

The University of British Columbia
Computer Science 304

Midterm Examination
January 30, 2012

Time: 50 minutes

Total marks: 40

Instructor: Rachel Pottinger

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

Signature _____

This examination has 3 double-sided 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.

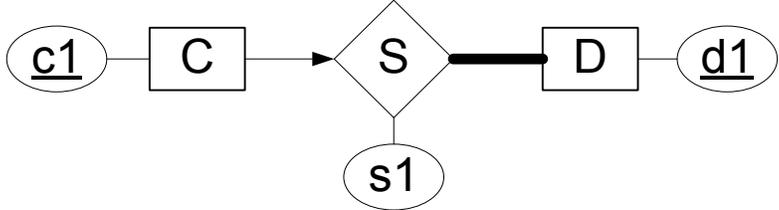
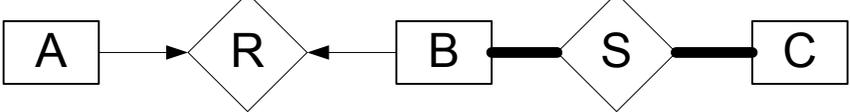
State any assumptions you make

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 | | 10 |
| 2 | | 8 |
| 3 | | 4 |
| 4 | | 8 |
| 5 | | 10 |
| Total | | 40 |

1. { 10 marks}

| | | |
|----|---|--|
| a. | <p>All constraints on the following ER diagram can be translated into the relational model with what we know now</p>  | <p><i>TRUE</i></p> <p><i>FALSE</i></p> |
| b. | <p>Suppose that a1 and a2 are the only entities of A, b1 and b2 are the only entities of B, and c1 and c2 are the only entities of C.</p> <p>If $T = \{(e1, f1)\}$ means a relationship between e1 and f1 exists in relationship set, then $R = \{\}$; $S = \{(b1, c1), (b2, c1), (b2, c2)\}$ is possible according to the following ER diagram (attributes have been left off to avoid confusion):</p>  | <p><i>TRUE</i></p> <p><i>FALSE</i></p> |
| c. | <p>A weak entity allows us to treat a relationship set as an entity set for purposes of participation in (other) relationships</p> | <p><i>TRUE</i></p> <p><i>FALSE</i></p> |
| d. | <p>We cannot check a database instance to verify an integrity constraint.</p> | <p><i>TRUE</i></p> <p><i>FALSE</i></p> |
| e. | <p>In an ER diagram, the primary key of an entity is the key chosen as the principal means to identify entities in an entity set</p> | <p><i>TRUE</i></p> <p><i>FALSE</i></p> |

2. {8 marks} Consider the schema $S(A, B, C, D, E, F)$ together with the functional dependencies:

$ABC \rightarrow E$

$ABC \rightarrow D$

$D \rightarrow A$

$A \rightarrow E$

$E \rightarrow F$

Is S in BCNF? Why or why not? If not, decompose into BCNF using the method shown in class and in the book; circle the answers in your final decomposition. If so, explain why it is in BCNF.

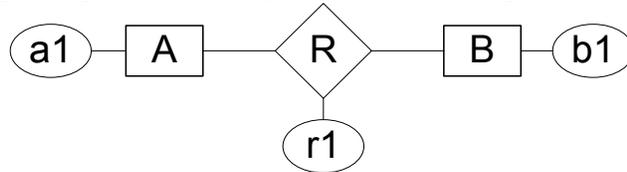
3. {4 marks} Consider $R(A,B,C,D,E)$ with functional dependencies
 $C \rightarrow D$
 $DE \rightarrow B$
 $AB \rightarrow C$

is R in 3NF? Why or why not? (Note: I have *NOT* asked you to decompose if R is not in 3NF.)

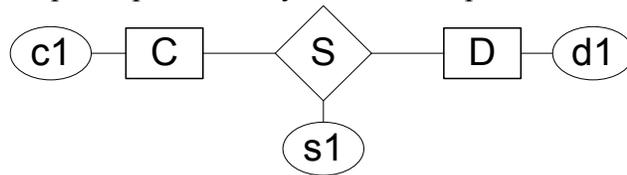
4. {8 marks}

For each part below, annotate the related diagram so that it provides the additional requested functionality – **do not add any additional constraints beyond what is required**. If nothing needs to be done to the diagram or it is impossible to add that constraint in our version of ER diagram, state why. State any assumptions.

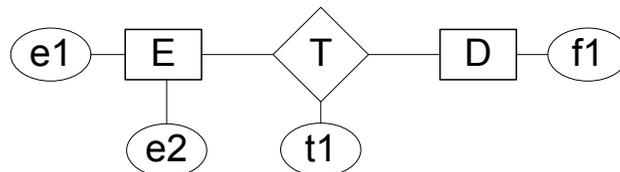
a. Each entity in A participates in exactly one R relationship



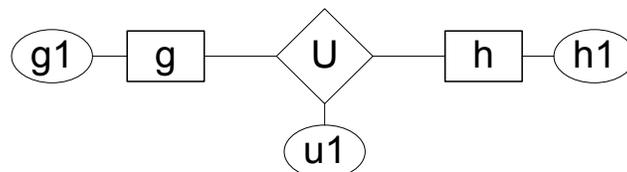
b. Each entity in C can participate in many S relationships



c. The key of E is e1 and e2



d. The key of U is u1



5. {10 marks}

Suppose that we have a ternary relationship S between entity sets D , E , and F such that D has a key constraint and E has a key constraint and total participation; these are the only constraints. D has attributes $d1$ and $d2$, with $d1$ being the key; E has attributes $e1$ and $e2$, with $e1$ being the key; and F has attributes $f1$ and $f2$, with $f1$ being the key. S has no descriptive attributes. All attributes are integers. Write SQL statements that create tables corresponding to this information so as to capture as many of the constraints as possible. If you cannot capture some constraint, explain why.