

The University of British Columbia
Computer Science 304

Midterm Examination
February 5, 2007

Time: 50 minutes

Total marks: 38

Instructor: Rachel Pottinger

Name _____ Student No _____
(PRINT) (Last) (First)

Signature _____

This examination has 6 pages.

Check that you have a complete paper.

This is a closed book, closed notes exam. No books or other material may be used.

Answer all the questions on this paper.

Give very **short but precise** answers.

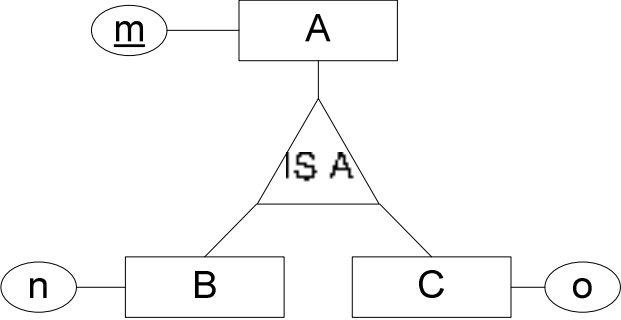
State any assumptions you make

Work fast and do the easy questions first. Leave some time to review your exam at the end.

Good Luck

Question	Mark	Out of
1		6
2		11
3		4
4		10
5		7

1. {6 marks, 1 mark per question} Circle only **one** answer per question – no points will be taken off for incorrect answers (i.e., you might as well guess):

a. If X is a key of a relation R, X is also a superkey of R	True False
b. A relationship in an ER diagram must be uniquely determined by the entities in that relationship	True False
c. Every relation that is in BCNF is also in 3NF	True False
<p>d. </p> <p>A, B, and C above should be represented by two tables, $B(\underline{m},n)$, $C(\underline{m},o)$, in a corresponding relational schema if the IS-A relationship is partial</p>	True False
e. $MN \rightarrow O, P \rightarrow Q, Q \rightarrow O$ is a minimal cover for the set of functional dependencies $MN \rightarrow O, P \rightarrow Q, MN \rightarrow Q, Q \rightarrow O$.	True False
f. An insertion anomaly is when it may not be possible to store certain information unless some other, unrelated, information is stored as well	True False

2. {11 marks} Consider the schema $R = (A, B, C, D, E)$ together with the functional dependencies:

$AB \rightarrow C$

$CD \rightarrow A$

$C \rightarrow E$

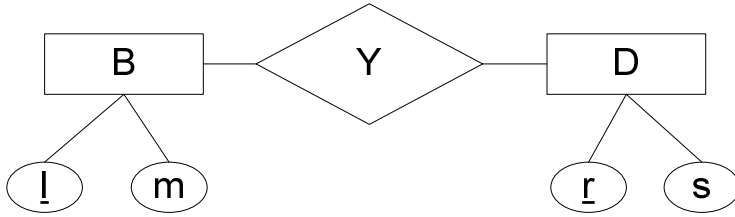
$C \rightarrow B$

- a. {4 marks} What are the key(s) of R ? Show your work to prove why each key is a key
- b. {5 marks} Is $R(A, B, C, D, E)$ in **BCNF**? Why or why not? If not, decompose this relation into BCNF using the algorithm we covered in class and in the book; circle all answers in your final decomposition.
- c. {2 marks} Is $R(A, B, C, D, E)$ in **3NF**? Why or why not?

3. {4 marks} ER relationship types.

a.

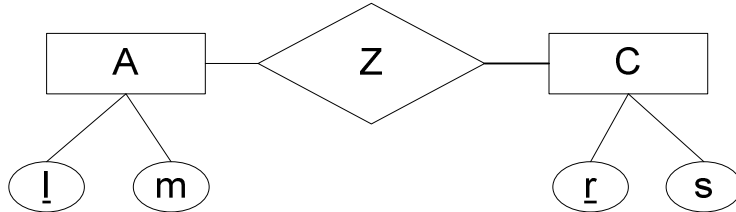
i. {1 mark} Change the ER diagram below so that B to D is a Many to One relationship



ii. {1 mark} Give a set of entities for B and D that violate the above constraint, and explain why they violate it

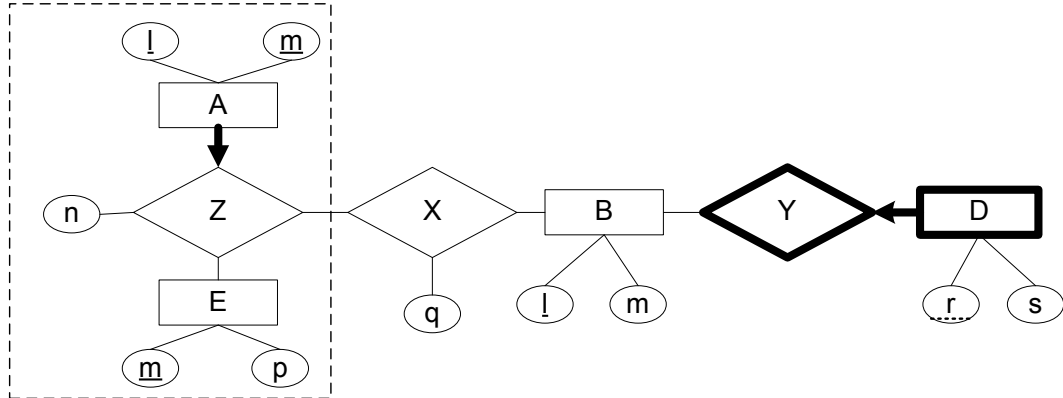
b.

i. {1 mark} Change the ER diagram below so that every C must participate in Z



ii. {1 mark} Give a set of entities for A and C that violate the above constraint, and explain why they violate it

4. {10 marks} Given the following ER diagram:



Transform the ER diagram into a relational schema using the methods discussed in class/the book. State any assumptions that you make – but your assumptions cannot contradict the facts given.

- a. {8 marks} Give the SQL DDL necessary to create the relational schema. You do *not* have to include types for any attributes

- b. {2 marks} Are there any constraints in the relational schema that cannot be modeled without using assertions? If so, which constraint(s)? If not, why not?

5. {7 marks} Consider the following relation instance:

A	B	C
Eric	2	Dempster
Eric	2	ICICS/CS
Ting	3	ICICS/CS
Ting	3	Dempster
Ying	5	SUB
Ying	6	Koerner

- a) {5 marks} Observe that $B \rightarrow A$ appears to hold with respect to the given instance. Check to see if all of the following dependencies hold with respect to the instance, *and give a reason if they do not*.
- $A \rightarrow B$
 - $A \rightarrow C$
 - $B \rightarrow C$
 - $C \rightarrow A$
 - $C \rightarrow B$
- b) {2 marks} Determine the minimum number of tuples that can be added to the above instance to invalidate $B \rightarrow A$. Demonstrate your answer by showing example(s) of such tuple(s).