Mid-quarter Examination

Due: In 70 minutes.

Course: CS 5180 Winter 1994 (day class).

Instructions:

1. PROVIDE YOUR NAME, IDENTIFICATION NUMBER and other information on the cover.
2. This is an OPEN TEXTBOOK, OPEN NOTES examination. Please do not use any book other than the textbook.
3. There are three questions in this paper. Q1 and Q2 have three parts each. Q3 has only one parts.
4. Please use the space provided (below the questions) to write the answers.
5. Budget your time to answer various questions to avoid spending too much time on a particular question. Some questions may take longer to answer. Some questions include a lot of text, which need not be studied in detail to answer the question.

NAME:

UMN Identification Number:

Computer-Account: Machine:

Classification: (Rochester/Extension/NTU/UNITE/Day-class)

Score Table	
Question	Score
Q1a	
Q1b	
Q1c	
Q2a	
Q2b	
Q2c	
Q3a	

Q1. Suppose you decide to adopt the following policy: a module M1 may be implemented before M2 if M1 has no components and it does not use M2 or any other module composing M2.

Q1a. (5 points)
Formally describe this as a relation between module as a boolean expression consisting of PART-OF and IS_COMPONENT_OF predicates.

Q1b. (2 points)
Describe a constraint on the graph representation of USES relation to make this policy feasible.

Q1c. (3 points)
Provide example USES and IS_COMPONENT_OF graphs, where this policy can not decide the order in which modules M1 and M2 should be implemented.

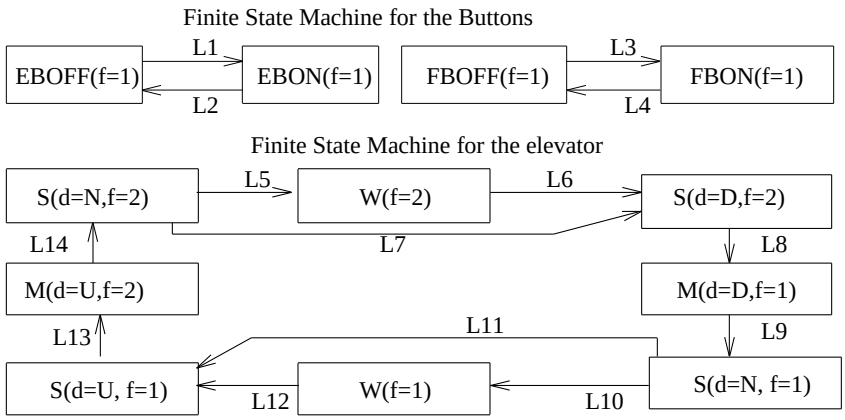
Q2 Consider the following problem concerning the specification of the control logic to move elevators between floors according to the specified constraints. An elevator is to be installed in a building with 2 floors. The elevator has two buttons, one for each floor. They illuminate when pressed and cause the elevator to visit the corresponding floor. The illumination is cancelled when the corresponding floor is visited by the elevator. Each floor has a button to request the elevator. These buttons illuminate when pressed. The illumination is cancelled when an elevator visits the floor and moves in the desired direction. When the elevator has no request to service, it should remain at its current floor with its doors closed.

Consider the states and events listed in following tables:

Object	states	definitions
elevator button for floor 1	EBON(f=1), EBOFF(f=1)	illuminated = on
elevator button for floor 2	EBON(f=2), EBOFF(f=2)	no illumination = off
floor button at floor 1	FBON(f=1), FBOFF(f=1)	
floor button at floor 2	FBON(f=2), FBOFF(f=2)	
elevator	W(f=1), W(f=2)	waiting with doors closed at floor f
elevator	M(d=U, f=2), M(d=D, f=1)	moving in direction d towards floor f
elevator	S(d=U, f=1), S(d=D, f=2)	standing with door open after arriving at floor f.
elevator	S(d=N, f=1), S(d=N, f=2)	standing with door open at floor f prior to moving

High Level Events	explanation
DC(f=1), DC(f=2)	Elevator Door Closes on floor f, with outstanding requests.
NR_DC(f=1), NR_DC(f=2)	No outstanding request and door closes at floor f.
RL(f=1), RL(f=2)	Request logged to go to floor f.
ST(f=1), ST(f=2)	During motion, sensor detects approach to floor f.
EAF(f=1), EAF(f=2)	Elevator arrives at floor f.
EBP(f=1), EBP(f=2)	Elevator button for floor f pressed.
FBP(f=1), FBP(f=2)	Floor button at floor f pressed.

Q2a. (10 points) Fill in the table to provide appropriate event labels for the transitions (L1 to L14) in the following state transition diagrams:



Label	A high level event	label	A high level event
L1		L2	
L3		L4	
L5		L6	
L7		L8	
L9		L10	
L11		L12	
L13		L14	

Q2b. (5 points)

Specify the high level event RL(f=1) as a boolean condition composed of the states of buttons, states of the elevator, and simple events of EBP(f=1), EBP(f=2), FBP(f=1) and FBP(f=2). Do not use any other high level event.

Q2c. (5 points)

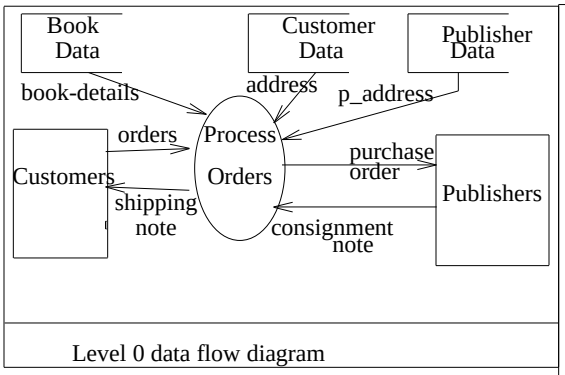
Critique the completeness of the informal (i.e. structured english) and formal (i.e. finite state machine) specifications of an elevator. Identify an important aspect of the operation of elevators, which is not described by these specifications.

Q3

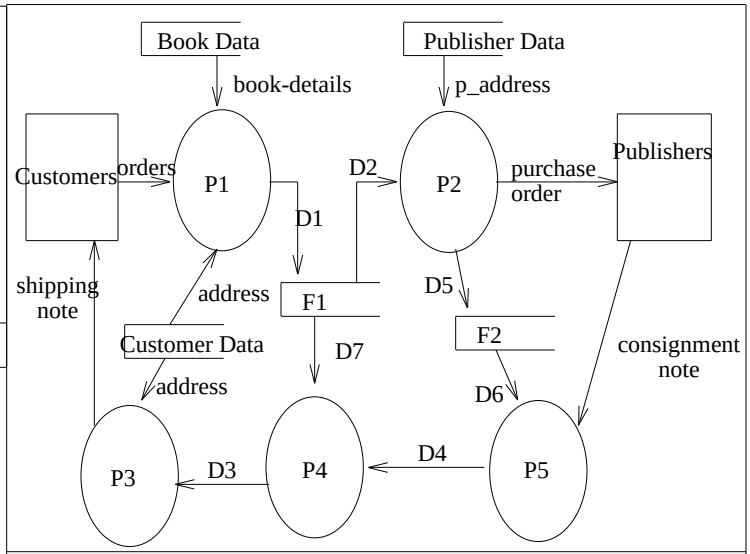
The CBM (Computer Books by Mail) acts as a clearing house, receiving orders from librarians for books about computers, ordering the books from the appropriate publishers at a discount, and filling the order (i.e. mailing relevant books to librarians according to their orders) on receipt of the books from the publisher. Invoices are produced by an external service bureau computer from forms filled out by CBM.

The new management plans to expand the operation considerably, improving service levels by holding stocks of the 100 most frequently ordered books, and making it possible for all professional (not only librarians) to order by calling a toll-free number 800-DPBOOKS (i.e. 800-372-6657), as well as by mail as at present. This will create problems of credit-checking, of course, and create the need for an inventory control system of some sort. The people who take orders off the phone will need rapid access to a catalog of books to verify authors and titles, and to be able to advise callers what books are available on any given topic. It is not clear if accounting (e.g. managing invoices, payments) should also be done in-house with the new system.

A level 0 data flow diagram for the envisaged system is provided below.



Level 0 data flow diagram



Level 1 data flow diagram

Q3a. (10 points): Complete the level 1 data flow diagram by completing the data dictionary given below. Provide a MEANINGFUL name using one or two words from the problem domain. Also provide a short definition for each symbol (i.e. cryptic name) in the diagram.

Symbol	Name	Textual description up to 80 characters using domain concepts.
F1		
F2		
P1		
P2		
P3		
P4		
P5		
D1		
D2		
D3		
D4		
D5		
D6		
D7		