UNIVERSITY of TORONTO
SCARBOROUGH

Summer 2011 CSCC43/ Introduction to Databases

Assignment 1

Due Date: **Tuesday, June 14th, 11:59 p.m.**

Question A – ER Diagram [30 marks]

A small private airport owner would like to build a database application to keep track of airplanes, airplanes owners, airport employees, and pilots. From the requirements gathering sessions, the following information was collected:

1. Each airplane has a registration number, is of a particular plane type, and is stored in a particular hangar.

2. Each plane type has a model number, a capacity, and a weight.

3. Each hanger has a number, a capacity and a location.

4. The database application should also keep track of the owners of each plane, the purchase date, and the employees who have serviced the plane.

5. Each plane undergoes service many times.

6. A service record includes as attributes the date of maintenance, the number of hours spent on the work, and the type of work done.

7. The airplane registration number is used to identify a service record.

8. An owner is either a person or a corporation. For corporation, the data kept includes name, address, and telephone number.

9. Each pilot has license number and restrictions.

10. Each employee has a salary, shift worked.

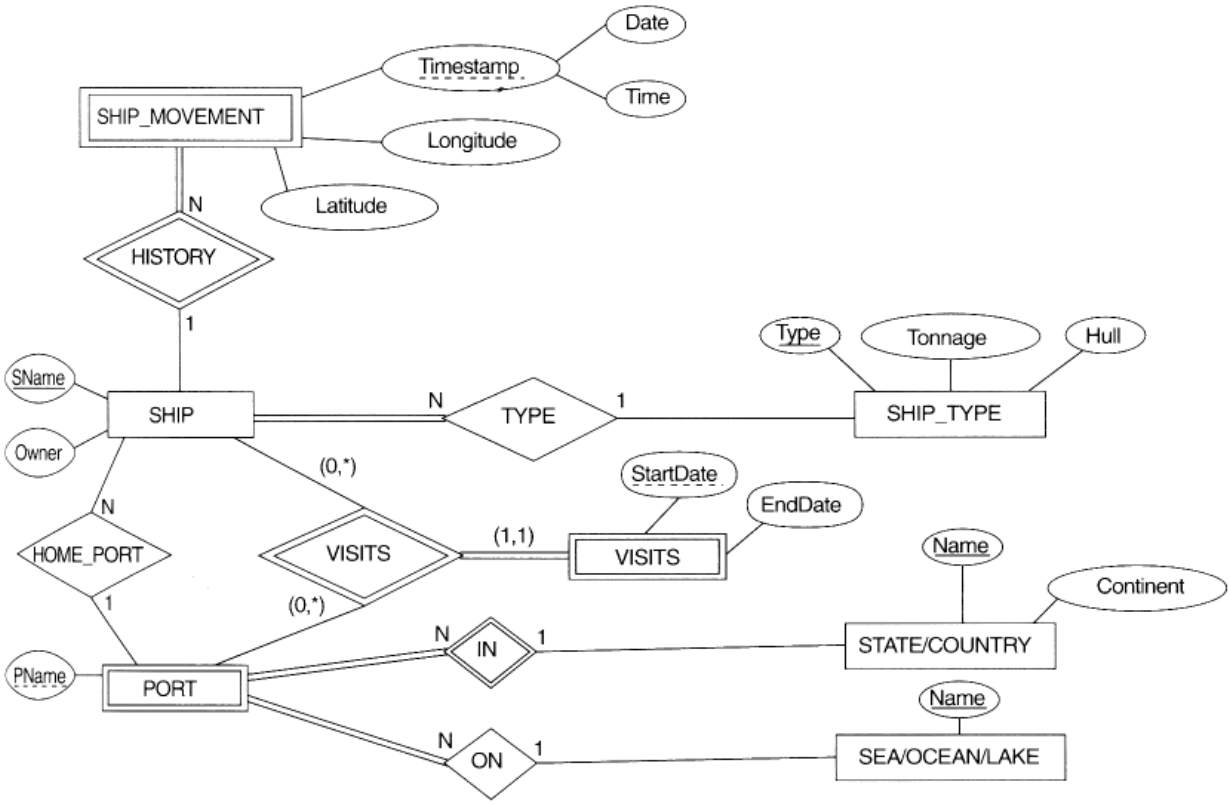
11. All person entities in the database have data kept on their social security number, name and address and telephone number.

12. The database should also keep track of the types of planes each pilot is authorized to fly and the types of planes each employee can do maintenance work on.

Draw a detailed ER schema diagram for this application (including: strong/weak entities, partial/full participation, cardinality, etc…). Discuss any assumptions you made, and that justify your EER design choices.

Question B – Relational Schema [15 marks]

The following figure shows an ER Schema for a database that may be used to keep track of transport ships and their locations for maritime authorities. Map this figure to a relational schema, and specify all primary keys and foreign keys.



Question C – Relational Algebra [55 marks]

Assume a company tracks its customers, agents, products and orders using the following set of tables as described and illustrated below;

Table: CUSTOMERS	contains information about customers
Columns:	
cid	Unique identifier for a customer/row
canme	Name of a customer
city	City where the customer (headquarters) is located
discnt	Each customer has a negotiated discount on prices

Table: AGENTS	contains information about agent employees
Columns:	
aid	Unique identifier for an agent/row
aname	Last name of agent
city	City where agent is based
percent	Percentage commission each agent receives on each sale

Table: PRODUCTS	contains information about products for sale
Columns:	
pid	Unique identifier for a product/row
pname	Descriptive name of product
city	City where this product is warehoused
quantity	Quantity on hand for sale, in standard units
price	Wholesale price of each unit product

Table: ORDERS	A table containing information about orders
Columns:	
ordno	Unique identifier for this order
month	Month the order was placed; assume that orders started in January of this year
cid	This customer..
aid	...purchased through this agent...
pid	...this specific product...
qty	...in this total quantity...
dollars	...at this dollar cost

The following figure shows the tables with sample data:

CUSTOMERS

cid	cname	city	discnt
c001	TipTop	Duluth	10.00
c002	Basics	Dallas	12.00
c003	Allied	Dallas	8.00
c004	ACME	Duluth	8.00
c006	ACME	Kyoto	0.00

PRODUCTS

pid	pname	city	quantity	price
p01	comb	Dallas	111400	0.50
p02	brush	Newark	203000	0.50
p03	razor	Duluth	150600	1.00
p04	pen	Duluth	125300	1.00
p05	pencil	Dallas	221400	1.00
p06	folder	Dallas	123100	2.00
p07	case	Newark	100500	1.00

AGENTS

aid	aname	city	percent
a01	Smith	New York	6
a02	Jones	Newark	6
a03	Brown	Tokyo	7
a04	Gray	New York	6
a05	Otasi	Duluth	5
a06	Smith	Dallas	5

ORDERS

ordno	month	cid	aid	pid	qty	dollars
1011	jan	c001	a01	p01	1000	450.00
1012	jan	c001	a01	p01	1000	450.00
1019	feb	c001	a02	p02	400	180.00
1017	feb	c001	a06	p03	600	540.00
1018	feb	c001	a03	p04	600	540.00
1023	mar	c001	a04	p05	500	450.00
1022	mar	c001	a05	p06	400	720.00
1025	apr	c001	a05	p07	800	720.00
1013	jan	c002	a03	p03	1000	880.00
1026	may	c002	a05	p03	800	704.00
1015	jan	c003	a03	p05	1200	1104.00
1014	jan	c003	a03	p05	1200	1104.00
1021	feb	c004	a06	p01	1000	460.00
1016	jan	c006	a01	p01	1000	500.00
1020	feb	c006	a03	p07	600	600.00
1024	mar	c006	a06	p01	800	400.00

Write a relational algebra expression to answer each of the following queries. You should pose the query as a single, self contained relational algebra expression that does not depend on any intermediate results created by means of an alias, except where absolutely necessary.

1) Find all (`ordno,pid`) pairs for orders of quantity equal to 1000 or more.

2) Find all (`ordno, cname`) pairs for orders of dollar value less than $500 (use one join).

3) Find all (`ordno, cname, aname`) triples for orders in March (use two joins).

4) Find all product names of products in Duluth ordered in March.

5) Find all (`cid, aid, pid`) triples for customer, agent, product combinations that are all in the same city. Nothing about orders is involved in this selection.

6) Find all (`cid, aid, pid`) triples for customer, agent, product combinations, no two of which are in the same city.

7) Get `pnames` ordered by at least one customer in Dallas through an agent based in Tokyo.

8) Display all pairs of aids for agents who live in the same city.

9) Find `cids` of customers who have the largest discount (separately, find those who have the smallest discount).

10) Find `pids` of products ordered through agent a03 but not through agent a06.

11) Get `aids` and `anames` of agents with `aname` beginning with the letter "N" who do not place orders for any product in Newark.

12) Get names of agents who place orders for all products ordered by customer c002.

13) Get (`cid,aid,pid`) triples for customer, agent, product combinations so that at most two of them are in the same city.

14) Get `aids` of agents who place individual orders in dollar value greater than $500 for customers living in kyoto.

15) Get `cids` of customers who order all their products through only one agent.

Submission Instructions and Notes

- Assignment's solution must be done individually.
- Handwritten submission is acceptable BUT write legibly! YOU MUST WRITE in PEN for your assignment to remarked later.
- Stable your assignment solution together, number the pages, and attach a cover page with your name, UTORID, and Student number.
- Late assignments is subject to 25% (absolute value) deducted for every day the assignment is late -- to a maximum of three days.
- There will be a 24 hour blackout prior to the due date - the TA is not going to be answering questions on the designated discussion board (http://portal.utoronto.ca) during that time.
- *Notes:*
    - Computer Science department is currently moving to the new building (IC) Hence, the C43 dropbox location is yet to be determined. Once the information is available, it will be posted on the course announcement page (http://portal.utoronto.ca/)
    - Tools supporting ER diagrams are listed in the following web page:
      http://www.databaseanswers.org/modelling_tools.htm