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## Object Oriented Software Models

### Use case diagram and use case description

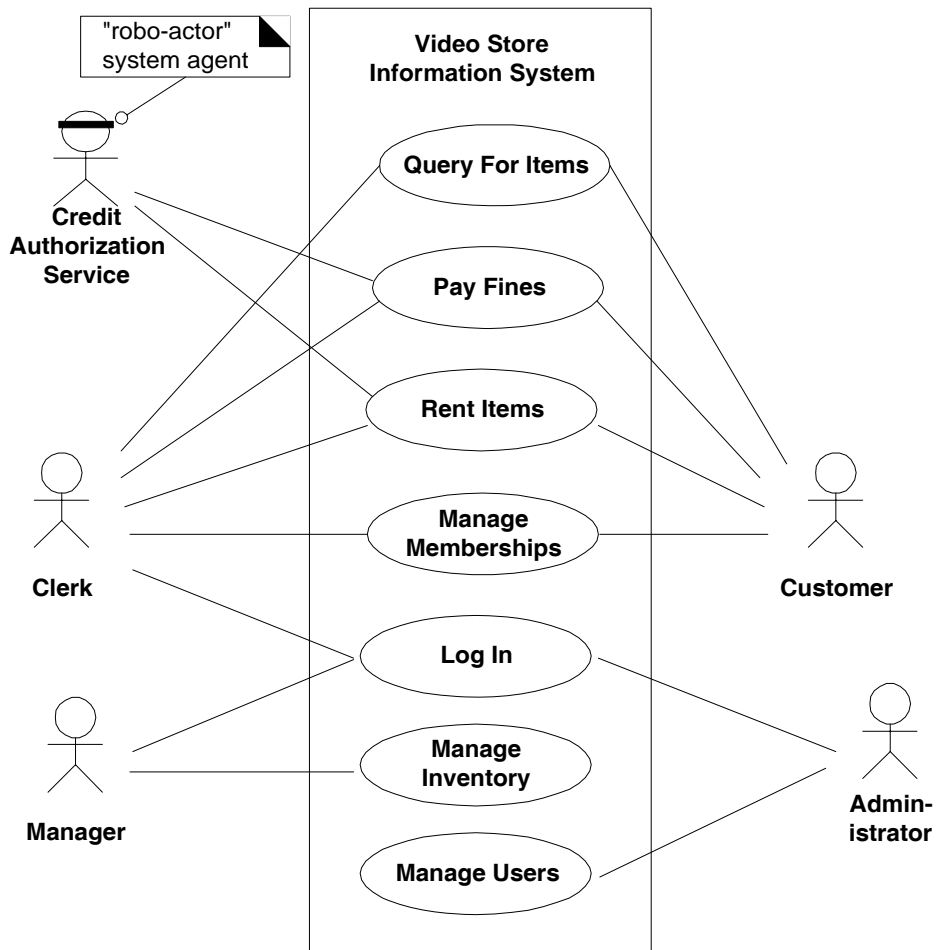
1. Draw a use case diagram for a student-course-registration system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
2. Sketch the template used to describe a use case.
3. Describe the use case “change password” in student-course-registration system.
4. Describe the use case “register a course” in student-course-registration system.
5. Draw a use case diagram for a course grading system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
6. Draw a use case diagram for a library system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
7. Draw a use case diagram for book store system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
8. Draw a use case diagram for a rent car system. Show the ‘includes/uses’, ‘extends’ and generalization relationships
9. Draw a use case diagram for a health club system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
10. Draw a use case diagram for a web-based buying system. Show the ‘includes/uses’, ‘extends’ and generalization relationships.
11. Consider the following use cases of a Food Ordering system:

Use case	Actor	Input	Output
Place order	Customer	Order data	
Print receipt	Customer		receipt
Get food order	Kitchen		food order
Get Management reports	Management		Management reports

- Draw the corresponding use case diagram
- Draw the corresponding context diagram.

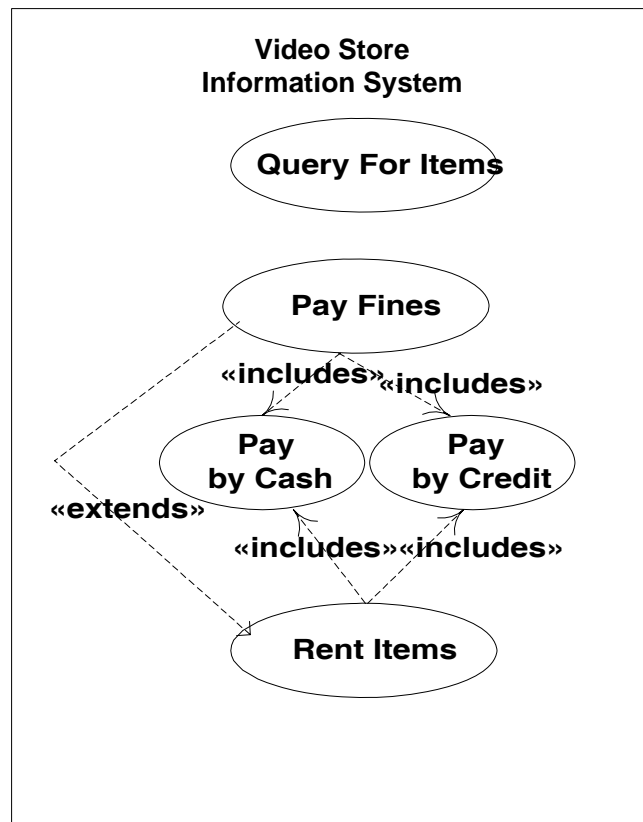
12. Consider the following use case diagram,

Redraw the given use case diagram after applying generalization between actors,



13. Consider the below use case diagram for a video store information system (actors are not shown).

- What are the names of the mandatory use cases?
- What are the names of the optional use cases?
- Add an actor having a role of customer and connect it to the appropriate use cases.



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14. Consider the Internet Sales System described below.
- Draw a use case diagram for the system
  - Draw the corresponding class diagram
  - Draw an SSD for the system.

The Internet Sales System will have a database of basic information about the CDs that it can sell over the Internet, similar to the CD database at each of the retail stores (e.g., title, artist, id number, price, quantity in inventory). Every day, the Internet Sales System will receive an update from the distribution system that will be used to update this CD database. Some new CDs will be added, some will be deleted, and others will be revised (e.g., a new price). The Electronic Marketing [EM] Manager (a position that will need to be created) will also have the ability to update information [e.g., prices for sales).

The Internet Sales System will also maintain a database of marketing materials about each CD that will help Web users learn more about them. Vendors will be encouraged to e-mail marketing materials (e.g., music reviews, links to Web sites, artist information, and sample sound clips) that promote their CDs. The EM Manager will go through the e-mails and determine what information to place on the Web. He or she will add this information to a marketing materials database (or revise it or delete old information) that will be linked to the Web site. Customers will access the Internet Sales System to look for CDs of interest. Some customers will search for specific CDs or CDs by specific artists, while other customers want to browse for interesting CDs in certain categories (e.g., rock, jazz, classical). When the customer has found all the CDs he or she wants, the customer will "check out" by providing personal information (e.g., name, e-mail, address, credit card), and information regarding the order (e.g., the CDs to purchase, and the quantity for each item). The system will verify the customer's credit card information with an on-line credit card clearance center and either accept the order or reject it.

Every hour or so, the orders will be pulled out of the order database and sent to the distribution system. The distribution system will handle the actual sending of CDs to customers: however, when CDs are sent to customers [via UPS or mail), the distribution system will notify the Internet Sales System, which in turn will e-mail the customer. Weekly reports can be run by the EM manager to check the order status.

15. Define 3 releases for a library system. Use the Release Planning table below. A release may take between 2 and 3 weeks. Start by week 6.

Release Planning					
Release #	Week	Actor	Use Case Name	Priority (H, M, L)	Remark

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### Class Diagram

16. Draw the class diagram for a vehicle with the following assumptions:

- A vehicle is composed of the following parts:
  - One chassis
  - Two to four doors
- A chassis is composed of:
  - One engine
  - One transmission gear
  - Four wheels
- An engine is composed of:
  - Four to 12 pistons.

17. Select the right matching from the list below (A, B, C, ..):

Item	Related items (A, B, C, ...)
Class diagram	
Class	
Use case diagram	
Sequence diagram	
State diagram	
Use case text	
CRC card	

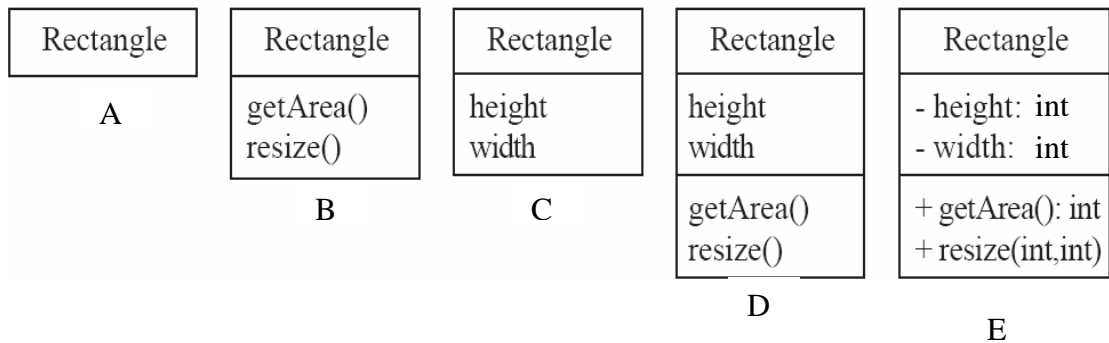
- A) Describes classes and their relationships
- B) Static model that remains constant in the system over time
- C) Dynamic model
- D) Documents the essential properties of each class
- E) Shows the behaviour of systems in terms of how objects interact with each other
- F) Shows how systems behave internally

- G) Shows the alternative (extended) paths
- H) Shows the responsibilities and collaborations of a class
- I) Shows the over all functionality of the system
- J) Shows the messages between objects
- K) Describes the functionality of a single function
- L) Should be written for each class
- M) Shows the includes and extend relationships
- N) Shows the generalization relationship
- O) Shows the generalization, aggregation, composition and association relationships
- P) Shows the successful (happy) path
- Q) Shows stimulus
- R) Shows multiplicity
- S) Shows visibility
- T) Used to model real time systems
- U) Shows abstract and concrete classes
- V) Shows the life time and activation of objects

18. In a class diagram, relationships between classes show multiplicity that indicates how an instance of a class can be associated with the instances of other classes. State six types of multiplicity and give an example for each.

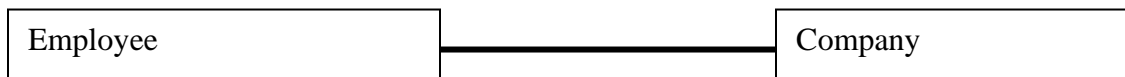
19. Consider the following different representations of class 'Rectangle'.

- Complete using A,,E:
  - ----- represents the class 'Rectangle' at early analysis phase
  - ----- represents the class 'Rectangle' at the design phase
  - ----- shows the class 'Rectangle' with visibility
- Method ----- has one argument
- Method ----- has two arguments



20. Consider association between the classes company and employee. Show the multiplicity assuming the following rules:

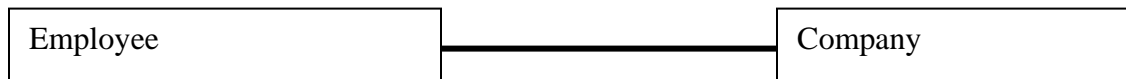
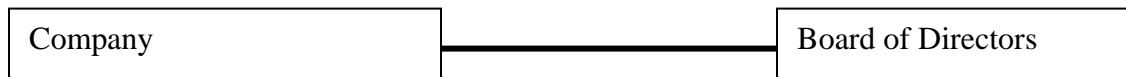
- A company has many employees
- An employee can only work for one company
- A company can have zero employees
- It is not possible to be an employee unless you work for a company





21. Consider association between the shown classes, Show the multiplicity.

For the Committee- Employee relationship, assume that an employee may be a member of one to three or five committees, and that a committee may include at least two and a maximum of 4 employees.

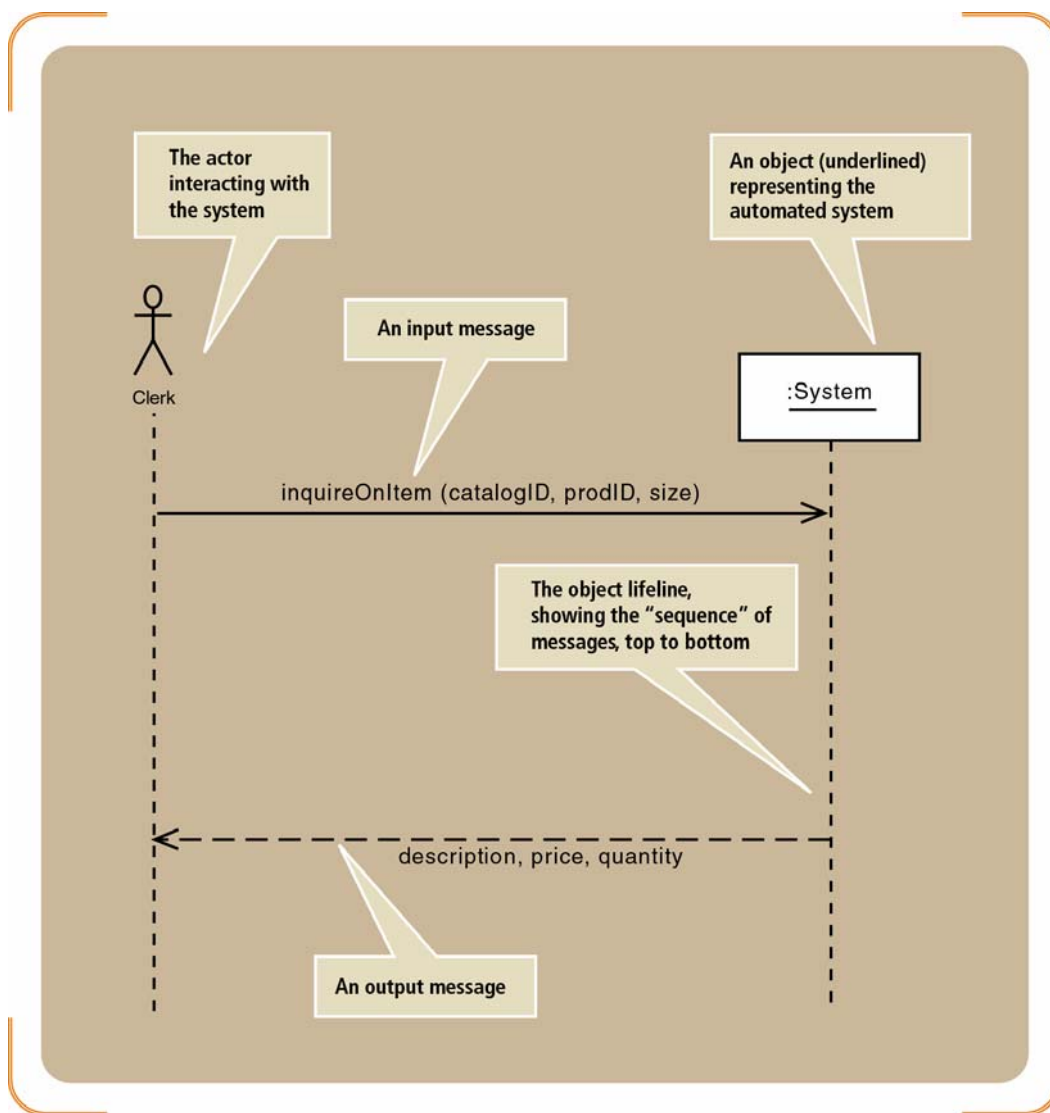


22. What is meant by CRC?

23. Sketch the front side of a CRC card template.

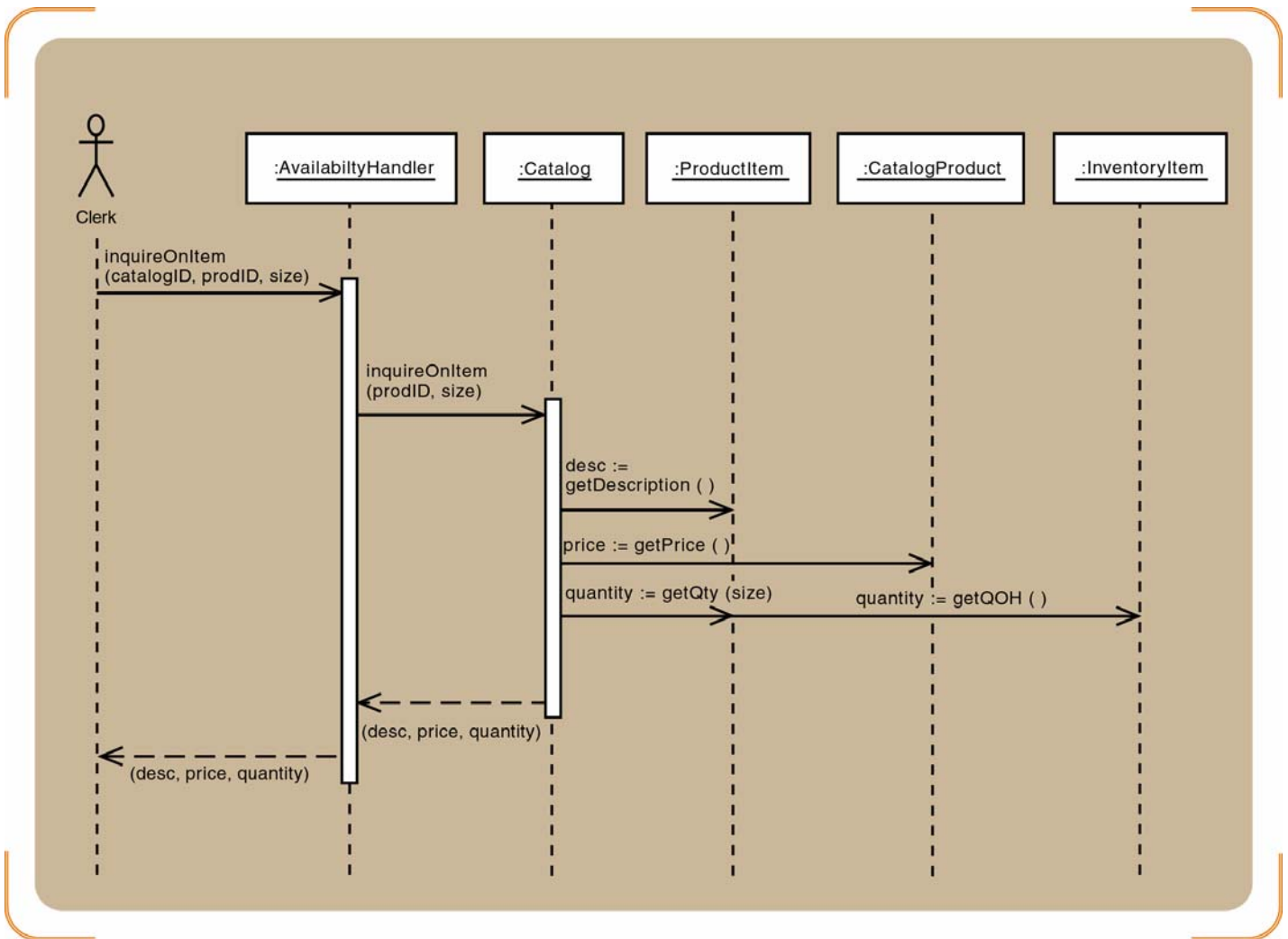
24. Consider the diagram below:

- What is the name of the diagram?
- What is the goal of this diagram?
- How many objects are participating in the interaction?
- Draw on the diagram the rectangle showing the activation of the system.



25. Consider the diagram below:

- What is the name of the diagram?
- What is the goal of this diagram?
- How many objects are participating in the interaction?
- What are the inputs to the interaction?
- What are the outputs of the interaction?
- Which object does provide the item description?
- Which object does provide the item available quantity?
- Which object does provide the item price?
- Which object has the longest activation?
- The diagram is one of the UML diagrams (True/False) \_\_\_\_\_
- The diagram shows the static view of the system (True/False) \_\_\_\_\_
- The diagram shows the dynamic view of the system (True/False) \_\_\_\_\_
- What method(s) must be included in the class Catalog? \_\_\_\_\_
- What method(s) must be included in the class CatalogProduct? \_\_\_\_\_

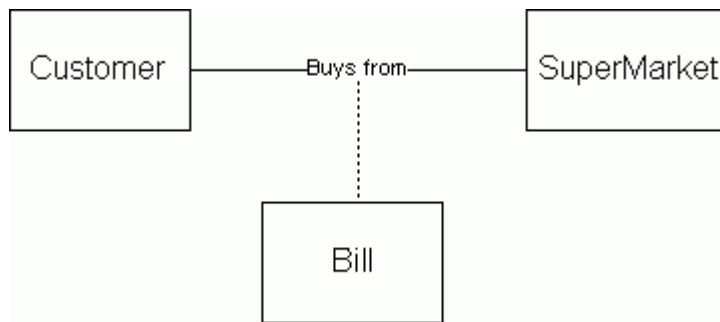


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26. Write true (T) or false (F) for the following statements:

T/F	Statement
	An SSD shows the interactions between the system and the external world represented by actors
	An SSD shows the interactions between the system and classes of the system
	In an SSD, the system is treated like a black box
	An SSD is equivalent to a context diagram
	A detailed sequence diagram uses all of the same elements as an SSD
	The <code>:System</code> object is replaced by all of the internal objects and messages within the system
	In a sequence diagram, activation lifelines indicates when an object is executing a method
	In a sequence diagram, activation lifelines indicates when an object is idle
	In a sequence diagram, you should determine all of the internal messages that result from each input message
	In a sequence diagram, you should define origin and destination objects for each message
	When realizing a use case, you determine what objects collaborate by sending messages to each other
	When realizing a use case, you determine what classes collaborate by sending messages to each other
	When designing a class, most attributes should be public
	Coupling measures how closely classes are linked
	Cohesion shows how closely classes are linked

27. What are the different models used in object modelling
28. State the different levels of Visibility of object classes
29. Compare the different levels of Visibility of object classes
30. Identify the regular and association classes in the class diagram below.



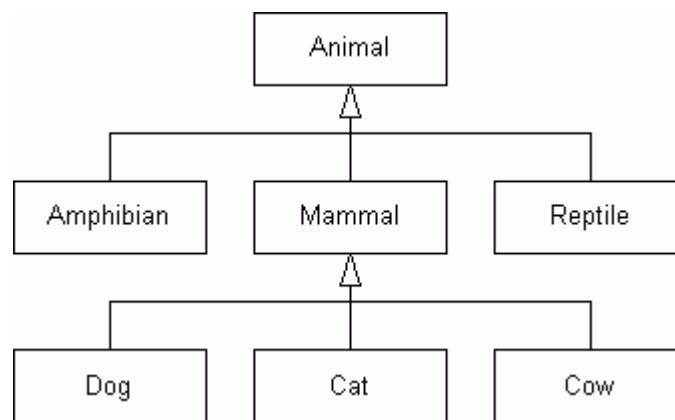
Class	Regular or Association class

31. Write true or false:

- The inheritance stands for "**is a**" kind of association.
- In UML, inheritance is represented with a line that connects the parent to a child class, and on the parent's side you put an open triangle.
- In generalization, a child is substitutable for a parent. That is, anywhere the parent appears, the child may appear.
- One class (the child class or subclass) can inherit attributes and operations from another (the parent class or superclass).
- The parent class is more general than the child class.

- You may discover inheritance when attributes and operations of one class are general and apply to perhaps several other classes - which may add attributes and operations of their own
- You may discover inheritance when two or more classes have a number of common attributes and operations.
- Classes that provide no objects are said to be abstract classes.
- You indicate an abstract class by writing its name in italics.
- Abstract classes are intended only as bases for inheritance and provide no objects of their own.

32. Consider the animal kingdom. What does the figure below show?

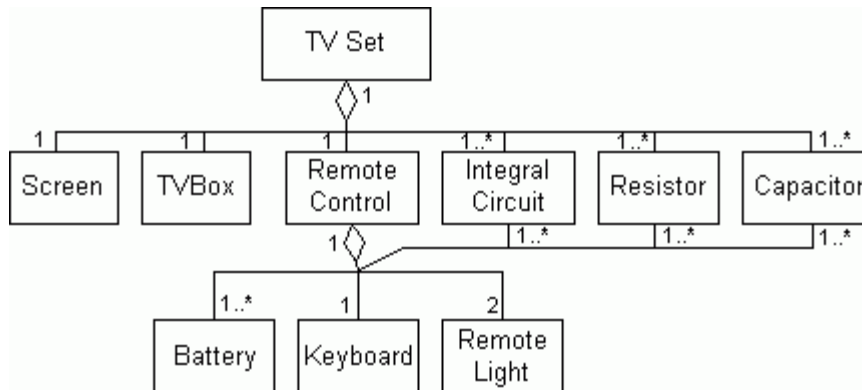


33. How you model the case of a class that consists of a number of component classes?

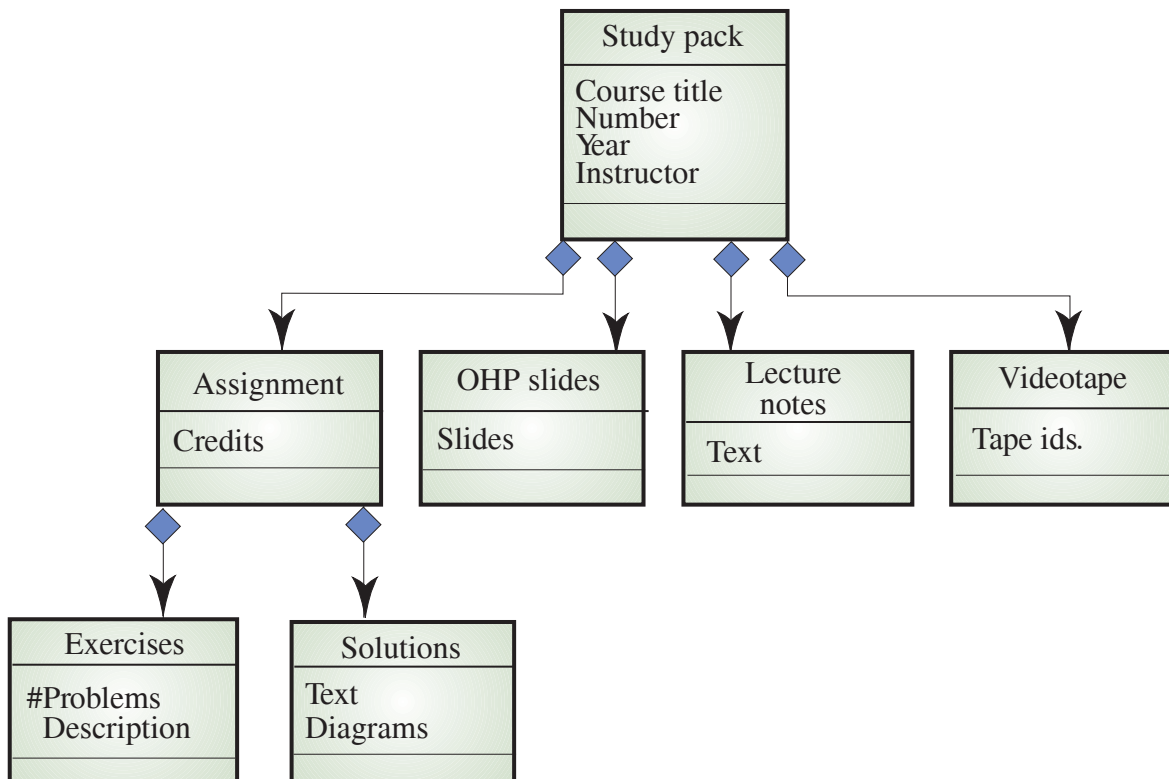
34. Write true or false

- a part-whole association is a generalization relationship
- a part-whole association is an aggregation relationship
- a part-whole association is an inheritance relationship
- A composite is a strong type of aggregation
- Each component in a composite can belong to just one whole.
- The symbol for a composite is the same as the symbol for an aggregation except the diamond is filled

35. What does the figure below show?

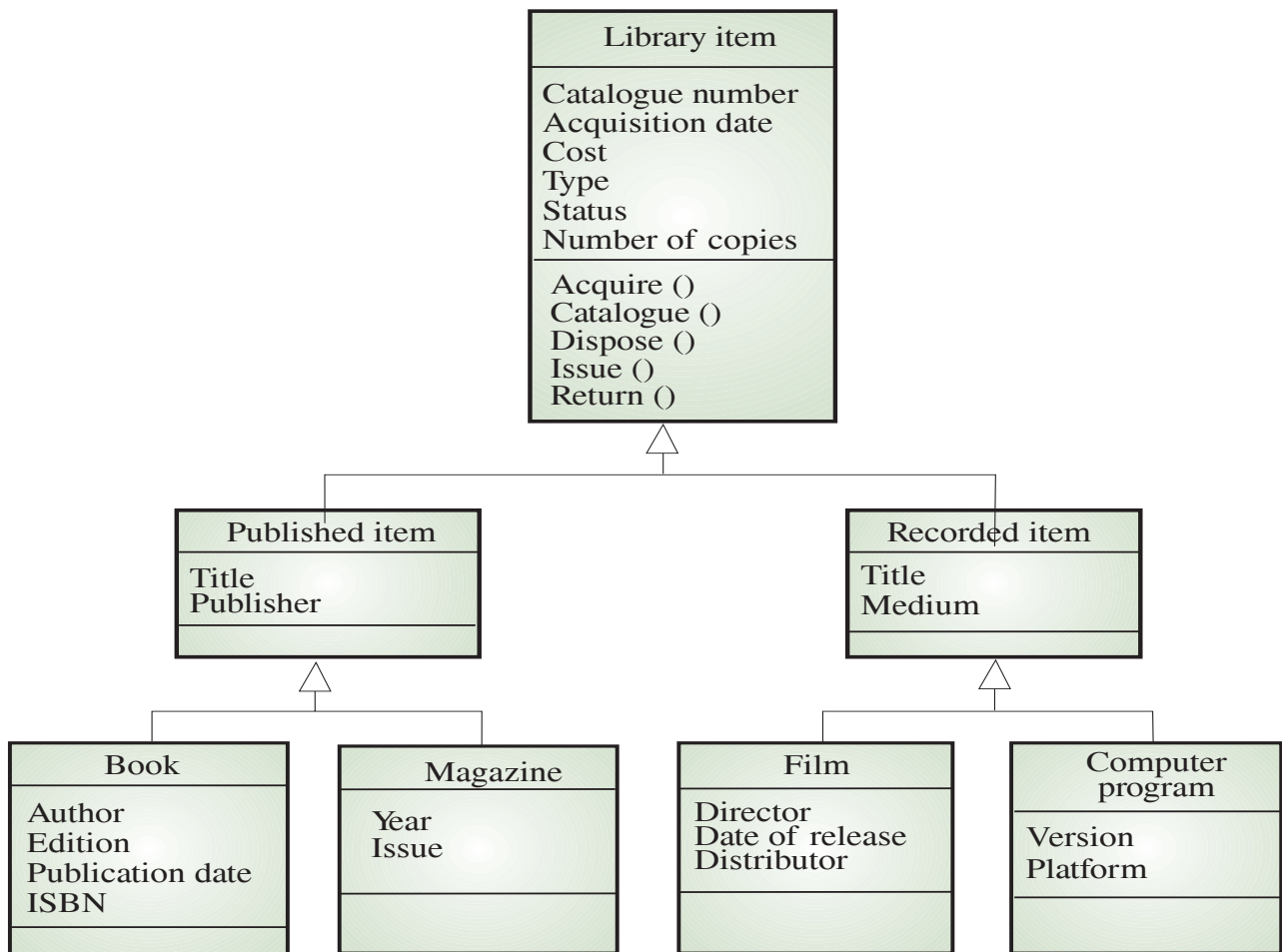


36. What does the class diagram below show?



37. Consider the above class diagram. Assume appropriate multiplicity between classes and show this on the diagram

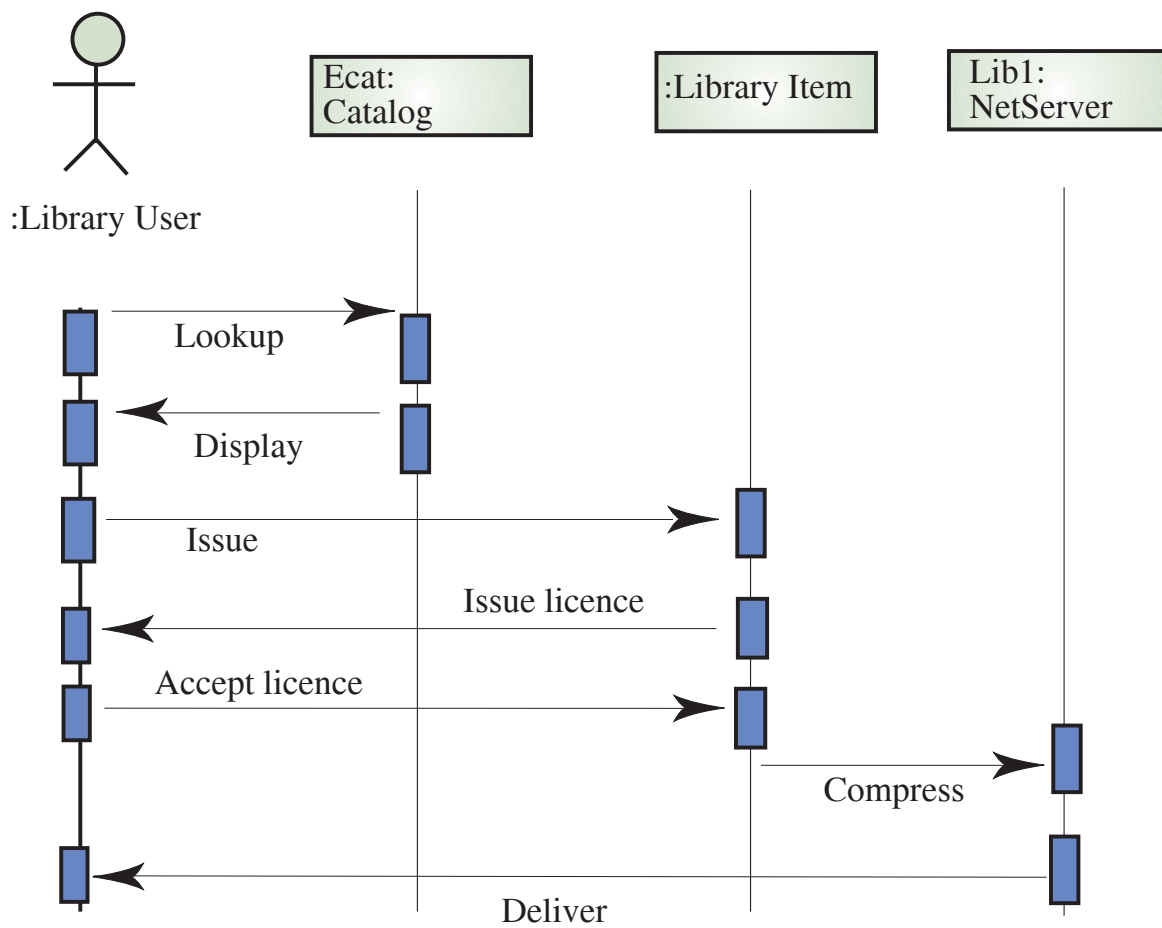
**38.** The following figure shows a library **class hierarchy**.



List all attributes and methods of each of the subclasses Book, Magazine, Film, and Computer program.



- 39. What is the name of the diagram below?
- 40. Consider the diagram below, how many objects are participation in the interaction?
- 41. Consider the diagram below, what is the longest active life line.



**42. Complete:**

- UML means \_\_\_\_\_
- UML is used in \_\_\_\_\_
  
- In object classes, **public level** visibility means that usability of attributes and methods extend to \_\_\_\_\_
- In object classes, **protected level** visibility means that usability of attributes and methods is open only to classes that \_\_\_\_\_ from original class
- In object classes, **private level** visibility means that usability of attributes and methods is open only to the \_\_\_\_\_ class
- \_\_\_\_\_ model shows how classes are composed of other classes

**43. Mark T (True) or F (False):**

- a. Object models describe the system in terms of object classes
- b. Data modelling is described by ER diagrams
- c. In object classes, **public level** visibility means that usability of attributes and methods extend to other classes
- d. In object classes, **protected level** visibility means that usability of attributes and methods is open only to classes that inherit from original class
- e. In object classes, **private level** visibility means that usability of attributes and methods is open only to the original class
- f. The UML uses an asterisk (\*) to represent *more* and to represent *many*
- g. Aggregation model shows how classes are composed of other classes
- h. In a sequence diagram, message that's closer to the top occurs in time **after/before** a message that's closer to the bottom

44. Explain what is meant by state.

45. Explain what is meant by stimuli.

46. Give an example of internal stimuli

47. Draw a state chart showing the behavioural model of a microwave oven. Complement your drawing with tables describing the states and stimulus of the system.

48. Draw a state chart showing the behavioural model of a coffee machine

49. Draw a state chart showing the behavioural model of soft drink vending machine.

50. Explain what would you do when you have more than 11 states to draw on a state chart.

51. Consider the shown state chart for a microwave oven. Complete the missing stimuli on the chart.

