Exam 3

CSSE 373 – Formal Methods in Specification and Design

Fall 2007

Name: _____

Instructions

This exam is open book and open notes. You may use your laptop but are not required to do so. You may also reference the course materials on Angel. Network, server, or laptop problems will not be considered an excuse for poor performance on the exam.

You may use the back of pages if you run out of space. Please indicate on the front when you do so.

As discussed in class, for each problem you may choose the number of points that problem is worth, within a given range. I will use a default allocation of points if you decide against indicating your own allocation. For each problem, the range of points is indicated by a list like this: **Points:** [10–15–20–**25**–30–35]

For the example the default allocation would be 25 points. You could choose any multiple of 5 by circling the number, for example: **Points:** [10–(15)–20–**25**–30–35]. The number of points chosen must sum to 100 for the exam.

Score

Problem	Percent Earned	Default Point Allocation	Scores with Default Allocation	Requested Point Allocation	Scores with Requested Allocation
1		30			
2		25			
3		20			
4		25			
Total		100			

1. **Points:** [15–20–25–**30**–35–40]

   a. A certain vending machine dispenses products that each cost 20¢. The vending machine accepts nickels and dimes, but no more than 25¢ worth. You are to design the control algorithm for the money handling unit of the vending machine **using a statechart**. The hardware provides the following input signals to you:

   - IN — signaled when the customer Inserts a Nickel
   - ID — signaled when the customer Inserts a Dime
   - select$_x$ — signaled when the customer selects product x
   - disable — signaled when a service technician puts the machine "out of service"
   - enable — signaled when a service technician puts the machine back in service

   You may use the following output signals:

   - RN — Return a Nickel to the customer
   - ID — Return a Dime to the customer
   - dispense$_x$ — dispense product x to the customer

   You may add additional "internal" signals if necessary. If the machine is disabled after money has been inserted, it must remember the amount when re-enabled again. The machine must make correct change. For full credit you must use the higher-order features of statecharts. Be sure to indicate all initial states.

For instructor use only

	5	3	1	s
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Co				
D				
N				
b				

b. Describe in English—do not change your diagram above—how you would modify your vending machine statechart to include a check for whether the selected product was in stock.

2. **Points:** [15–20–**25**–30–35] Draw a **UML sequence diagram** for a user posting a message to an on-line discussion forum. Assume that the user has already logged in to the system, but that the system verifies the user's log-in status before posting the message.

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	5	3	1	s
Cl				
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3. **Points:** [10–15–**20**–25–30] Draw a **UML activity diagram** for a student registering for a single class using a web-based system. Assume that the student's first selection is unavailable. Use "swim lanes" to indicate what the student and the registration system each do. Use forks and decisions as appropriate.

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4. **Points:** [15–20–**25**–30–35] This question is about the article "Dependable Software by Design", by Daniel Jackson[1].

   c. In a paragraph, summarize the central claim of the article.

   d. Say whether you agree or disagree with the article's claim and support your position.

[1] Daniel Jackson. Dependable software by design. *Scientific American*, 294(6):68–75, Jun 2006.

5. If you wish to deviate from the default point scheme, go back and indicate how many points you wish each question to be worth. Your chosen points must sum to exactly 100. *I will use the default points allocation if your chosen points do not sum to exactly 100.*