Specification of Information Systems (233030) Examination

28th January, 2010

Explain your answers, but keep them precise: short and to the point.

1. a. What is the difference between a connection domain of a reactive system and a subject domain of a reactive system? Illustrate you answer by means of an example.

    b. Explain the difference between a stimulus, response, event and action by means of an example.

    c. Can the connection domain and subject domain of a system overlap? Illustrate you answer by means of an example.

    d. Can the subject domain of a reactive system be part of that system? Illustrate you answer by means of an example.

2. a. What is the reason for having a mission statement of a system?

    b. Consider (i) a mission of an organization, (ii) a mission of a system used by the organization, and (iii) the mission of the users of that system? In which way is each of these different from from the others? Explain by means of examples of each.

    c. Three kinds of events can trigger a service. describe these three kinds of events and give examples.

    d. How do we know that a service delivery has finished?

3. a. Figure 1(a) shows a ternary relationship. Describe the meaning of the cardinality properties in the diagram.

    b. Suppose we want to represent that Teaching can be related to different teachers, courses and rooms in different years, do we need to change the model? Explain your answer. (Draw an alternative model if needed.)

    c. Figure 1(b) shows another ERD. Describe the cardinality properties of this diagram in words.

    d. Add cardinalities to figure 1(b) to agree as much as possible with figure 1(a). What is the remaining difference with figure 1?

    e. Figure 1(c) decomposes the ternary relationship of figure (a) into three binary relationships. Does this contain the same information as figure (a)? Explain your answer.

4. A door controller contains three components, namely a control process, a component that validates a card code)(a number identifying the card
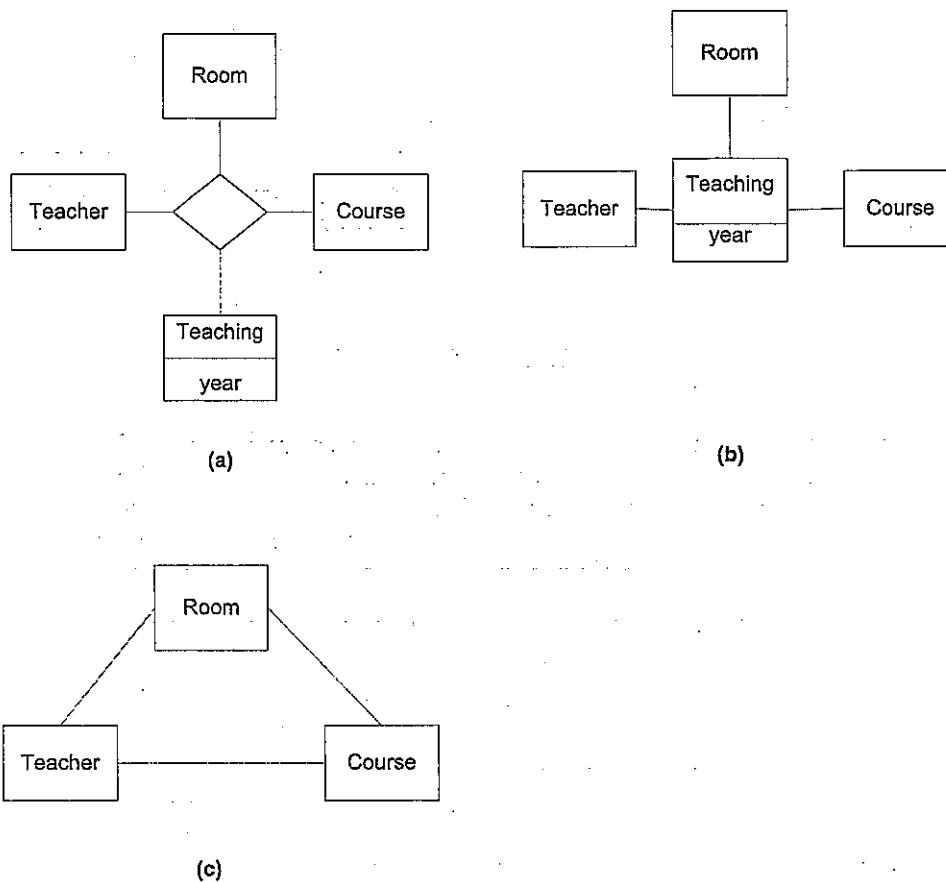
Figure 1: Some ERDs.

itself), and a component that can validate a PIN code. Figure 2 shows the behavior of the control process. The controller interfaces with a card reader, a sound device that can give a beep, and a door, to which it can give an unlock command. When the door is closed (e.g. by a person who has passed through it) then it automatically locks.

a. Draw the context diagram of the controller, including the events and actions that it receives and sends, respectively.

b. Can either or both decision states (represented by hexagons) be eliminated? Explain your answer.

c. The door can receive an alarm command and will respond to it by sounding an alarm. Extend the behavior of the control, process so that if the door does not close within 10 seconds after opening it, an alarm is sent and the control process enters an Alarm state. It can exit this state only by receiving a door closed event and will respond to this by entering the Ready state. Add a timeout transition to figure 2 to represent this.

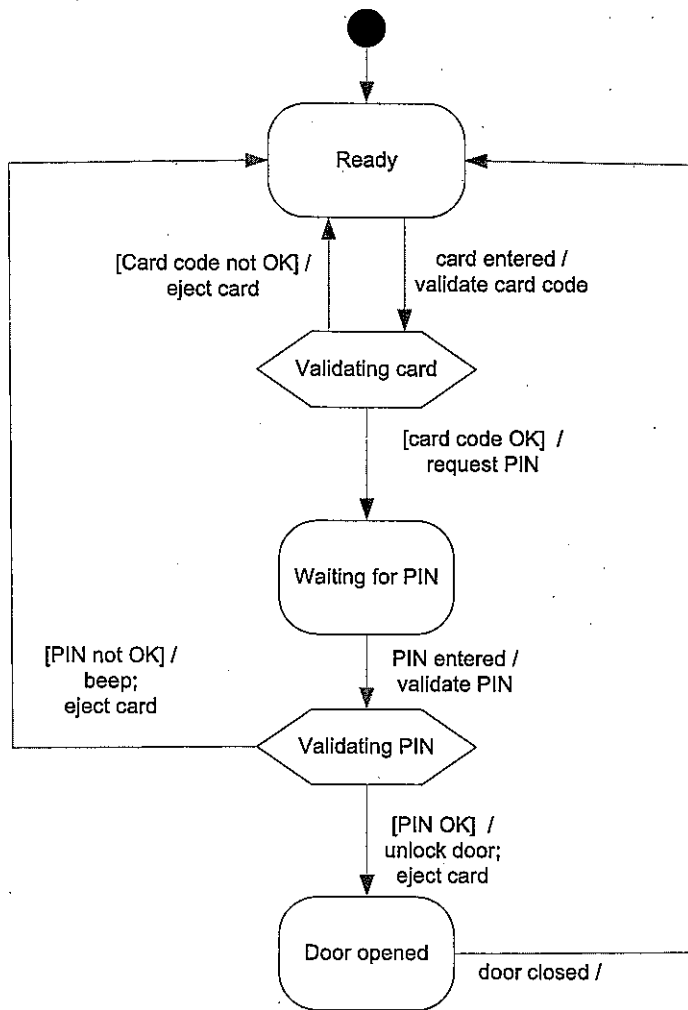d. Change the diagram of figure 2 to represent the behavior that a PIN

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Figure 2: An STD.

can be re-entered when wrong, and can be entered 4 times in total; the 4th time the card will be ejected.

e. The context of the door controller is extended with a stop button. Change the diagram of figure 2 to represent the behavior that when a card is in the system, someone can press the stop button, with the effect that the card is ejected and the system enters the Ready state. Use a hierarchical state to represent this.

Problem	a	b	c	d	e	
1	2	4	4	4		14
2	4	8	6	4		22
3	4	4	6	6	4	24
4	6	6	6	6	6	30
						90

Grade $= (10 + \text{points})/10$