

The University of British Columbia
Computer Science 304

Midterm Examination
October 31, 2005

Time: 50 minutes

Total marks: 50

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 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.

The marks for each question are given in {}. Use this to manage your time. Do not spend on a question more minutes than the marks assigned to it.

Good Luck

MARKS	
1.	
2.	
3.	
4.	
Total	

1. {8 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.	SQL is a procedural language	True False
b.	We use ER diagrams to logically model concepts	True False
		True False
c.	This diagram is an example of a relationship with a many to one cardinality ratio	True False
d.	Every query that can be expressed in relational algebra can be expressed as a safe query in domain relational calculus; the converse is also true	True False
e.	$AB \rightarrow C, D \rightarrow E, E \rightarrow C$ is a minimal cover for the set of functional dependencies $AB \rightarrow C, D \rightarrow E, AB \rightarrow E, E \rightarrow C$.	True False
f.	An update anomaly is when it is not possible to store certain information unless some other, unrelated, information is stored as well.	True False
g.	Given the table $R(\underline{a}, \underline{b}, c)$ (i.e., a and b form the primary key of R), the following is a valid table definition. CREATE TABLE S (a INTEGER, d INTEGER, e INTEGER, PRIMARY KEY (d), FOREIGN KEY (a) references R)	True False
h.	In ER diagrams, aggregation may be used instead of a ternary relation if we need to impose additional constraints	True False

2. {14 marks} Consider the schema $R = (A, B, C, D, E, F)$ together with the functional dependencies:

$A \rightarrow B$

$DE \rightarrow F$

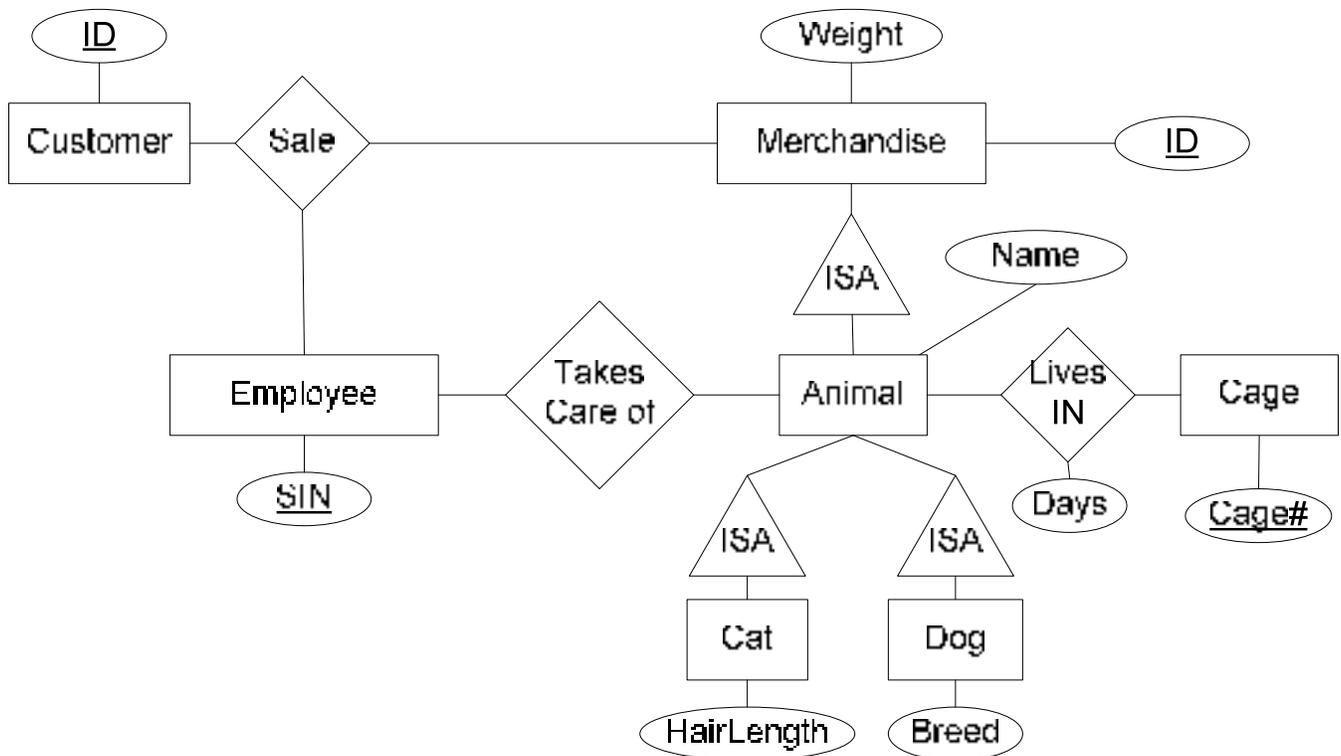
$B \rightarrow C$

a. {10 marks} Is $R(A, B, C, D, E, F)$ in BCNF? If so, say why. 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.

b. {4 marks} Is $R(A, B, C, D, E, F)$ in 3NF? If so, why. If not, list all violations of 3NF in R .

3. {14 marks} Look at the following partially-constructed ER diagram about pet stores, which includes the following:

- Merchandise can be of many types, including animals and other types
- Animals can be cats, dogs, or other species
- Merchandise can be sold, which involves the merchandise, an employee, and a customer
- Animals are taken care of by some employee
- Animals live in cages



- a. {6 marks} Make the following changes/additions to the ER diagram:
- Add in the constraint that each animal must be taken care of by some employee
 - Add in the date that an employee takes care of an animal. Note that you should make it possible for an employee to take care of an animal on more than one date
 - Add in the specification that each animal lives in *exactly one* cage

4. {14 marks} Consider a relational database about real estate that is maintained by a real estate agency. The database consists of the following table (where the primary keys are underlined):

House (id, asking_price, address, postal_code, baths, beds, sqft, sellerID)
Seller(id, name, home_phone, e-mail, agentID)
Buyer(id, name, home_phone, e-mail, agentID)
Agent(id, name, mobile_phone, e-mail)
Sold(house id, buyer id, sale-date, selling_price)

Where House gives information about a house for sale, seller gives information about the sellers of a house, Buyer gives information about (prospective) home buyers, Agent gives information about agents (who can act on behalf of either the buyer or the seller), and sold gives information about the sale of a particular home – including the price at which the home sold, which may differ from the asking price.

- a. {7 marks} answer the following questions in relational algebra:
- What are the ids, addresses, asking_price, and selling_price of all houses that sold for less than the asking price?
 - What are names of all of (prospective) buyers who have not bought a house? Each name should appear only once.
- b. {7 marks} Answer the following questions in SQL:
- For each postal code in which there were at least three houses sold, find the postal code and the average selling price of houses in that postal code.
 - Find the addresses and asking prices of all houses that have at least 3 bedrooms and two bathrooms that have not sold. Each address, asking price pair should appear only once.