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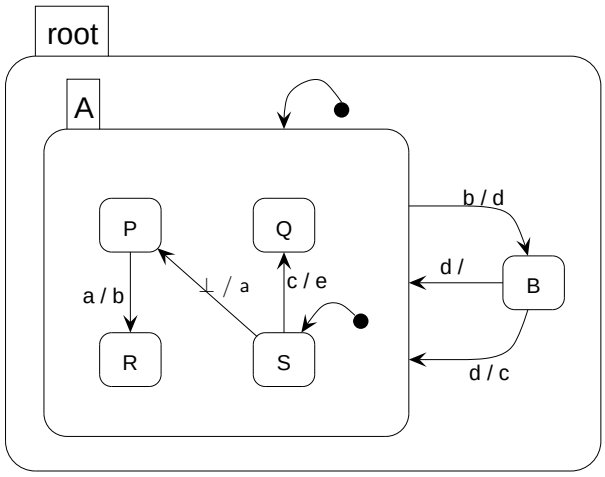
Foundations of UML
Winter term 2009
– Assignment 8 –

Hand in the solutions before the exercise class on January 20th.

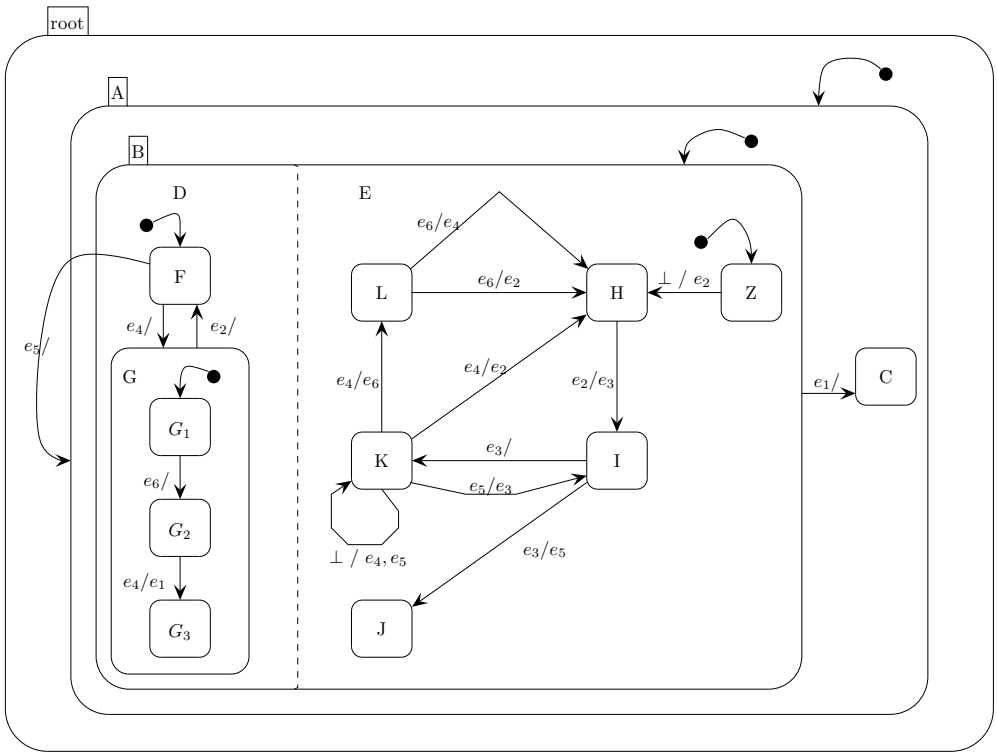
Exercise 1 (15 points)

Let the following Statecharts Sc_1 and Sc_2 be given:

Sc_1:



Sc_2:



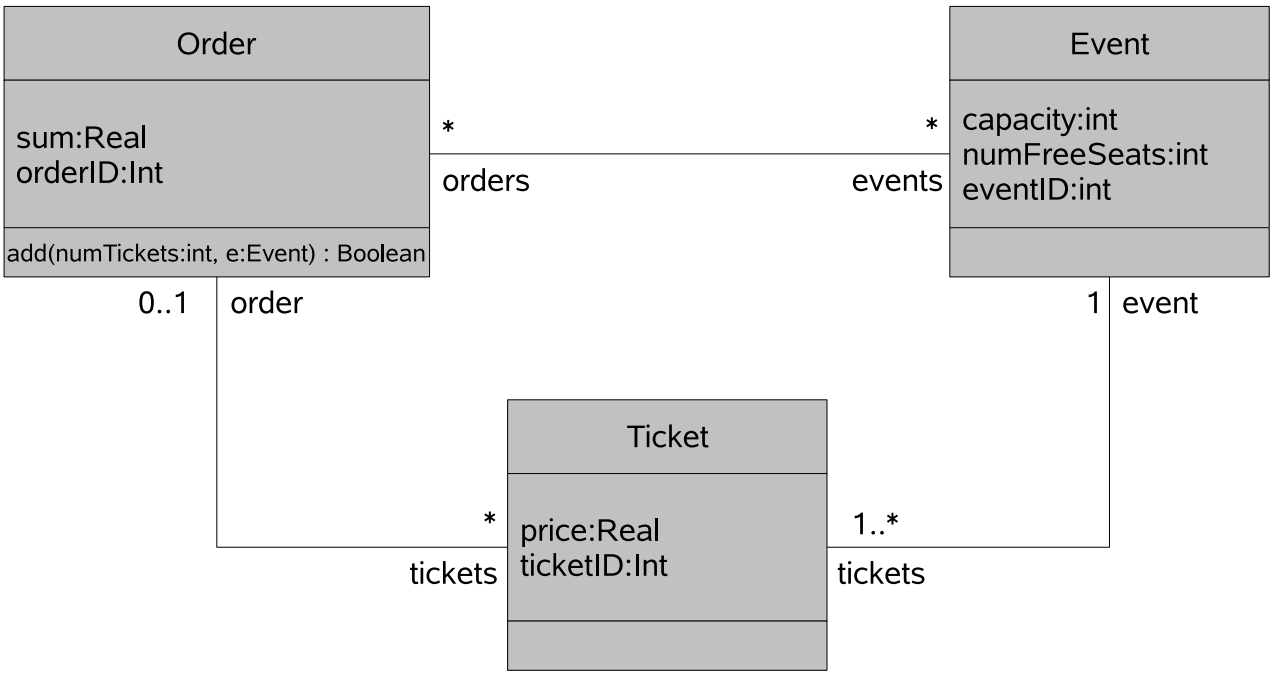
a) Determine the formal semantics for each of the Statecharts Sc_1 and Sc_2 (i.e., construct the related Mealy machine for each Statechart) by successively calculating locations and steps (starting from

the initial location l_0). In both cases write down all your calculations before constructing the corresponding automaton.

b) Determine the priority between moving from F to G and moving from F to A if both edges are enabled.

Exercise 2 (10 points)

Let the following class diagram be given:



It is part of a ticket reservation system where a user can order tickets for events like cinema films or theater or cabaret performances.

a) Describe the following statements as OCL invariants:

   i) The attribute `sum` must not be negative.

   ii) The attribute `sum` is 0 if no tickets are ordered.

   iii) The attribute `sum` exactly describes the prize of the tickets ordered.

   iv) Different instances of `Ticket` have different order numbers.

   v) Each `Event` has at least 0 free seats.

   vi) An `Event`'s capacity (i.e., the total number of seats) is greater than the number of all ordered tickets of this event.

b) Describe the pre- and post conditions of method `add`, which adds a number of `num` tickets to the order if there are still enough free seats and in this case increases the sum correctly. In case there are not enough seats nothing is done.

Exercise 3 (10 points)

Given the class diagram from exercise 1, a concrete instance of the system is being created. There are two events: a film *Dumbo* and a theater performance called *The Magic Flute*. The film has got two categories: two cheap tickets for 5 Euro, each and two more expensive ones for 10 Euros, each. The theater seats are divided into 5 categories. There is a ticket for 20, 40, 60, 80 and 100 Euros. The film has got a capacity of 4 but there are already two seats occupied by an order O_0 which includes a ticket for 5 and one for

10 Euros. Moreover O_0 contains the most expensive ticket for the theater event. From now on cheaper tickets are sold first (e.g., the first ticket to be sold for the film *Dumbo* is a 5 Euro ticket).

a) Draw the system's "initial" configuration which is described above.

b) Draw the system's configuration after each of the following actions:

   (a) A new `order` O_1 is created. For this order:

      i) Buy a ticket for *The Magic Flute*.

      ii) Buy a ticket for the film *Dumbo*.

   (b) A new `order` O_2 is created. For this order:

      iii) Buy two tickets for the film *Dumbo*.

      iv) Buy three tickets for *The Magic Flute*.