CSC 370 — Database Systems
Summer 2015
Assignment No. 2
Version 1.1. Added item 7.

Note 1 **This assignment is to be done individually**

- Deadline: May 22
- This assignment is worth 1% of your total course mark.

Objectives

After completing this assignment, you will:

- Understand 3NF relations
- Understand simple E/R diagrams

Your task, should you choose to accept it

From the textbook, solve exercises:

1. 3.4.2 parts b) and c) only.
2. 3.5.2
3. 3.5.3
4. 4.1.1
5. 4.1.2
6. 4.1.4 (use the solution to the exercise in class for 4.1.3)
7. Provide CREATE TABLE statements for 4.1.2 (diagram after d) and 4.1.4 (diagram after b)

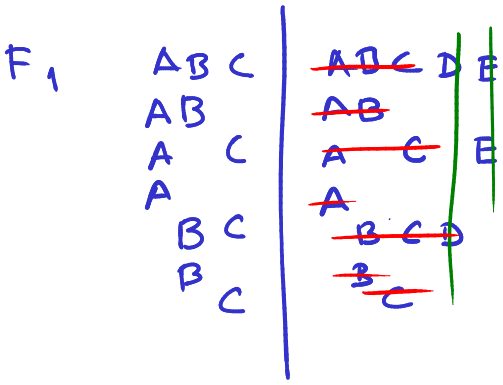
What to submit

At the beginning of the class, submit a paper copy of your assignment.

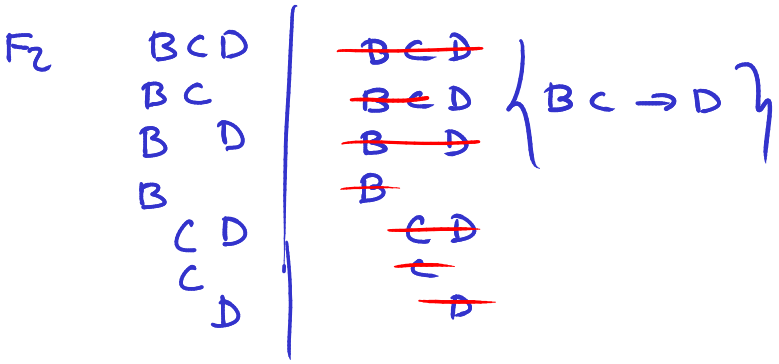
3.4.2 b.

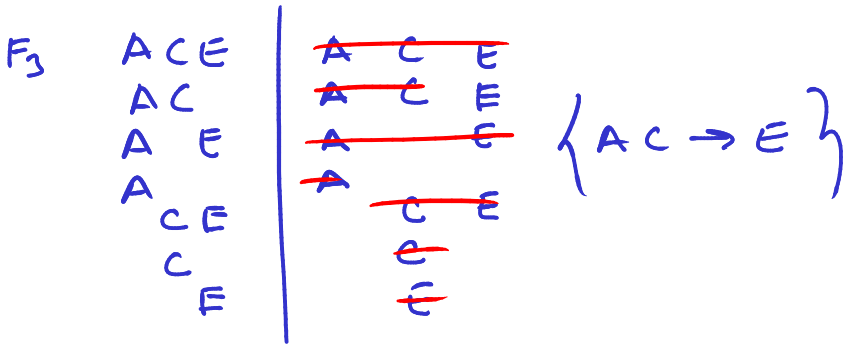
$R(ABCDE)$ $\quad F = \{ AC \to E,\ BC \to D \}$

$R_1 = ABC$ $\quad R_2 = BCD$ $\quad R_3 = ACE$



None





$F = \{ AC \to E,\ BC \to D \}$ $\quad F_1 \cup F_2 \cup F_3 = \{ BC \to D,\ AC \to E \}$

$\Rightarrow$ FD preserving.

3.4.2 b.

$R(ABCDE)$ $\quad F = \{ A \to D,\ D \to E,\ B \to D \}$

$R_1 = ABC$ $\quad R_2 = BCD$ $\quad R_3 = ACE$

FD_1

ABC	~~ABC~~ D E
AB	~~AB~~ D E
A C	~~A~~ ~~C~~ D E
A	~~A~~ D E
B C	~~B~~ ~~C~~ D E
B	~~B~~ D E
C	~~C~~

None

F_2

BCD	~~BCDE~~
BC	~~BC~~ DE
B D	~~B~~ ~~D~~ E
B	~~B~~ DE
C D	~~C~~ ~~D~~ E
C	~~C~~
D	~~D~~ E

$BC \to D$

$B \to D$

F_3

ACE	~~A~~ ~~C~~ D ~~E~~
AC	~~A~~ ~~C~~ D E
A E	~~A~~ D ~~E~~
A	~~A~~ D E
CE	~~C~~ ~~E~~
C	~~C~~
E	~~E~~

$AC \to E$

$A \to E$

$F = \{ A \to D,\ D \to E,\ B \to D \}$

$F_1 \cup F_2 \cup F_3 = \{ BC \to D,\ B \to D,\ AC \to E,\ A \to E \}$

Can $A \to D$ be generated from ↑ ?

$\{A\}^+ = \{A\ E\} \Rightarrow$ NO

· Decomposition is not FD preserving.

3.5.2

Courses (C T H R S G)

$C \rightarrow T$

$HR \rightarrow C$

$HT \rightarrow R$

$HS \rightarrow R$

$CS \rightarrow G$

a) Keys Attributes never in RHS : {~~C~~ ~~T~~ H ~~R~~ S ~~G~~}

Hence H and S must be part of a key.

H S C T R G	H S C T R G
H S C T R G	H S
H S C T G	H S
H S C T	H S
H S C R G	H S
H S C R	H S
H S C G	H S
H S C	H S
H S T R G	H S
H S T R G	H S
H S T G	H S
H S T	H S
H S R G	H S
H S R	H S
H S G	H S
H S	H S C T R G.

HS is a Candidate key.

Hence HS is the only CK

b) Minimal basis?

1) $C \to T$
$HR \to C$
$HT \to R$
$HS \to R$
$CS \to G$

} already in Canonical Form

2) $\{H\}^+ = \{H\}$ $\quad \{S\}^+ = \{S\}$
$\{T\}^+ = \{T\}$
$\{C\}^+ = \{CT\}$ All LHS att required.

3) $C \to T$ ✓
$HR \to C$ ✓
$HT \to R$ ✓
$HS \to R$ ✓
$CS \to G$ ✓

$\{CS\}^+ = \{CT\}$

Yes it is a minimal basis.

c) Decompose.

$R_1 = CT$ $\quad C \to T$
$R_2 = HRC$ $\quad HR \to C$
$R_3 = HTC$ $\quad HT \to R$
$R_4 = HSR$ $\quad HS \to R$ ← Contains candidate key.
$R_5 = CSG$ $\quad CS \to G$

All relations are BCNF.

3.5.3 Stocks(BOISQD)

$S \to D$ $I \to B$ $IS \to Q$ $B \to O$

Attributes not in RHS: {~~B~~ ~~O~~ I S ~~Q~~ ~~D~~}

Is IS a CK? $\{IS\}^+ = \{I\ S\ D\ B\ Q\ O\}$.

Since any CK must contain IS, therefore IS is the only CK.

b)

$S \to D$
$I \to B$
$IS \to Q$
$B \to O$

$\{S\}^+ = \{D\ S\}$
$\{I\}^+ = \{I\ B\ O\}$

All FDs are required ⇒ minimal basis!

c) $R_1 = SD$ $S \to D$

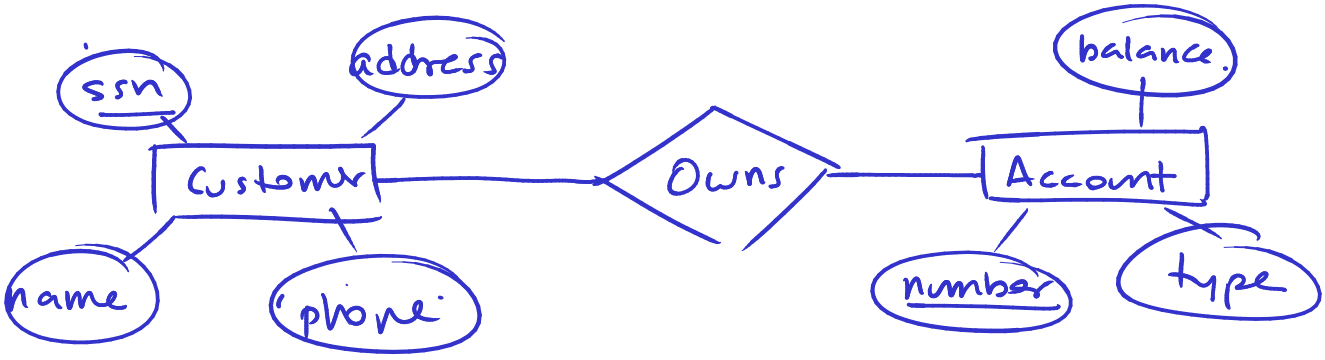
$R_2 = IB$ $I \to B$

$R_3 = ISQ$ $IS \to Q$ ← contains CK.

$R_4 = BO$ $B \to O$.

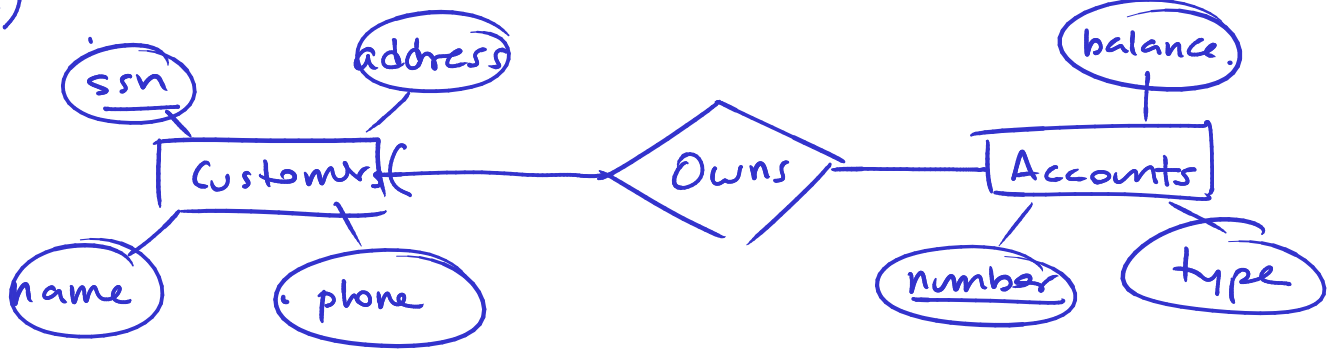
All are BCNF

4.1.1



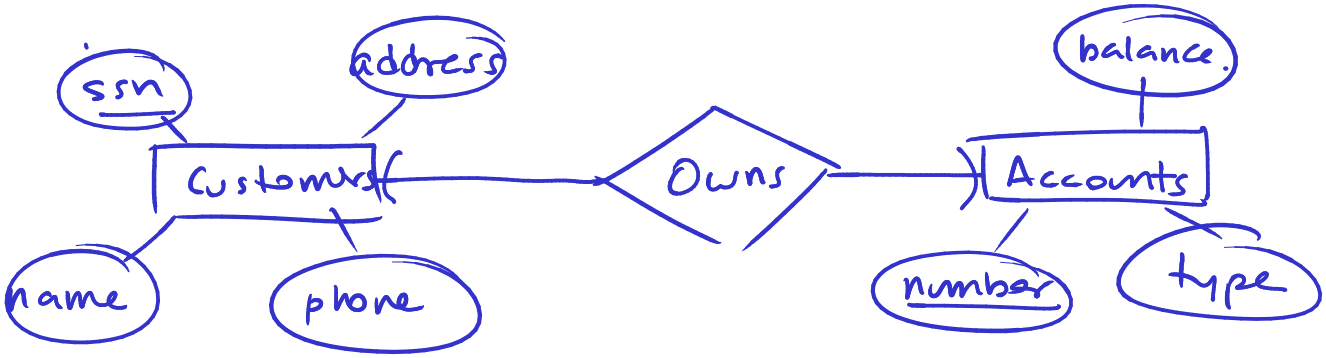
4.1.2

a)



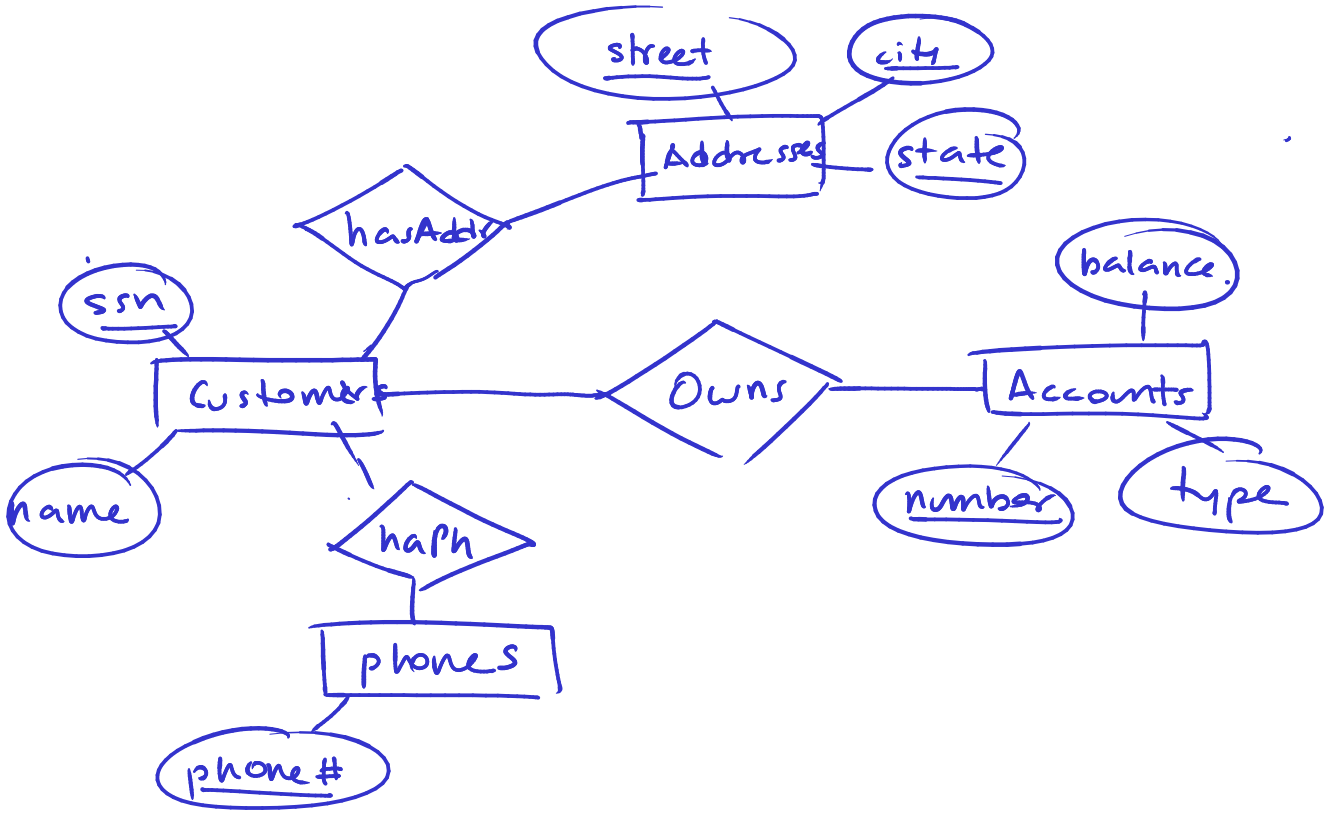
Implies exactly one customer

b)

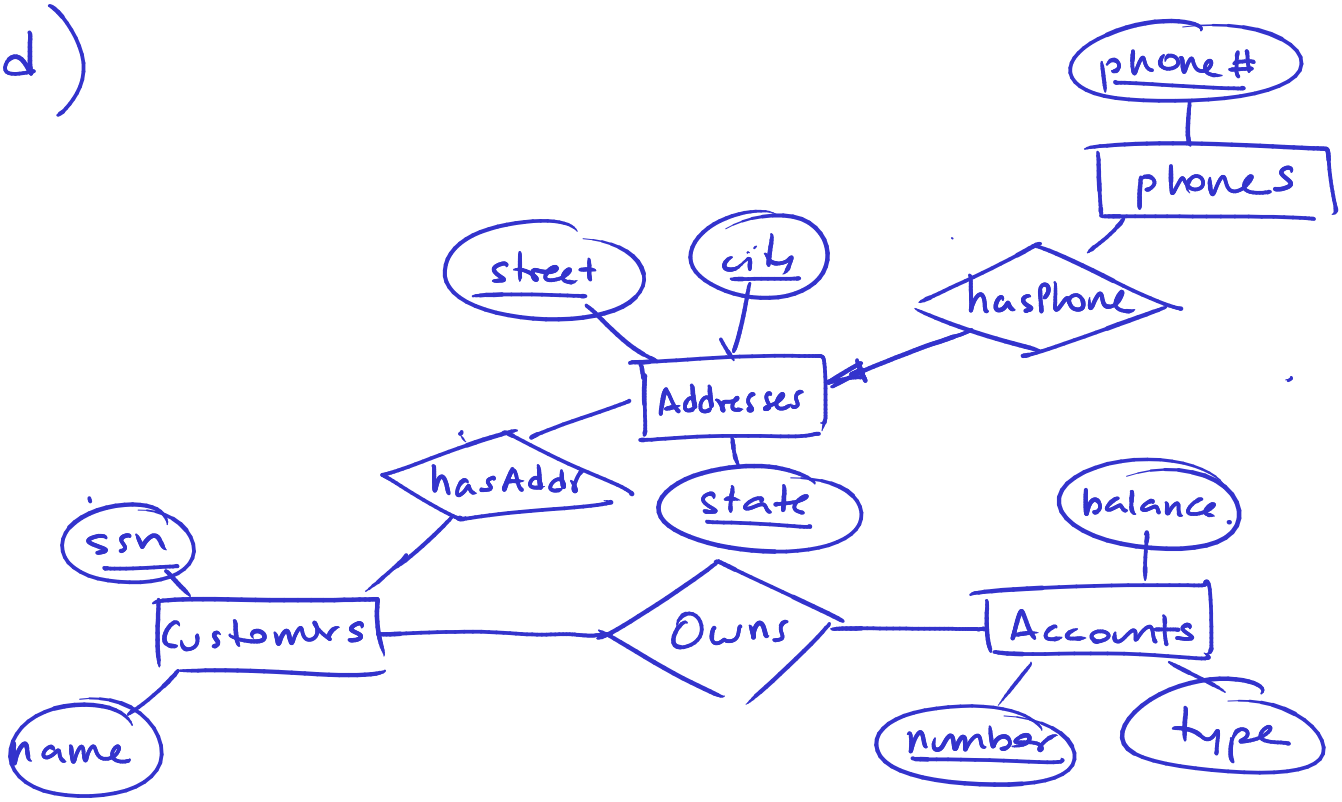


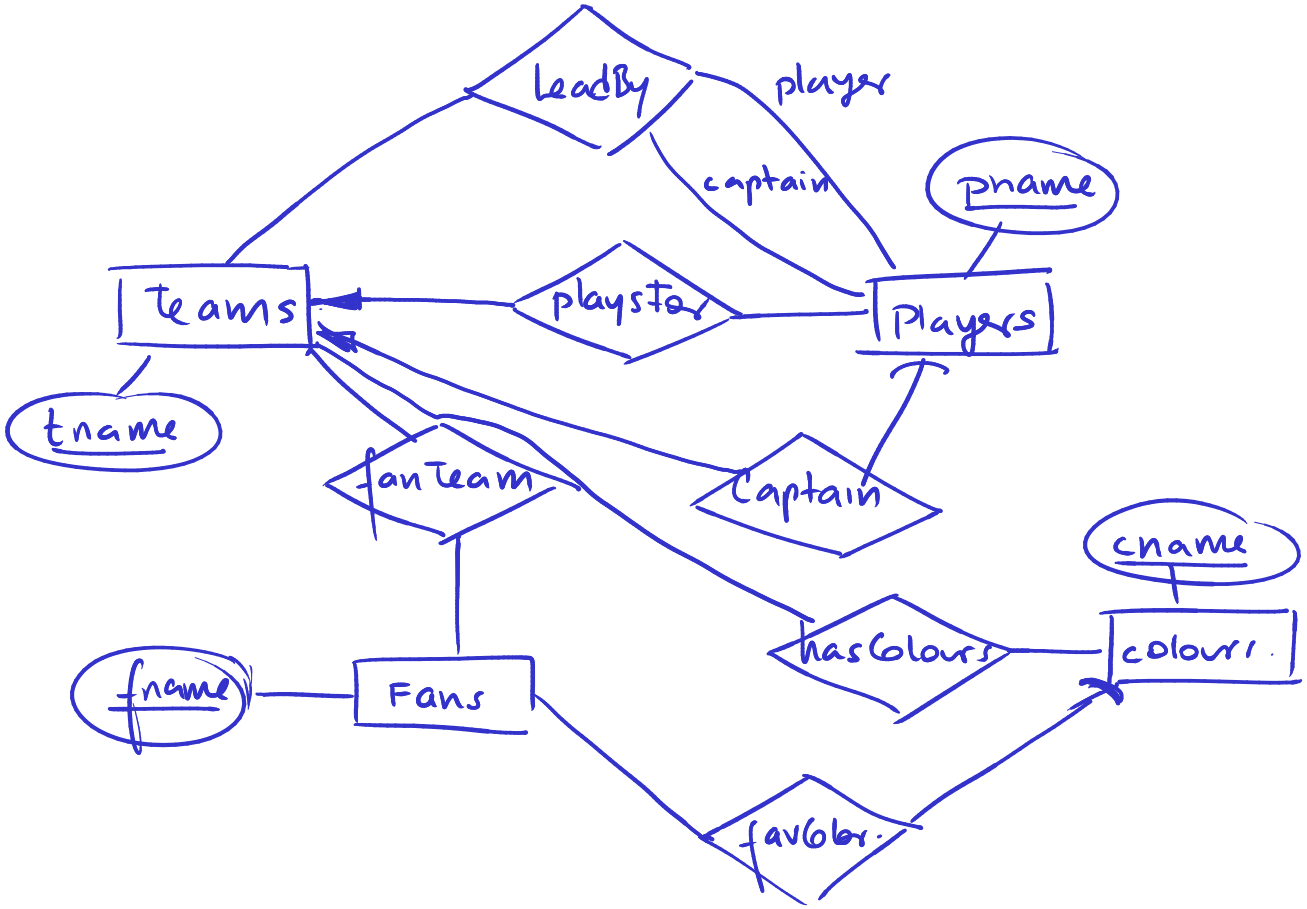
Implies exacty one account and exactly one customer

c)

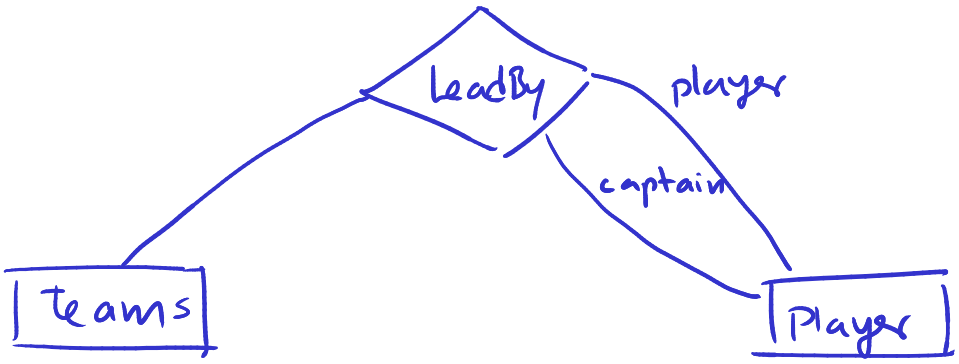

street
city
Addresses
state
hasAddr
ssn
balance
Customers
Owns
Accounts
name
number
type
hasPh
phones
phone#

d)


phone#
phones
street
city
hasPhone
Addresses
hasAddr
state
ssn
balance
Customers
Owns
Accounts
name
number
type



b) Replace



with