CECS 451
Assignment 7
Total: 28 Points

General Instruction

- Submit your work in the Dropbox folder via BeachBoard (Not email or in class).
- Please do not submit LaTeX source files.

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1. (6 points) Exercise 14.14: a, b, and c.
2. (8 points) In Figure 1, suppose we observe an unending sequence of days on which the umbrella appears. As the days go by, the probability of rain on the current day increases toward a fixed point, we expect that $\vec{P}(R_t|u_{1:t}) = \vec{P}(R_{t-1}|u_{1:t-1}) = \langle \rho, 1-\rho \rangle$. Find ρ.

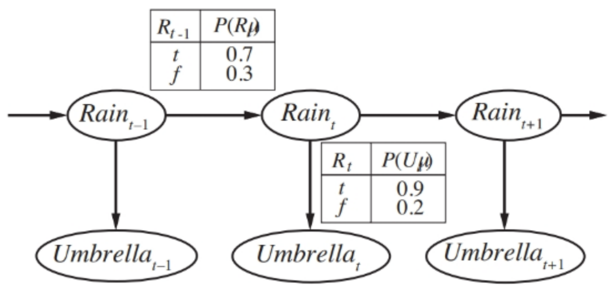

Figure 1: Bayesian network structure and conditional distributions describing the umbrella world. The transition model is $\vec{P}(R|R_{t-1})$ and the sensor model is $\vec{P}(U|R_t)$.

3. A professor wants to know if students are getting enough sleep. Each day, the professor observes whether the students sleep in class, and whether they have red eyes. The professor has the following domain theory:
   - The prior probability of getting enough sleep, with no observations, is 0.7.
   - The probability of getting enough sleep on night t is 0.8 given that the student got enough sleep the previous night, and 0.3 if not.
   - The probability of having red eyes is 0.2 if the student got enough sleep, and 0.7 if not.
   - The probability of sleeping in class is 0.1 if the student got enough sleep, and 0.3 if not.

   (a) (6 points) Formulate this information as a hidden Markov model that has only a single observation variable. Give a Bayesian network and conditional distributions.

   (b) (8 points) Consider the following evidences, and compute $\vec{P}(ES_2|\vec{e}_{1:2})$ and $\vec{P}(ES_1|\vec{e}_{1:3})$.
   - $\vec{e}_1$ = not red eyes, not sleeping in class
   - $\vec{e}_2$ = red eyes, not sleeping in class
   - $\vec{e}_3$ = red eyes, sleeping in class