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 twelwe 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 $\mathbf{P}(Parked_{t+1} \mid Parked_t)$ 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?