

UNIVERSITY OF VICTORIA
Faculty of Engineering
Department of Computer Science

CSC 370 (Database Systems)
Instructor: Daniel M. German

Midterm #1
4 June 2018

Duration: 75 minutes

Student ID: V00852222

This is a closed-book exam. You are only allowed one hand written sheet of paper (letter-size).

This examination paper consists of 6 pages. Please bring any discrepancy to the attention of an invigilator.

Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

Please write your answers clearly.

For instructors use:

Question	Points	Score
1	16	8
2	8	7.5 8
Total:	24	15.5

21

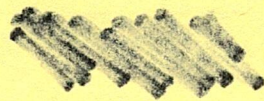
6 + 3 + 4
4
3.5 + 4

(5)

12

12

12



1. Database design

For each question in this section, place an **X** beside all answers that apply (there might be more than one answer per question). Each question is worth three (3) marks. Partial marks are not given for incomplete answers.

(a) [3 points] Consider the relation $R(A,B,C,D,E)$ with functional dependencies:

$$AB \rightarrow C, C \rightarrow D, BD \rightarrow E$$

Which of the following sets of attributes does not functionally determine E?

☒ 1. ACD

☐ 2. ABC

☐ 3. AB

☐ 4. BC

☒ 5. AD

$$AB \rightarrow C$$

$$C \rightarrow D$$

$$BD \rightarrow E$$

need B

✶ (b) [3 points] Let $R(A,B,C,D,E)$ be a relation in Boyce-Codd Normal Form (BCNF). Suppose ABC is the only candidate key for R. Which of the following functional dependencies is guaranteed to hold for R?

☐ 1. $ACDE \rightarrow B$

☒ 2. $ABCD \rightarrow E$

☐ 3. $BCD \rightarrow E$

☐ 4. $ACD \rightarrow E$

☐ 5. $AB \rightarrow C$

$$ABC \rightarrow R$$

- (c) [3 points] Consider relation $R(A,B,C,D)$ with functional dependencies:

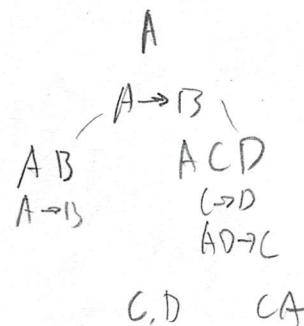
$A \rightarrow B, C \rightarrow D, AD \rightarrow C, BC \rightarrow A$

Suppose we decompose R into a set of relations in Boyce-Codd Normal Form (BCNF).

Which of the following sub-relations could not be in the result of the decomposition?

- ☐ 1. CD
☒ 2. ABD
☐ 3. AB
☒ 4. AC

$A \rightarrow B$
 $C \rightarrow D$
 $AD \rightarrow C$
 $BC \rightarrow A$



- (d) [3 points] Consider the relation $R(A,B,C,D,E)$ with functional dependencies: $A \rightarrow BC$
 $CD \rightarrow E, B \rightarrow D, E \rightarrow A$

Which of the following is a candidate key?

- ☒ 1. BDE
☒ 2. CD
☒ 3. A
☐ 4. AB
☒ 5. BC

$A \rightarrow BC$
 $CD \rightarrow E$
 $B \rightarrow D$
 $E \rightarrow A$

$A \rightarrow ABCDE$
 $E \rightarrow A$
 $BC \rightarrow ABCDE$

(e) [4 points] Given the relation R(A,B,C,D,E,F,G,H) with functional dependencies:

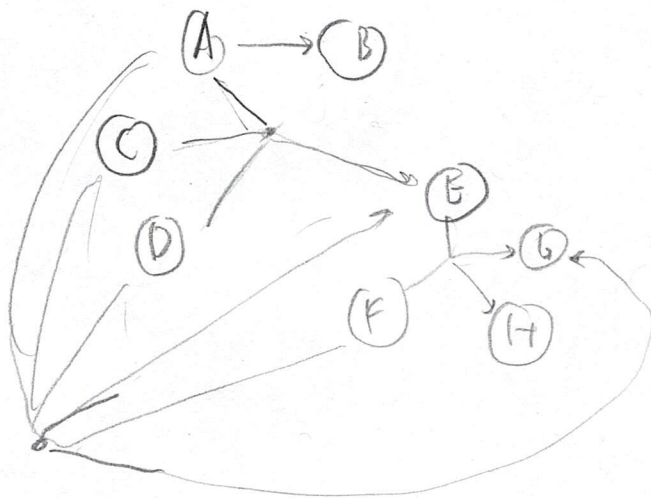
$$A \rightarrow B, ABCD \rightarrow E, EF \rightarrow GH, ACDF \rightarrow EG.$$

Compute its minimal basis. Show all your work. Write your solution inside the box below.

$A \rightarrow B, ACD \rightarrow E, EF \rightarrow G, EF \rightarrow H$

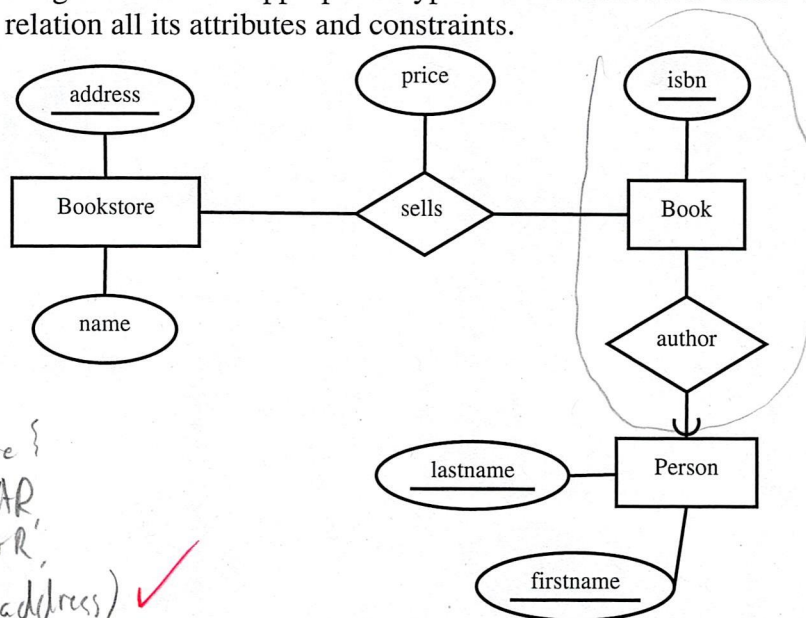
$A \rightarrow B$ $A \rightarrow B$
 $ABCD \rightarrow E$ $\rightarrow A \rightarrow B$ $\rightarrow ACD \rightarrow E$
 $EF \rightarrow GH$ $\rightarrow \text{split}$ $EF \rightarrow G$ $EF \rightarrow H$ $\leftarrow \text{dup}$
 $ACDF \rightarrow EG$ $\rightarrow ACD \rightarrow E$ $\rightarrow \cancel{EF} \rightarrow \cancel{G}$ \leftarrow

need: A, C, D, F
 ~~$\frac{b}{c}$ not on RHS~~



2. Entity Relationship

- (a) [4 points] Provide CREATE TABLE statements for the SQL relations that represent the following ER diagram. Choose appropriate types for the attributes. Make sure you include in each relation all its attributes and constraints.



```

CREATE TABLE Bookstore {
    address VARCHAR,
    name VARCHAR,
    PRIMARY KEY (address) ✓
}
  
```

```

CREATE TABLE Book {
    isbn CHAR(11),
    author_lastname VARCHAR NOT NULL,
    author_firstname VARCHAR NOT NULL,
    PRIMARY KEY (isbn) ✓,
    FOREIGN KEY (author_lastname, author_firstname) REFERENCES Person ✓
}
  
```

```

CREATE TABLE Person {
    lname VARCHAR,
    fname VARCHAR,
    PRIMARY KEY (lname, fname) ✓
}
  
```

```

CREATE TABLE Sells {
    address VARCHAR,
    isbn CHAR(11),
    price INT,
    PRIMARY KEY (address, isbn) ✓,
    FOREIGN KEY (address) REFERENCES Bookstore ✓,
    FOREIGN KEY (isbn) REFERENCES Book ✓
}
  
```


(b) [4 points] Draw the ER diagram for the following database requirements. Choose appropriate names for the entities and attributes. **Hint:** do not over complicate it and do not worry about things that are not explicitly indicated below (e.g. there is no restriction on how many players can have the same number in a given team).

1. A player has a name, age and address. A player can be uniquely identified by providing both: his/her name and address.
2. Each team has a unique name. We want to keep track of the city where the team plays.
3. A player plays for at most one team.
4. A team assigns each of its players a number.
5. A team must have exactly one captain (a player).

