Timed & hybrid systems (2.8.2)
TD n° 1 : Modeling

Exercice 1 – Genetic network
We consider expression of two genes A and B, i.e. production of two proteins P and Q
– The proteins are degraded with rate k (the proportion k of each protein disappears in a unit of time).
– The protein P catalyses the expression of the gene B : the production of the protein Q is proportional to the concentration of P with a coefficient a. As soon as the concentration of P crosses a threshold s, the production of Q becomes constant equal to as
– The protein Q inhibits the expression of the gene A : the production of the protein P equals d – b·(concentration de Q). As soon as the concentration of Q crosses a threshold r, the production of P blocks.
Modelize this system by a hybrid automaton.

Exercice 2 – Scheduling
We want to schedule two jobs with a total execution time up to 16 minutes.
– Job 1 : Compute (10 min); Print (5 min)
– Job 2 : Download (3 min); Compute (1 min); Print (2 min)
There is only one printer and one computing board.
Represent the problem as reachability for a timed or hybrid automaton :
1. without preemption ;
2. with preemptible computing.

Exercice 3 – Bus stop verification
System : A bus passes every 7 to 9 minutes. A taxi passes every 6 to 8 minutes. At noon a bus and a taxi passed. Property : Between 12 :05 and 12 :30, within 5 minutes after every bus, a taxi passes.
1. Represent by a timed automaton all possible behaviors of the system.
2. Represent by a timed automaton all behaviors violating the property.
3. Think how to verify whether the property always holds