CS 3630

Database Design and Implementation

Spring 2021

**Assignment 5**

**Goals**

1. Understand the forms of normalization.
2. Be able to convert a database to a higher normal form.

**Introduction**

The tables used in this homework assignment are (very) loosely based upon the NFL (National Football League). There exist teams that compete in games over several seasons. Each team consists of several players who each play a specific position. A game is played with two teams. The winner of the game is determined by which team has the most points when the game is over. The following are a list of columns that are used in these tables and what they mean.

1. player\_id: A unique id to identify players.
2. player\_name: The name of the player. Player names are not unique.
3. position: The position that the player plays.
4. team\_current\_name: The current name of the team.
5. team\_current\_location: The location that the team is currently associated with.
6. season\_number: The number of the season, starting at number one for the first season.
7. season\_year: The year of the season (Ex: 2019).
8. game\_number: The number of the game within a given season. I made up game numbers for the games.
9. winning\_team\_name: The name of the team who won the game
10. points\_scored: The number of points scores in a game be a given team.

**Question 1: Convert the following table to the first normal form and only the first normal form. Show all the data in the table(s) for the first normal form. A list of functional dependencies is provided below the table.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Season\_number** | **Game\_number** | **Winning\_team\_name** | **Team\_current\_name** | **Team\_current\_location** | **Points\_scored** |
| 100 | 1 | Chiefs | Chiefs | Kansas City | 38 |
| 100 | 1 | Chiefs | Chargers | Los Angeles | 28 |
| 100 | 2 | Chiefs | Chiefs | Kansas City | 42 |
| 100 | 2 | Chiefs | Steelers | Pittsburgh | 37 |
| 100 | 3 | Packers | Packers | Green Bay | 10 |
| 100 | 3 | Packers | Bears | Chicago | 3 |
| 100 | 4 | Packers | Packers | Green Bay | 21 |
| 100 | 4 | Packers | Vikings | Minnesota | 16 |
| 99 | 1 | Rams | Rams | Los Angeles | 33 |
| 99 | 1 | Rams | Raiders | Las Vegas | 13 |
| 99 | 2 | Rams | Rams | Los Angeles | 34 |
| 99 | 2 | Rams | Cardinals | Arizona | 0 |
| 99 | 3 | Patriots | Patriots | New England | 13 |
| 99 | 3 | Patriots | Rams | Los Angeles | 3 |
| 97 | 3 | Patriots | Patriots | New England | 34 |
| 97 | 3 | Patriots | Falcons | Atlanta | 28 |
| 95 | 3 | Patriots | Patriots | New England | 28 |
| 95 | 3 | Patriots | Seahawks | Seattle | 24 |
| 85 | 3 | Patriots | Patriots | New England | 24 |
| 85 | 3 | Patriots | Eagles | Philadelphia | 21 |
| 84 | 3 | Patriots | Patriots | New England | 32 |
| 84 | 3 | Patriots | Panthers | Carolina | 29 |
| 82 | 3 | Patriots | Patriots | New England | 20 |
| 82 | 3 | Patriots | Rams | Los Angeles | 17 |

**Explain why this table is not in the first normal form.**

The table is not in the first normal form because it has non-atomic values such as “Chiefs,Chargers” , “Kansas City, Los Angeles”, and “38,28”.

**Explain why your new table in the first normal form is but not the second normal form.**

The new table contains partial dependencies, and as such it is not in 2NF, as 2NF can not contain partial dependencies.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **season\_number** | **game\_number** | **winning\_team\_name** | **team\_current\_name** | **team\_current\_location** | **points\_scored** |
| 100 | 1 | Chiefs | Chiefs, Chargers | Kansas City, Los Angeles | 38, 28 |
| 100 | 2 | Chiefs | Chiefs, Steelers | Kansas City, Pittsburgh | 42, 37 |
| 100 | 3 | Packers | Packers, Bears | Green Bay, Chicago | 10, 3 |
| 100 | 4 | Packers | Packers, Vikings | Green Bay, Minnesota | 21, 16 |
| 99 | 1 | Rams | Rams, Raiders | Los Angeles, Las Vegas | 33, 13 |
| 99 | 2 | Rams | Rams, Cardinals | Los Angeles, Arizona | 34, 0 |
| 99 | 3 | Patriots | Patriots, Rams | New England, Los Angeles | 13, 3 |
| 97 | 3 | Patriots | Patriots, Falcons | New England, Atlanta | 34, 28 |
| 95 | 3 | Patriots | Patriots, Seahawks | New England, Seattle | 28, 24 |
| 85 | 3 | Patriots | Patriots, Eagles | New England, Philadelphia | 24, 21 |
| 84 | 3 | Patriots | Patriots, Panthers | New England, Carolina | 32, 29 |
| 82 | 3 | Patriots | Patriots, Rams | New England, Los Angeles | 20, 17 |

**Functional Dependencies**

* season\_number, game\_number 🡪 winning\_team\_name
* season\_number, game\_number, team\_current\_name 🡪 team\_current\_location
* season\_number, game\_number, team\_current\_name 🡪 points\_scored
* team\_current\_name 🡪 team\_current\_location
* **Question 2: Convert the following table to the second normal form. Show all the data in the new table(s). A list of functional dependencies is provided below the table.**

|  |  |
| --- | --- |
| **season\_number** | **season\_year** |
| 100 | 2019 |
| 99 | 2018 |
| 97 | 2016 |
| 95 | 2015 |
| 85 | 2005 |
| 84 | 2004 |
| 82 | 2002 |

|  |  |
| --- | --- |
| **game\_number** | **season\_year** |
| 1 | 2019 |
| 1 | 2018 |
| 2 | 2019 |
| 2 | 2018 |
| 3 | 2019 |
| 3 | 2018 |
| 3 | 2016 |
| 3 | 2015 |
| 3 | 2005 |
| 3 | 2004 |
| 3 | 2002 |
| 4 | 2019 |

**Explain why this table is not in the second normal form.**

Because there were partial dependencies due to the primary keys(season\_number and game\_number)

**Explain why your new table in the second normal form.**

The newest table now has two different primary keys, instead of having them combined into one table.

|  |  |  |
| --- | --- | --- |
| **season\_number** | **season\_year** | **game\_number** |
| 100 | 2019 | 1 |
| 100 | 2019 | 2 |
| 100 | 2019 | 3 |
| 100 | 2019 | 4 |
| 99 | 2018 | 1 |
| 99 | 2018 | 2 |
| 99 | 2018 | 3 |
| 97 | 2016 | 3 |
| 95 | 2015 | 3 |
| 85 | 2005 | 3 |
| 84 | 2004 | 3 |
| 82 | 2002 | 3 |

**Primary Key** = season\_number, game\_number

**Functional Dependencies**

* season\_number 🡪 season\_year

**Question 3: Convert the following table to the third normal. Show all the data in the new table(s). A list of functional dependencies is provided below the table.**

|  |  |  |  |
| --- | --- | --- | --- |
| **player\_id** | **player\_name** | **position** | **team\_current\_name** |
| 1 | Tom Brady | Quarterback | Buccaneers |
| 2 | Rob Gronkowski | Tightend | Buccaneers |
| 3 | Aaron Rodgers | Quaerterback | Packers |
| 4 | Davante Adams | Wide Receiver | Packers |
| 5 | Patrick Mahomes | Quarterback | Chiefs |
| 6 | Travis Kelce | Tightend | Chiefs |
| 7 | Bill Belichick | Overlord | Patriots |
| 8 | Joe Montana | Quarterback | NULL |
| 9 | Barry Sanders | Running Back | NULL |
| 10 | Jerry Rice | Wide Receiver | NULL |

|  |  |
| --- | --- |
| **team\_current\_name** | **team\_current\_city** |
| Buccaneers | Tampa Bay |
| Packers | Green Bay |
| Chiefs | Kansas City |
| Patriots | New England |

|  |  |
| --- | --- |
| **player\_id** | **team\_current\_city** |
| 1 | Tampa Bay |
| 2 | Tampa Bay |
| 3 | Green Bay |
| 4 | Green Bay |
| 5 | Kansas City |
| 6 | Kansas City |
| 7 | New England |
| 8 | NULL |
| 9 | NULL |
| 10 | NULL |

* player\_id 🡪 player\_name
* player\_id 🡪 position
* player\_id 🡪 team\_current\_name
* player\_id 🡪 team\_current\_city
* team\_current\_name 🡪 team\_current\_city

**Explain why this table is not in the third normal form.**

The table contains transitive dependency. If you take the player id, you can get the teams current name, which you can also get the teams current city, so the player id correlates to the teams current city through transitive dependency.

**Explain why your new table(s) are the third normal form.**

There is no longer and transitve dependency, it is in the second normal form, and each non-key attribute is dependent on the key directly.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **player\_id** | **player\_name** | **position** | **team\_current\_name** | **team\_current\_location** |
| 1 | Tom Brady | Quarterback | Buccaneers | Tampa Bay |
| 2 | Rob Gronkowski | Tightend | Buccaneers | Tampa Bay |
| 3 | Aaron Rodgers | Quaerterback | Packers | Green Bay |
| 4 | Davante Adams | Wide Receiver | Packers | Green Bay |
| 5 | Patrick Mahomes | Quarterback | Chiefs | Kansas City |
| 6 | Travis Kelce | Tightend | Chiefs | Kansas City |
| 7 | Bill Belichick | Overlord | Patriots | New England |
| 8 | Joe Montana | Quarterback | NULL | NULL |
| 9 | Barry Sanders | Running Back | NULL | NULL |
| 10 | Jerry Rice | Wide Receiver | NULL | NULL |

**Primary Key =** player\_id

**Functional Dependencies**

Note: There are no duplicate player names, however it is possible that there could be. Therefore the player\_name does not determine the position.

* player\_id 🡪 player\_name
* player\_id 🡪 position
* player\_id 🡪 team\_current\_name
* player\_id 🡪 team\_current\_city
* team\_current\_name 🡪 team\_current\_city

**Submission**

Submit the completed word document on Canvas.

Name this file <your last name>\_assignment\_05.

**Grading**

|  |  |
| --- | --- |
| **Criteria** | **Possible Points** |
| Problem 1 – Tables | 20 |
| Problem 1 - Explanations | 15 |
| Problem 2 – Tables | 20 |
| Problem 2 - Explanations | 15 |
| Problem 3 – Tables | 20 |
| Problem 3 - Explanations | 10 |
|  |  |
| **Total** | 100 |