Specification of Information Systems (233030)
Examination

Jan 21, 2008

Explain your answers, yet keep your explanations precise. Long-winded answers are not appreciated.

1. a. Define the following concepts: Conceptual entity and physical entity.

1. b. Provide a maximum of three examples of conceptual entities.

1. c. Consider the concept of subject domain. Can the subject domain of one message between the system and its environment be different from the subject domain of the system itself? Explain your answer.

1. d. Can a connection domain of a system be part of the subject domain of that same system? Provide an example to explain your answer.

1. e. Can some elements of the subject domain of a system appear in the context diagram for this system?

2. The entity relationship model in Figure 2.1. says that:

   (i) a sport team can participate in a sport competition that takes place on one particular date,
   (ii) the competition is in a sport discipline, and that
   (iii) such a participation leads to a score.

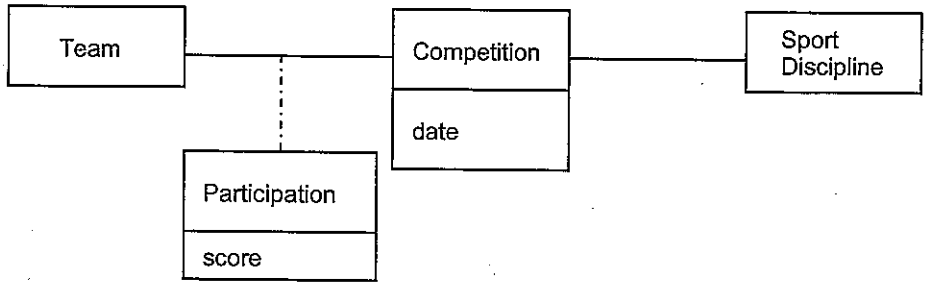

Figure 2.1

2. a. Add relative cardinality properties to this figure and explain each of these properties. Redraw the figure on your answer sheet.

2. b. Each competition must include at least 5 teams and can accommodate maximum 20 teams, and each team can participate in maximally three competitions per year. Add cardinality properties to represent this. If a property can not be represented as a snapshot-cardinality, write it as a comment added to the diagram.

2. c. The competition information system is available at national level and we must now represent the fact that a sport team takes part in a competition hosted in a particular location. One competition can be hosted at several locations. Adapt Figure 2.1 to represent this.

2. d. Consider the two Entity Relationship models in Figure 2.2 and Figure 2.3. Do these two figures say the same or different things about any parts of the subject domain? Why?

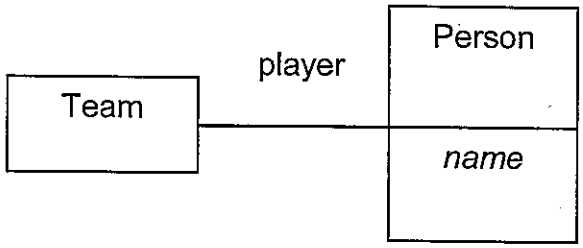

Figure 2.2

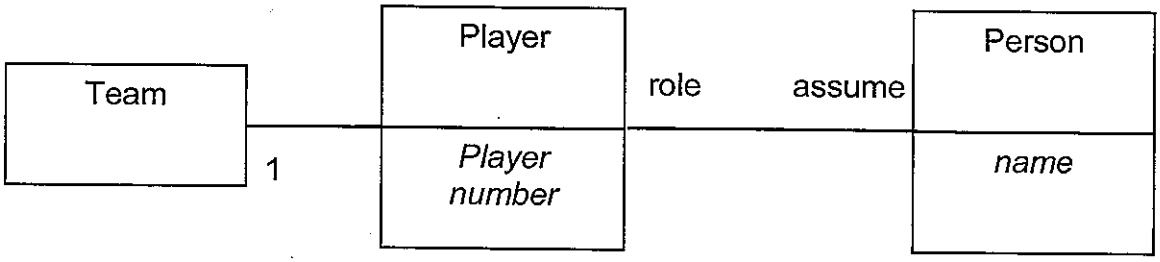

Figure 2.3.

2. e. Consider Figure 2.3. In this Entity-relationship model, *player number* is an attribute of the entity Player. Is this attribute an identifier or not? Write why.

3. a. Consider the concept of service as it is treated in this course. Can a service be implemented by more than one software system components? Motivate your answer.

3. b. Is it possible that one Function Refinement Tree includes as leaves both services and transactions? Provide an example.

3. c. In a Data Flow Diagram, a data store remembers the data written to it until it is deleted. There are two ways to represent access to a data store. Which are these two ways? What does each way of representation indicate?

3. d. Can an event flow depart from a data store? Why?

3. e. In a Data Flow Diagram (DFD), a composite process is a process specified by a lower-level DFD. A composite process may or may not be stateful. When exactly it is stateless?

4. a. Consider the concept of context. Consider the following description of a Purchase Request Tracking System. Create a structured context diagram illustrating the functionality in this system.

"The Purchase Request Tracking System in a company has two goals. The first and most essential goal is to enable the official Buyers of the company to automatically track what they have ordered from Vendors against what has been delivered. The Buyers are employees of the company who manage purchase orders and talk with Vendors. The Vendors are external businesses who sell or deliver goods/products which the company needs in its day-to-day operation. The second goal of the system is to simplify the lives of employees who wish to order things, who must sign purchase requests, and who are to track the purchases against budgets. In simplest form the human work process to be supported is that a Requestor creates a request, which is sent to an Approver who (i) signs it, (ii) adds accounting codes and (iii) forwards it to the Buyer. The Buyer double checks item part numbers, Vendors' names, and the Approver's signature authorization, then issues one or more Purchase Orders (PO) to Vendors. When goods are delivered, the Receiver enters the amounts of goods received against the POs. The Buyer and Receiver can adjust the amounts received against those ordered, and see what still is missing from the order. The Requestor signs that the goods were received in good condition. At this point the Request is considered to be delivered. The invoice management system and payment processing system will make use of the information that a Request is indeed delivered, but are out of scope of the Purchase Request Tracking system.

At any point in time, any of the employees in the company or their managers can check on the state of the request and the POs. Buyers can also check the overall buying patterns of a particular employee, a department or the company.

The Requestor can be any employee who puts in a request to buy goods. The Approver is, typically, the Requestor's manager, who must approve the purchase. The Manager is responsible for his department's budget. The Receiver is someone in the organization, who receives the goods from the Vendor."

4. b. A Purchase Order (PO) sent by a Buyer to a Vendor constitutes **a legal offer** to buy products or services. In the event of non-payment by the Buyer, the Vendor can use the PO as a legal document in a court of law to demonstrate the buyer's intent and to facilitate money collection actions. The PO received by the Vendor is also **the right** of the Vendor to make a contract for this particular Buyer, which is a legally binding exchange of promises or agreements between the two parties that the law will enforce. Why are these rights not represented by the context diagram?

4. c. Identify one entity in the context diagram which can also be an entity of the connection domain of the Purchase Request Tracking system. (Hint: An entity of the connection domain of the system passes information between the system and the sources and destinations in the environment.)

5. There are two ways to represent a state: (i) as a node in a STD and (ii) as a value of a variable. Figure 5.1 presents an STD with two variables. The first one is explicitly represented by variable ***x***. Its possible values are ***hot*** and ***cold***. The second variable is nameless. It is represented by the two nodes of the STD. Its possible values are ***Hi*** and ***Lo***.

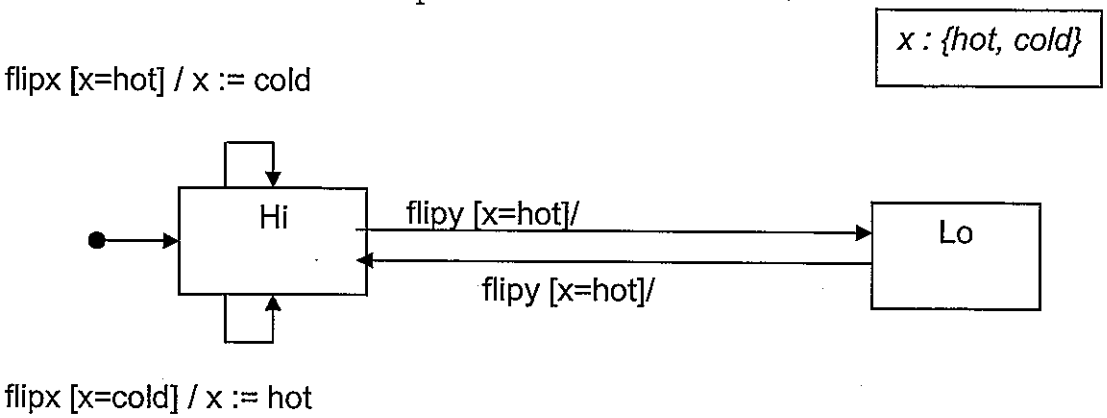

Figure 5.1

5. a. Create a statechart with two parallel components that represents each variable by a parallel component of the statechart. One component is called x and has states Hot and Cold; the other component is called y and has states Hi and Lo. Assume that x is initialized to Hot.

5. b. Does this statechart represent the same behavior as the STD in Figure 5.1?

5 c. Create a statechart (by using again variables x and y) with one state and four state transitions, each of which represents one update of a variable (we mean variables x and y).

5 d. Does this diagram represent the same behavior as the STD in Figure 5.1?

5 e. A transition without named event trigger can be used to model decisions. Describe the situations in which using a decision state is unavoidable. (This question is not related to Figure 5.1. and the diagrams in questions 5a and 5c).

Problem	a	b	c	d	e	
1	3	3	2	4	4	16
2	4	5	4	5	2	20
3	3	6	3	2	2	16
4	8	5	2			15
5	7	3	6	3	4	23
						90

Grade = (10 + points) / 10