

1. A fire station has one fire truck. When an emergency call comes, the truck goes out, fights fire and then returns.
 - (a) Design a hidden Markov model (HMM) with two states (*parked* and *not parked*) to describe the behaviour of this system. Choose transition probabilities to reflect the following properties of the domain.
 - On the average, there is an alert once in twelve hours.
 - The expected duration for one fire mission is 3 hours.Use one hour time slices in your model.
 - (b) Write down the corresponding transition model $\mathbf{P}(Parked_{t+1} | Parked_t)$ using a Boolean random variable *Parked*.
 - (c) Use the model to determine how many hours a day the truck spends at the fire station (on the average and in the long run)?
 - (d) Given a parametrized prior distribution $\mathbf{P}(Parked_0) = \langle k, 1 - k \rangle$, derive an exact expression for the distribution $\mathbf{P}(Parked_t)$ as a function of t using the transition model and prediction.
 - (e) Does $\mathbf{P}(Parked_t)$ converge as t approaches to infinity?