

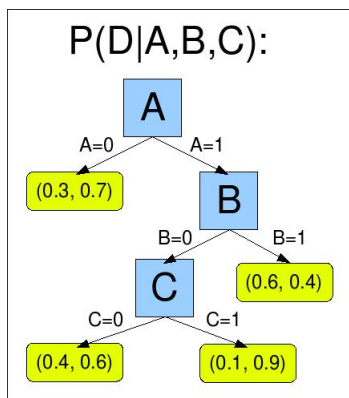
Practice questions for Quiz 2

CS 228 - Winter 2009

January 14, 2009

The following questions are provided as examples of the types of questions we will ask on the quiz this week, as well as the kinds of questions you should be asking yourself (and answering) as you read the text.

1. Use the following figure for the next two questions.



- Which of the following is equal to 0.6 (the first number in the parentheses corresponds to $D=0$, the second to $D=1$)?
 - $P(B = 1|A = 1)$
 - $P(C = 0|A = 1, B = 0)$
 - $P(D = 0|A = 1, B = 1)$
 - $P(D = 0|A = 1, B = 0, C = 0)$
- List all context-specific independencies that are represented by this tree-CPD.

2. DBN

Two robots, Romeo and Juliet, are moving around the Gates Building. They are on different floors and never meet. Each robot moves using a random walk (i.e. at each time step moving from one position to a random neighbor in the grid.) In general, the robots do not know their location, and have to estimate it based on their sensors. Each has a standard noisy sonar sensor of the environment, which gives one reading per time step. In addition, they have access to an inter-robot proximity sensor (a single one for both of them), that provides a noisy measurement of

their distance to each other. (e.g., if Romeo is directly below Juliet, they will probably “feel” closer than if they are on opposite sides of the building.) The entire model is known to both robots; the map of the building, the sensor models of all sensors, and the random walk model used by both robots.

- Draw a Bayesian network that represents the first three time steps of this process. Define random variables as needed. Be sure to include all relevant edges and nodes. You do not need to fill in any CPDs.
- Juliet wants to localize herself - getting the most informed probability distribution about her location. Does it help Juliet to accomplish this if Romeo transmits his sonar observations to her. Justify this using the Bayes net structure.
- Now assume that at time step 2, the robot’s proximity sensor breaks. Would it be useful for Romeo to transmit his sonar readings for time steps 3+? Justify this using the Bayes net structure.
- Now assume that at time step 2, when the sensor breaks, Juliet happens to know exactly where she is, due to a unique landmark on her floor. Would it now be useful for Romeo to transmit his sonar readings for time steps 3+? Justify this using the Bayes net structure.

3. The following questions will be based from Figure 5.8.c in the course reader, on page 121.

- Imagine that instead of the situation as shown in Figure 5.8.c, we also want to model a few things at the university level. Assuming that each class and student can only be associated with a single university, modify the figure with additional plates, nodes and edges to capture the following: The university has a reputation, which can be either high or low. Depending on the reputation of the university, class difficulties change (perhaps some professors feel they have a standard to maintain, while others feel they can slack off now that the university is famous). Draw a plate model that models this scenario.
- Now add to your previous model to capture the fact that the university has an honor roll. Each student can either be on the honor roll or not. The student’s presence on the honor roll depends only on the grades that student has received. Draw a plate model that models this scenario.