Huy Bui

NORMALIZATION

SQL and Relational Database

Assignment

Timo Mynttinen

2018



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# INTRODUCTION to normalization

Normalization is a database design technique that begins by examining the relationships (called functional dependencies) between attributes. Normalization is a formal technique for analysing relations based on their primary key and functional dependencies.

# NORMALIZATION PROCESS

Three normal forms were initially proposed called First Normal Form (1 NF), Second Normal Form (2 NF), and Third Normal Form (3 NF). Except for 1 NF, all these normal forms are based on functional dependencies among the attributes of a relation.

## First Normal Form (1 NF)

A relation in which the intersection of each row and column contains one and only one value. We begin the process of normalization by first transferring the data from the source (for example, a standard data entry form) into table format with rows and columns. In this format, the table is in unnormalized form and is referred to as an unnormalized table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SocialSecurityNumber | Employee | ContractNumber | HoursDone | TargetName | TargetAddress |
| 051159-056G | Adela Banner | 201401 | 16 | Mikpoli | Patteristonkatu 3 |
| 110684-0056 | Ellis Holt | 201401 | 22 |  |  |
|  |  | 201402 | 27 | Päämajakoulu | Otto Mannisenkatu 10 |
| 110682-112F | Ralf Cockburn | 201403 | 14 | Akseli | Hallituskatu 7-9 |
|  |  | 201404 | 33 | Elomaan Talo | Pirttiniemenkatu 7 |
| 081169-167S | Jerome Palmer | 201404 | 15 |  |  |
| 230899-178K | Hammond Danniel | 201405 | 21 | Mikkelin Kuntopalvelu | Savilahdenkatu 16 |
|  |  | 201406 | 37 | Mikkelin I Apteekki | Porrassalmenkatu 1 |
| 031295-132D | Cathleen Forrest | 201407 | 11 | RengasCenter | Juvantie 77 |
| 073078-234N | Kimmy Terrell | 201407 | 25 |  |  |

To transform the unnormalized table to First Normal Form, we identify and remove repeating groups within the table. A repeating group is an attribute, or group of attributes, within a table that occurs with multiple values for a single occurrence of the nominated key attribute(s) for that table. By entering appropriate data in the empty columns of rows containing the repeating data. In other words, we fill in the blanks by duplicating the nonrepeating data, where required.1st NF

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SocialSecurityNumber | ContractNumber | Employee | HoursDone | TargetName | TargetAddress |
| 051159-056G | 201401 | Adela Banner | 16 | Mikpoli | Patteristonkatu 3 |
| 110684-0056 | 201401 | Ellis Holt | 22 | Mikpoli | Patteristonkatu 3 |
| 110684-0056 | 201402 | Ellis Holt | 27 | Päämajakoulu | Otto Mannisenkatu 10 |
| 110682-112F | 201403 | Ralf Cockburn | 14 | Akseli | Hallituskatu 7-9 |
| 110682-112F | 201404 | Ralf Cockburn | 33 | Elomaan Talo | Pirttiniemenkatu 7 |
| 081169-167S | 201404 | Jerome Palmer | 15 | Elomaan Talo | Pirttiniemenkatu 7 |
| 230899-178K | 201405 | Hammond Danniel | 21 | Mikkelin Kuntopalvelu | Savilahdenkatu 16 |
| 230899-178K | 201406 | Hammond Danniel | 37 | Mikkelin I Apteekki | Porrassalmenkatu 1 |
| 031295-132D | 201407 | Cathleen Forrest | 11 | RengasCenter | Juvantie 77 |
| 073078-234N | 201407 | Kimmy Terrell | 25 | RengasCenter | Juvantie 77 |

## Second Normal Form (2 NF)

Second Normal Form is based on the concept of full functional dependency. Second Normal Form applies to relations with composite keys, that is, relations with a primary key composed of two or more attributes. A relation with a single-attribute primary key is automatically in at least 2 NF. The normalization of 1 NF relations to 2 NF involves the removal of partial dependencies. If a partial dependency exists, we remove the partially dependent attribute(s) from the relation by placing them in a new relation along with a copy of their determinant.

2nd NF

Employee

|  |  |
| --- | --- |
| SocialSecurityNumber | Employee |
| 051159-056G | Adela Banner |
| 110684-0056 | Ellis Holt |
| 110684-0056 | Ellis Holt |
| 110682-112F | Ralf Cockburn |
| 110682-112F | Ralf Cockburn |
| 081169-167S | Jerome Palmer |
| 230899-178K | Hammond Danniel |
| 230899-178K | Hammond Danniel |
| 031295-132D | Cathleen Forrest |
| 073078-234N | Kimmy Terrell |

Contract

|  |  |  |
| --- | --- | --- |
| ContractNumber | TargetName | TargetAddress |
| 201401 | Mikpoli | Patteristonkatu 3 |
| 201401 | Mikpoli | Patteristonkatu 3 |
| 201402 | Päämajakoulu | Otto Mannisenkatu 10 |
| 201403 | Akseli | Hallituskatu 7-9 |
| 201404 | Elomaan Talo | Pirttiniemenkatu 7 |
| 201404 | Elomaan Talo | Pirttiniemenkatu 7 |
| 201405 | Mikkelin Kuntopalvelu | Savilahdenkatu 16 |
| 201406 | Mikkelin I Apteekki | Porrassalmenkatu 1 |
| 201407 | RengasCenter | Juvantie 77 |
| 201407 | RengasCenter | Juvantie 77 |

Work Done

|  |  |  |
| --- | --- | --- |
| SocialSecurityNumber | ContractNumber | HoursDone |
| 051159-056G | 201401 | 16 |
| 110684-0056 | 201401 | 22 |
| 110684-0056 | 201402 | 27 |
| 110682-112F | 201403 | 14 |
| 110682-112F | 201404 | 33 |
| 081169-167S | 201404 | 15 |
| 230899-178K | 201405 | 21 |
| 230899-178K | 201406 | 37 |
| 031295-132D | 201407 | 11 |
| 073078-234N | 201407 | 25 |

## Third Normal Form (3 NF)

A relation that is in first and second normal form and in which no non-primary –key attribute is transitively dependent on the primary key. The normalization of 2 NF relations to 3 NF involves the removal of transitive dependencies. If a transitive dependency exists, we remove the transitively dependent attribute(s) from the relation by placing the attribute(s) in a new relation along with a copy of the determinant.

3rd NF

Contract

|  |  |
| --- | --- |
| ContractNumber | TargetName |
| 201401 | Mikpoli |
| 201401 | Mikpoli |
| 201402 | Päämajakoulu |
| 201403 | Akseli |
| 201404 | Elomaan Talo |
| 201404 | Elomaan Talo |
| 201405 | Mikkelin Kuntopalvelu |
| 201406 | Mikkelin I Apteekki |
| 201407 | RengasCenter |
| 201407 | RengasCenter |

Target

|  |  |
| --- | --- |
| TargetName | TargetAddress |
| Mikpoli | Patteristonkatu 3 |
| Mikpoli | Patteristonkatu 3 |
| Päämajakoulu | Otto Mannisenkatu 10 |
| Akseli | Hallituskatu 7-9 |
| Elomaan Talo | Pirttiniemenkatu 7 |
| Elomaan Talo | Pirttiniemenkatu 7 |
| Mikkelin Kuntopalvelu | Savilahdenkatu 16 |
| Mikkelin I Apteekki | Porrassalmenkatu 1 |
| RengasCenter | Juvantie 77 |
| RengasCenter | Juvantie 77 |

Physical SQL database

Employee

|  |  |  |
| --- | --- | --- |
| Id | SocialSecurityNumber | Employee |
| 1 | 051159-056G | Adela Banner |
| 3 | 110684-0056 | Ellis Holt |
| 4 | 110682-112F | Ralf Cockburn |
| 6 | 081169-167S | Jerome Palmer |
| 8 | 230899-178K | Hammond Danniel |
| 9 | 031295-132D | Cathleen Forrest |
| 10 | 073078-234N | Kimmy Terrell |

Contract

|  |  |  |
| --- | --- | --- |
| Id | ContractNumber | TargetName |
| 1 | 201401 | Mikpoli |
| 3 | 201402 | Päämajakoulu |
| 4 | 201403 | Akseli |
| 6 | 201404 | Elomaan Talo |
| 7 | 201405 | Mikkelin Kuntopalvelu |
| 8 | 201406 | Mikkelin I Apteekki |
| 9 | 201407 | RengasCenter |
| 10 | 201407 | RengasCenter |

Target

|  |  |  |
| --- | --- | --- |
| Id | TargetName | TargetAddress |
| 1 | Mikpoli | Patteristonkatu 3 |
| 2 | Päämajakoulu | Otto Mannisenkatu 10 |
| 3 | Akseli | Hallituskatu 7-9 |
| 4 | Elomaan Talo | Pirttiniemenkatu 7 |
| 5 | Elomaan Talo | Pirttiniemenkatu 7 |
| 6 | Mikkelin Kuntopalvelu | Savilahdenkatu 16 |
| 7 | Mikkelin I Apteekki | Porrassalmenkatu 1 |
| 8 | RengasCenter | Juvantie 77 |
| 9 | RengasCenter | Juvantie 77 |

Work Done

|  |  |  |
| --- | --- | --- |
| SocialSecurityNumber | ContractNumber | HoursDone |
| 051159-056G | 201401 | 16 |
| 110684-0056 | 201401 | 22 |
| 110684-0056 | 201402 | 27 |
| 110682-112F | 201403 | 14 |
| 110682-112F | 201404 | 33 |
| 081169-167S | 201404 | 15 |
| 230899-178K | 201405 | 21 |
| 230899-178K | 201406 | 37 |
| 031295-132D | 201407 | 11 |
| 073078-234N | 201407 | 25 |

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Connolly, T. M., & Begg, C. E. (2005). Database systems: a practical approach to design, implementation, and management. Pearson Education.