

## Test of Discrete Event Systems - 06.11.2017

### Exercise 1

A small hair salon has two chairs and two hairdressers. Customers arrive according to a Poisson process with rate 3 arrivals/hour. A customer is male with probability  $p = 1/3$ . The duration of a hair-cut is independent of the hairdresser, but depends on the gender of the customer. It is exponentially distributed with expected value 20 minutes for men, and 45 minutes for women. Since the hair salon does not have a waiting room, customers arriving when both chairs are busy, decide to give up hair cutting. The hair salon is empty at the opening.

1. Model the hair salon through a stochastic timed automaton  $(\mathcal{E}, \mathcal{X}, \Gamma, p, x_0, F)$ .
2. Assume that one hairdresser is serving a man and the other is serving a woman. Compute the probability that the next event is the arrival of a new customer.
3. Assume that both hairdressers are busy with male customers. Compute the probability that the next event is the termination of a hair cut.
4. Assume that both hairdressers are busy with male customers of different age. Compute the probability that the next event is the termination of the hair cut of the youngest man.
5. Assume that one hairdresser is serving a man and the other is serving a woman. Compute the probability that the hair cut of the man terminates before the hair cut of the woman.
6. Compute the probability that the third customer arriving after the opening has to give up hair cutting.
7. Assume that one hairdresser is serving a man and the other is serving a woman. Compute the probability that both hair cuts terminate before another customer arrives.
8. Assume that one hairdresser is serving a man and the other is serving a woman. Compute the probability that, in the next hour, both hair cuts are terminated and no other customer arrives.
9. Compute the probability that at least three customers arrive in the next hour.
10. Compute the average state holding time when:
  - (a) one hairdresser is serving a man and the other is idle;
  - (b) one hairdresser is serving a man and the other is serving a woman.