650.00 | 1 |
| 1007 | 10/25/2010 | 6 | Furniture Gallery | Boulder, CO | 11 | 4-Dr Dresser | Oak | 500.00 | 4 |
| | | | | | 4 | Entertainment Center | Natural Maple | 650.00 | 3 |

1NF

| | | | | | |
|----------------|-----------|---------------|----------|------|---------|
| <u>OrderID</u> | OrderDate | <u>CustID</u> | CustName | City | Country |
|----------------|-----------|---------------|----------|------|---------|

| | | | | | |
|----------------|---------------|----------|------------|-----------|--------|
| <u>OrderID</u> | <u>ProdID</u> | ProdDesc | ProdFinish | ProdPrice | OrderQ |
|----------------|---------------|----------|------------|-----------|--------|

2NF



3NF

| UNF | | | | | |
|---------------|----------------|------------|----------|-------------|------------|
| Photo ID (PK) | Photo Name | Mobile No. | Company | Company No. | Matches ID |
| P1 | Jim Nasium | 543 | Flashers | 129 | 5 |
| | | | | | 4 |
| | | | | | 2 |
| P2 | Rob Barr | 234 | Flashers | 129 | 1 |
| | | | | | 3 |
| P3 | Chris Tian | 456 | Shooters | 168 | 6 |
| P4 | Dina Mite | 765 | Shooters | 168 | 7 |
| P5 | Chris P. Bacon | 654 | Exposure | 876 | 8 |
| P6 | Joe King | 987 | Exposure | 876 | 9 |
| P8 | Anna Fender | 345 | Exposure | 876 | 10 |

| PROJ_NUM | PROJ_NAME | EMP_NUM | EMP_NAME | JOB_CLASS | CHG_HOUR | HOURS |
|----------|--------------|---------|------------------------|-----------------------|----------|-------|
| 15 | Evergreen | 103 | June E. Arbough | Elect. Engineer | 84.50 | 23.8 |
| | | 101 | John G. News | Database Designer | 105.00 | 19.4 |
| | | 105 | Alice K. Johnson * | Database Designer | 105.00 | 35.7 |
| | | 106 | William Smithfield | Programmer | 35.75 | 12.6 |
| | | 102 | David H. Senior | Systems Analyst | 96.75 | 23.8 |
| 18 | Amber Wave | 114 | Annelise Jones | Applications Designer | 48.10 | 24.6 |
| | | 118 | James J. Frommer | General Support | 18.36 | 45.3 |
| | | 104 | Anne K. Ramoras * | Systems Analyst | 96.75 | 32.4 |
| | | 112 | Darlene M. Smithson | DSS Analyst | 45.95 | 44.0 |
| 22 | Rolling Tide | 105 | Alice K. Johnson | Database Designer | 105.00 | 64.7 |
| | | 104 | Anne K. Ramoras | Systems Analyst | 96.75 | 48.4 |
| | | 113 | Delbert K. Joenbrood * | Applications Designer | 48.10 | 23.6 |
| | | 111 | Geoff B. Wabash | Clerical Support | 26.87 | 22.0 |
| | | 106 | William Smithfield | Programmer | 35.75 | 12.8 |
| 25 | Starflight | 107 | Maria D. Alonzo | Programmer | 35.75 | 24.6 |
| | | 115 | Travis B. Bawangi | Systems Analyst | 96.75 | 45.8 |
| | | 101 | John G. News * | Database Designer | 105.00 | 56.3 |
| | | 114 | Annelise Jones | Applications Designer | 48.10 | 33.1 |
| | | 108 | Ralph B. Washington | Systems Analyst | 96.75 | 23.6 |
| | | 118 | James J. Frommer | General Support | 18.36 | 30.5 |
| | | 112 | Darlene M. Smithson | DSS Analyst | 45.95 | 41.4 |

| REVENUE TRANSACTIONS | | | | | | | | |
|----------------------|------------------|----------------|--------------|-------|-------------|--------|------------|------------------|
| Invoice # | Transaction Date | Service Type # | Service Name | Hours | Hourly Rate | Amount | Customer # | Customer Name |
| 101 | 1/5/2003 | 1 | Bookkeeping | 6 | 25 | 150 | 251 | Stinson & Assoc. |
| | | 3 | Partnership | 25 | 50 | 1,250 | 251 | Stinson & Assoc. |
| 102 | 1/28/2003 | 4 | Personal | 6 | 40 | 240 | 136 | Jack Randall |
| 103 | 2/10/2003 | 4 | Personal | 4 | 40 | 160 | 200 | Judy and June |
| 104 | 2/18/2003 | 1 | Bookkeeping | 20 | 25 | 500 | 257 | Warren Cleaning |
| | | 3 | Partnership | 35 | 50 | 1,750 | 257 | Warren Cleaning |
| 105 | 2/25/2003 | 1 | Bookkeeping | 8 | 25 | 200 | 102 | Bernie Contrell |
| | | 4 | Personal | 16 | 40 | 640 | 102 | Bernie Contrell |
| | | 5 | Tax Planning | 5 | 75 | 375 | 102 | Bernie Contrell |
| 106 | 3/5/2003 | 1 | Bookkeeping | 151 | 25 | 3,775 | 385 | Kirk Company |
| 107 | 3/9/2003 | 4 | Personal | 6 | 40 | 240 | 154 | Amy Holt |