一、　问答题（每题 2 分，共 10 分）

1、**What is modeling? Please explain the concepts of timeliness, concurrency, correctness and robustness.**

Modeling

对于一些系统的简化/抽象表示，这些系统强调从给定观点的某些特定属性。该观点定义了模型的关注点和范围。

- A reduced/abstract representation of some system that highlights the properties of interest from a given point of view.
- The point of view defines concern and scope of the model.

参考 PPT

PPT2.0

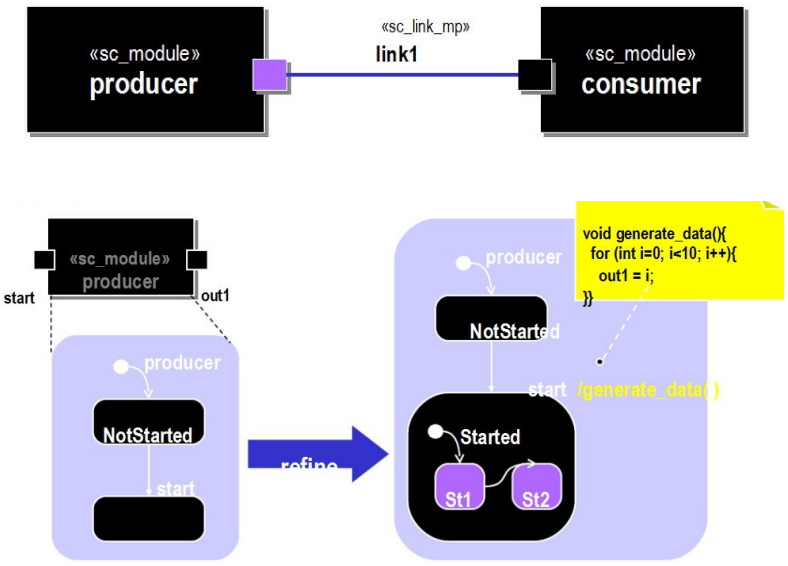
及时性：行动的及时性与行动会议有关时间限制，例如截止日期。 必须非常小心，以确保所有这些行动及时执行。关注是建模执行时间，截止日期，到达模式，同步模式和时间源。

并发：是多个的同时执行连续的行动链。 这些动作链可以执行在一个处理器（伪并发）或多个处理器（真正的并发）。围绕着问题并发系统的执行与以下内容有关：
并发线程的调度特性；
传入事件的到达模式；
线程必须同步时使用的集合点模式；
以及控制对共享资源的访问的方法。

正确性和健壮性：当系统始终做正确的事情时，系统是正确的。
新颖的（无计划的）情况下，它做正确的事情时，这样的系统是健壮的即使存在部分系统的计划外故障。 必须防范僵局，竞争条件和其他特殊情况条件。

精化操作

2、**Please explain the concept of refinement using the example below.**



精化：模型的具体化实现（implementation）。可以通过精化操作判断两个模型的一致性。

3、Define the term *use case*.

1.5.1 用例图(Use Case Diagram)

※ 用例图是从用户角度描述系统功能，是用户所能观察到的系统功能的模型图，用例是系统中的一个功能单元

二、Earliest Deadline First (EDF): Given are five tasks with arrival times, execution times and deadlines according to the following table. Determine the Earliest Deadline First (EDF) schedule. Is the schedule feasible? (10 points)

	T1	T2	T3	T4	T5
a_i	0	2	0	8	13
c_i	3	1	6	2	3
d_i	16	7	8	11	18

(1) The EDF schedule is feasible, and the respective schedule is shown in the Figure 3.

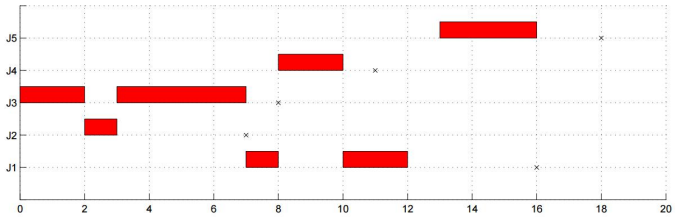
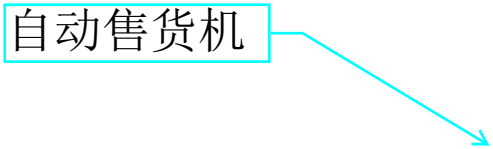


Figure 3: EDF schedule.



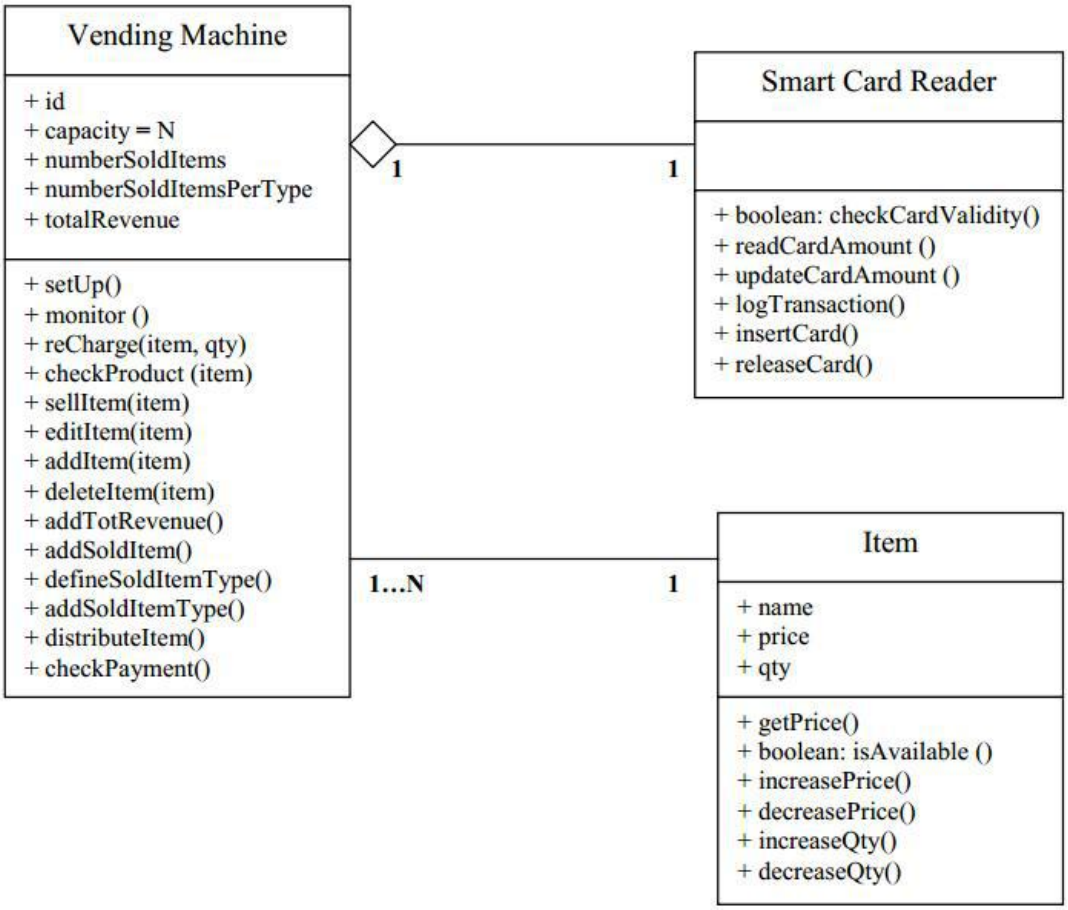
三、 **Class Diagram:** Model with a class diagram the following System: Vending Machine.

A vending machine sells small, packaged, ready to eat items (chocolate bars, cookies, candies, etc.). Each item has a price and a name. A customer can buy an item, using a smart card (issued by the vending machine company) to pay for it. No other payment forms (i.e. cash, credit card) are allowed. The smart card records on it the amount of money available.

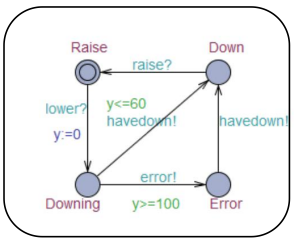
The functions supported by the system are:

- Sell an item (choose from a list of items, pay item, distribute item)
- Recharge the machine
- Set up the machine (define items sold and price of items)
- Monitor the machine (number of items sold, number of items sold per type, total revenue)

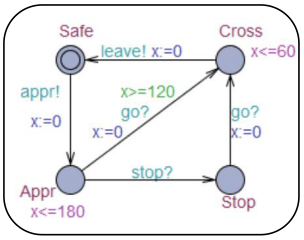
The system can be used by a customer, a maintenance employee (who recharges items in the machines), an administrator (who sets up the machine).


Vending Machine
+ id
+ capacity = N
+ numberSoldItems
+ numberSoldItemsPerType
+ totalRevenue
+ setUp()
+ monitor ()
+ reCharge(item, qty)
+ checkProduct (item)
+ sellItem(item)
+ editItem(item)
+ addItem(item)
+ deleteItem(item)
+ addTotRevenue()
+ addSoldItem()
+ defineSoldItemType()
+ addSoldItemType()
+ distributeItem()
+ checkPayment()
1
1
Smart Card Reader
+ boolean: checkCardValidity()
+ readCardAmount ()
+ updateCardAmount ()
+ logTransaction()
+ insertCard()
+ releaseCard()
1…N
1
Item
+ name
+ price
+ qty
+ getPrice()
+ boolean: isAvailable ()
+ increasePrice()
+ decreasePrice()
+ increaseQty()
+ decreaseQty()

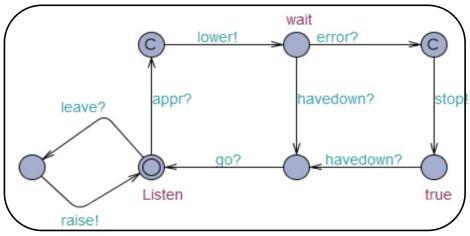
四、**timed automata:** please explain the running process of the following behavior model.



控制门



火车



控制器

答案如下:

火车处于 safe 状态，并在靠近路口时发出 appr 同步事件；

控制器处于 listen 状态，在接收到同步事件 appr 后，迁移至委托状态（C）并发出 lower 同步事件，并迁移至 wait 状态；

控制门处于 Raise 状态，当接收到 lower 事件后，迁移至 Downing 状态，并将时钟 y 设置为 0；

控制门在成功下降后，发出 havedown 事件；

控制器处于 wait 状态并接收到 havedown 同步事件，并作出状态的迁移；并发出 go 的同步事件；

以此类推

……