

University of Toronto
Faculty of Arts and Science
Department of Computer Science

CSC340S - Information Systems Analysis and Design

Spring 2003

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April-May Examination

No Aids Allowed
Duration: 2 hours

Make sure that your examination booklet has 12 pages
(including this one). Write your answers in the space provided.

This examination counts for 35% of your final mark.

Name: _____

(Please underline your last name)

Student Number: _____

Question Marks

1. _____/15

2. _____/15

3. _____/15

4. _____/20

5. _____/15

6. _____/10

7. _____/10

Total _____/100

The Parking Ticket Collection Division. Joanne Werke works for the Parking Ticket Collection Division of the Police Department. Her job is keeping track of the unpaid and paid parking tickets issued by the Police Department. When she comes to work in the morning, the first job that she must do is build a record of the tickets that were issued on the previous day. This is brought to her desk by one of the couriers from the Meter Maid section of the Police Department. They arrive at 8:15 am, just fifteen minutes after Joanne has begun work. Occasionally, a packet of tickets also arrives from the Security Department of the University. This packet usually arrives at about 9:00 am and contains the tickets that have been issued that week by the University. It's arrival is irregular and usually dependent on a decision of the Security Department to crack down on illegal parking on campus. Joanne can be certain that packets will arrive from University Security at the beginning of each term, after Alumni Week and after graduation, but the other times are arbitrary. Sometimes the tickets in the University packet have been issued two weeks ago and Joanne has already received payment for them.

Before processing the tickets, Joanne puts them in order by ticket number. If she is handling University issued tickets, they are assigned a different sequencing number so that Joanne does not have to wait until they arrive. Then Joanne processes each ticket individually. She uses the information on the ticket for three different logs that she has been asked to keep and also fills out an unpaid ticket form. The logs she keeps are: (a) Issuing Officer ticket record; (b) Projected ticket revenue; (c) Violation type summary.

The Issuing Officer ticket record is a log of the number and type of parking ticket violations issued by each officer. It is used in personnel evaluations and in assessing the viability of the ticket issuing routes given to the officers. The log contains the name of each officer, the officer's personnel number, and a daily record of the the types of tickets issued. The log looks as follows:

Officer: Jake Cartwheel

P#: 406-567-908

Day	Violation A	Violation B	Violation C	Violation Q
Jan 28,2003	34	2	12	1
Jan 29, 2003	21	5	28	0

The Projected ticket revenue log is a Lotus 1-2-3 Spreadsheet that is used to project the revenue that will come in from the payment of the parking ticket. It looks as follows:

Day: January 28, 2003

Ticket No.	Violation Type	Due Date	Amount	Out of Prov.	Expected Revenue
123456	Q	3/2/03	\$30.00	1	\$6.00
678901	A	3/2/03	\$20.00	0	\$18.00
...					
TOTAL			\$320	12	\$246.00

Only 20 percent of out of province issued tickets are paid. This is taken into account in the final total. In addition, approximately 10 percent of the remaining tickets are never paid. This is also taken into account. At the end of the day, Joanne takes this spreadsheet to the Accounting Department to be used in their record keeping. She is not happy with keeping this log because she has to type in all the ticket numbers. She already has to re-transcribe them in filling out the unpaid ticket form. Typing them in again seems redundant to her. She doesn't see why they can't just use the information in the unpaid ticket forms which she also brings them copies of.

The Violation Type Log is a handwritten log that is tabulated approximately once per month. Joe Schup from the Planning Department calls up a day in advance and asks Joanne to perform the tabulations. He then picks up the log and takes it to a planning meeting, returning it at the end of the day. Joanne is not sure what the information is used for, but wishes they would be more careful about spilling coffee on her carefully kept log. She also wishes that Joe would give her more warning because she already has to work late to handle the crunch of tickets that arrive at her desk daily. The Violation Type Log looks as follows:

VIOLATION TYPE LOG

Date	Violation A	Violation B	Violation C	Violation Q
25/1/03	23	45	65	1
26/1/03	43	40	56	2
27/1/03	45	45	108	3

Joanne also fills out the Unpaid Ticket form. This is attached as is a sample copy of the unpaid ticket. She makes a copy of the Unpaid Ticket form to go to accounting and keeps the original in her files. The parking ticket is sent to Microfilm to be copied and stored in the Police record microfilm files.

To fill out the Unpaid Ticket form, Joanne uses an online database maintained by the Department of Motor Vehicles. She types in the license number of the vehicle that has been issued a ticket. The database then prints out the vehicle owner, more detailed information on the vehicle and the owner's address. If the vehicle has been stolen or used in a crime, the database will also print out this information.

Unpaid Ticket Form

Ticket No. _____ Date of Issue: _____

License No.: _____

Vehicle Owner: _____

Address: _____

City, Prov.: _____ Postal Code: _____

Where Issued: _____ Officer Name: _____

Type Violation: _____ Officer No.: _____

Amt. Due: _____

Issued Ticket

Date: _____

Officer Name: _____ Officer No.: _____

Location: _____

License No.: _____

Vehicle Desc. _____

Type Violation: A _____ B _____ C _____ Q _____

Note: The above description is complex, may leave details out and supply unnecessary information. You will need to make some assumptions about the problem for the parts below. **MAKE SURE** you write your assumptions down!

1. [Entity-Relationship Diagrams; 15 marks]

Draw an Entity-Relationship diagram that represents the information about tickets, issuing officers, vehicles, owners and payments. Your solution should be an Entity-Relationship diagram, *NOT* a UML class diagram!

2. [Sequence Diagrams; 15 marks]

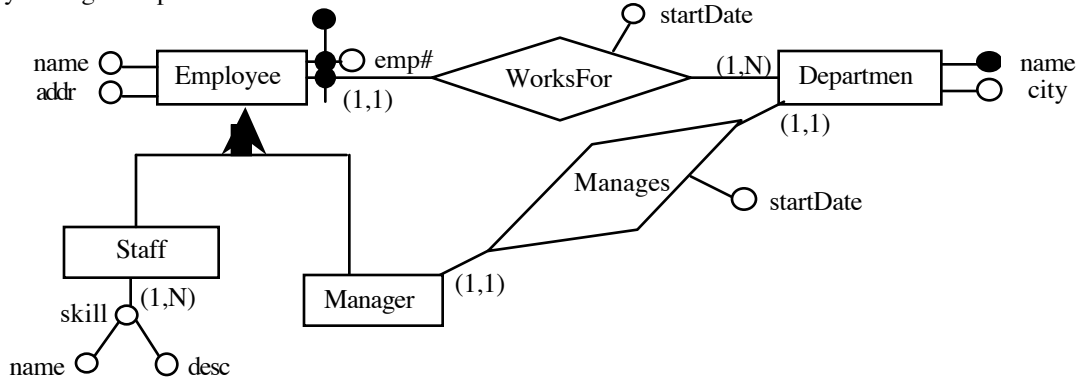
Draw a sequence diagram that describes the processing of tickets at the Parking Ticket Collection Division. Your diagram should include Joanne, the Tickets Division, the Accounting Department, Joe Schup and the Department of Motor Vehicles database. You can ignore University-issued tickets.

3. [State Diagrams; 15 marks]

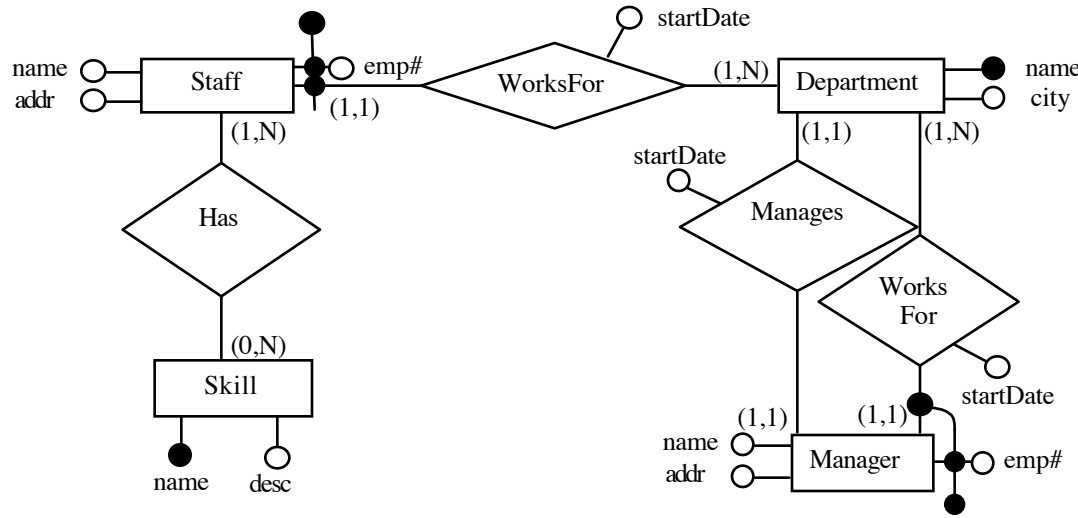
Draw a state diagram that describes the process of preparing an assignment. You may assume that the process involves a team of three members. The process begins when the assignment is posted, then the team meets and assigns tasks to each team member, also sets a time and date for the next meeting. Then team members go away and work concurrently on their tasks. When the time of the next meeting comes, they interrupt their individual work and meet. At the meeting they review what has been done, assign new tasks and go away to work on them. This is repeated until the deadline for the assignment, at which point they meet, merge their work and hand it in.

4. [Database Design; 20 marks]

Suppose you are given the Entity-Relationship (ER) schema shown below. It describes the contents of an employee database. Unless otherwise stated, attributes are assumed to be single-valued. In addition, you may assume that every employee is either staff or a manager, but not both. Moreover, assume that the operations on the database (hire, promote, retire) treat staff and managers differently. Finally, a manager may manage a department other than the one she works for.



[Part a; 10 marks] Draw an ER schema that captures the same information as the diagram above, but does not have any generalization relationships, nor any multi-valued attributes.



[Part b; 10 marks] Give a relational schema that captures the same information as your ER schema of part (a). Show clearly keys for each relation in your schema.

Sample solution

Staff(emp#,deptName,name,addr,startDate)

Manager(emp#,deptName,name,addr,startDate,manDept,manStartDate)

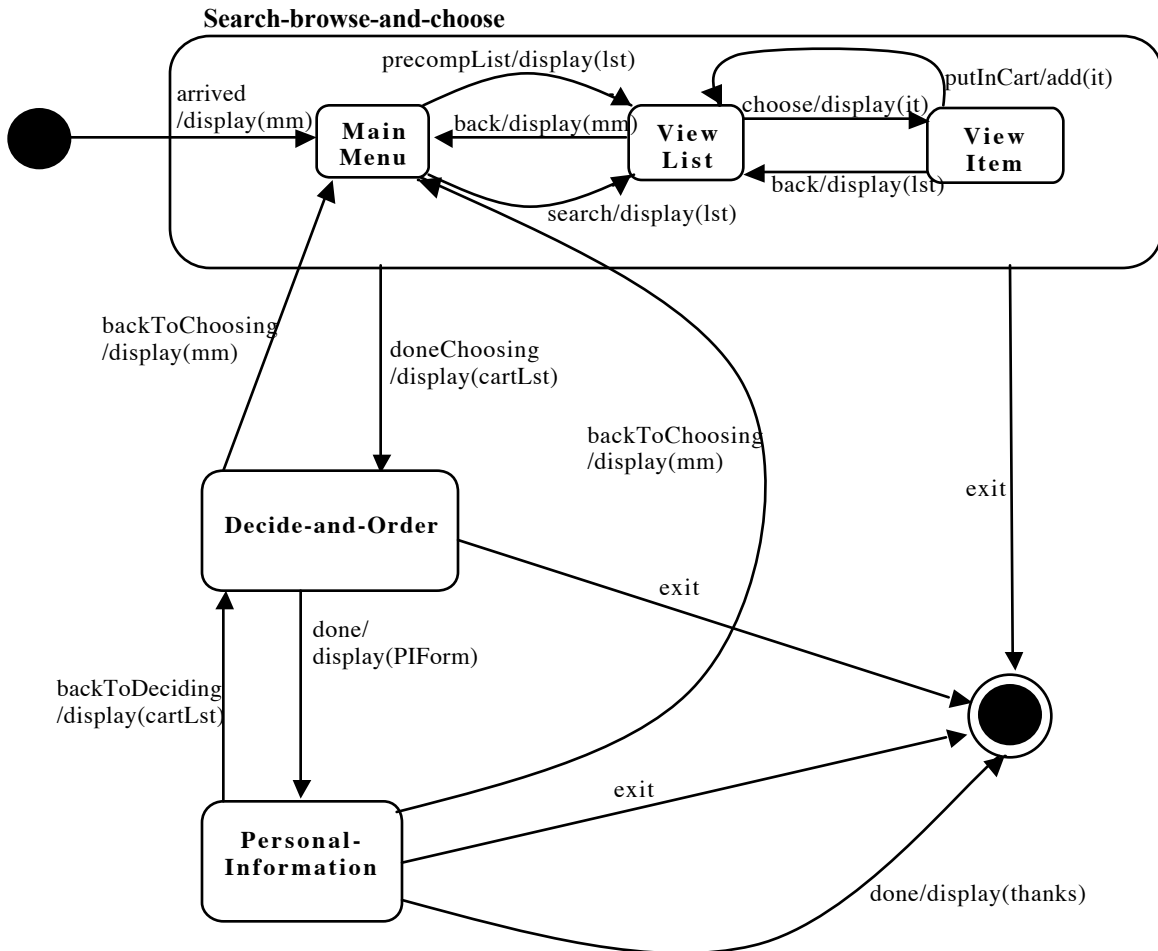
Department(name,city)

Skill(name,desc)

HasSkill(emp#,deptName,skillName)

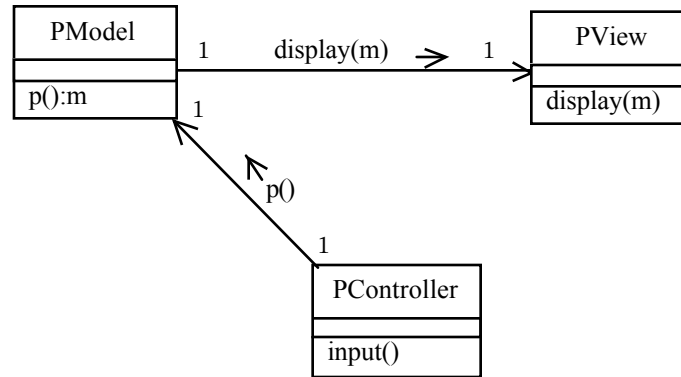
5. [User Interfaces; 15 marks]

Consider a Chapters-like on-line shopping user interface that has three modes. In the first, called *search-browse-and-order*, a user can see pre-compiled lists (bestsellers, home-and-garden, etc.), or search for all items either by author/artist name, or in terms of one or more keywords appearing in the title of a book/CD. While viewing a list, the user can go back and get another list. Alternatively, she can click on any one item and get a one-page description of the item and its price. The user may then choose to put the item she is viewing into her (electronic) shopping cart, or move back to the list she was browsing. At any time, the user may choose to move from the *search-browse-and-choose* mode to the *decide-and-order* mode. Here the user is asked to look through the list of items in her cart and either leave it there or remove it. Once the confirmation of cart items is over, she moves to the *personal-information* mode, where she provides personal information for payment and delivery. At any time the user can exit or move to one of the previous modes.

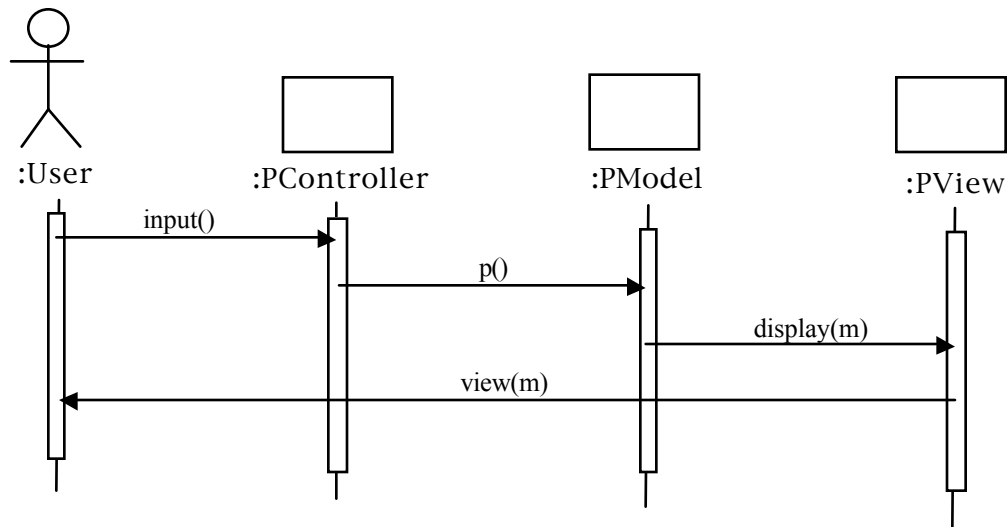


6. [Software Architectures; 10 marks] Consider a software component that takes a point-and-click input, calls an operation $p()$ and displays the message generated by the operation.

[Part a; 5 marks] Define a Model-View-Controller architecture for this component using a class diagram.



[Part b; 5 marks] Show how the architecture works for a given user input using a sequence diagram.



7. [Short Questions; 10 marks total]**7.1 [Database Design; 8 marks]** Consider a relation

Student(UnivNm,St#,Degree,UnivCity,UnivPresidentNm,UnivPresidentAddr)

[Part a; 4 marks] List functional dependencies present in this relation, assuming that “UnivNm” means “university name”, “UnivCity” means “city of the University”, etc. Also assume that university president names uniquely identify university presidents.

**UnivNm -> UnivCity,
UnivNm -> UnivPresident,
UnivPresident -> UnivPresidentAddr**

- **-1 mark for missing any one functional dependency**

[Part b; 4 marks] Place the Student relation into 3NF.

**Student(UnivNm,St#,Degree)
University(Nm,PresidentNm)
UnivPresident(Name,Addr)**

7.2 [Databases; 2 marks] “Relational databases don’t use pointers.” Is this statement true? If so, what do they use instead? If not, how do they use them?

It’s true. Relational databases use relation keys instead of pointers to refer to a tuple/record.

[Scratch paper]

[Scratch paper]