

CS 440 – Databases

Homework 4

Due: Wednesday March 10, 2021

- P. 114, Ex. 3.6.2, 3.6.3
- P. 138–139, Ex. 4.1.1, 4.1.3, 4.1.5, 4.1.9 - Note: For all of these, additionally specify the keys and the referential integrity constraints

Solutions

3.6.2

a)

$s \rightarrow n b$
 $cs \rightarrow cn cb$
 $as \rightarrow am$
 $s \twoheadrightarrow cs \text{ } cn \text{ } cb$
 $s \twoheadrightarrow as \text{ } am$

b) Key is $\{s, cs, as\}$. $s \rightarrow n b$ is a 4NF violation. So decomposing yields: $R_1 = \{s, n, b\}$ and $R_2 = \{s, cn, cs, cb, as, am\}$. In R_2 , $cs \rightarrow cn cb$ is a violation, so decompose into: $R_3 = \{cs, cn, cb\}$ and $R_4 = \{s, cs, as, am\}$. In R_4 , $as \rightarrow am$ is a violation, so decompose into: $R_5 = \{as, am\}$ and $R_6 = \{s, cs, as\}$. So the final decomposition is:

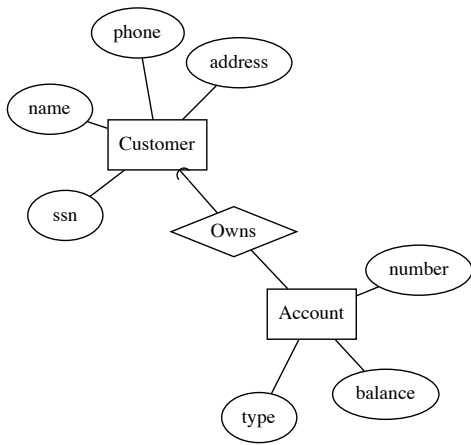
$\{s, n, b\}$
 $\{cs, cn, cb\}$
 $\{as, am\}$
 $\{s, cs, as\}$

3.6.3

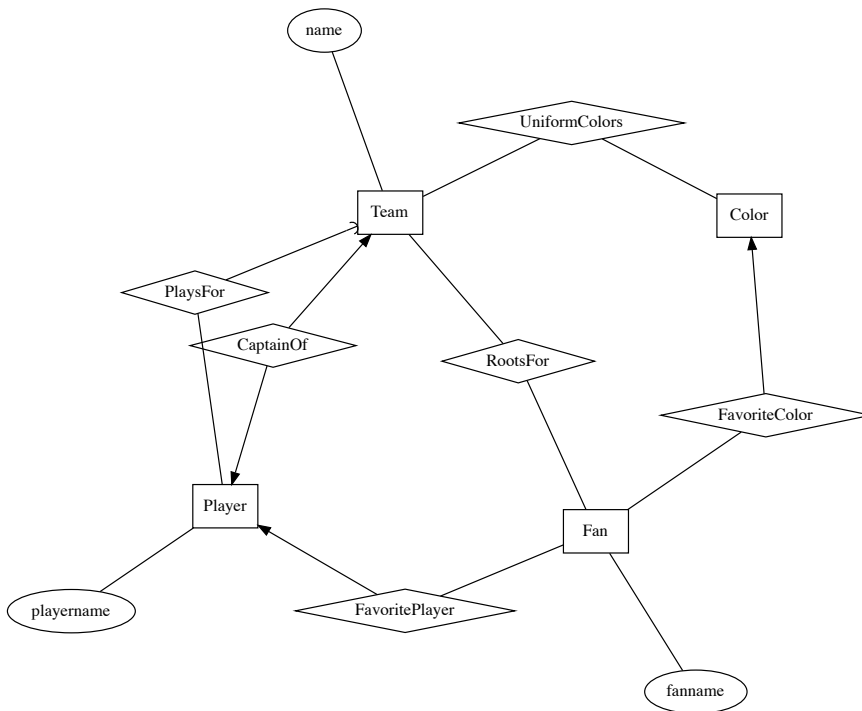
- a) Key: $\{A, B, C, D\}$ so both MVDs are 4NF violations. Decomposition: $\{A, B\}, \{A, C\}, \{A, D\}$
- b) Key: $\{A, B, C, D\}$ so both MVDs are 4NF violations. Decomposition: $\{B, C, D\}, \{A, B\}$.
- c) Key: $\{A, B, C\}$ so both the MVD and FD are 4NF violations violation. Decomposition: $\{B, D\}, \{A, B, C\}$.
- d) Key: $\{A, B, C\}$. All of the MVDs and FDs are violations. Decomposition: $\{A, B\}, \{A, D\}, \{A, C, E\}$

4.1.1

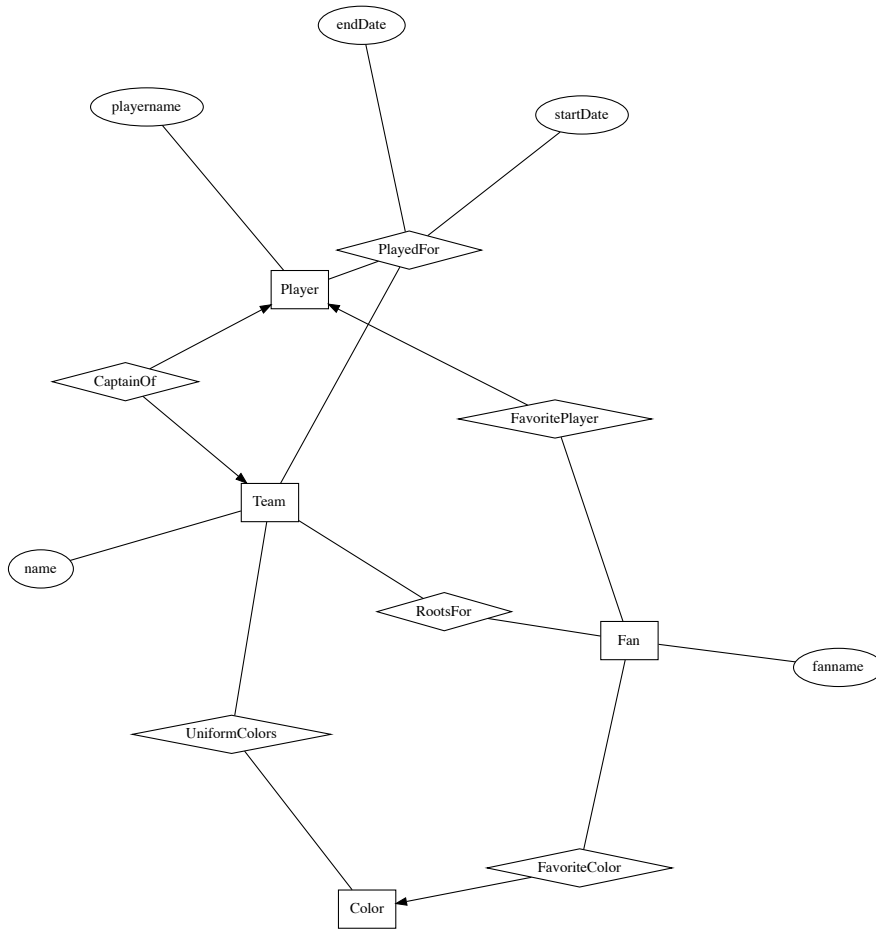
Keys: ssn for Customer and number for Account



4.1.3



4.1.5



4.1.9

