CSCE 582—Fall 2002

Final Exam—Closed Book (1.5 hours, 75 points)

Saturday 02/12/14

1. (From Chapter 12 of: Heuer, Richard. *Psychology of Intelligence Analysis.* Available at http://www.cia.gov/csi/books/19104/index.html.)

   > During the Vietnam War, a fighter plane made a non-fatal strifing attack on a US aerial reconnaissance mission at twilight. Both Cambodian and Vietnamese jets operate in the area. You know the following facts:
   >
   > (a) Specific case information: The US pilot identified the fighter as Cambodian. The pilot's aircraft recognition capabilities were tested under appropriate visibility and flight conditions. When presented with a sample of fighters (half with Vietnamese markings and half with Cambodians), the pilot made the correct identification P percent of the time and erred $(100 - P)$ percent of the time.
   >
   > (b) Base rate data: P percent of the jet fighters in that area are Vietnamese; $(100 - P)$ percent are Cambodian.
   >
   > Question: What is the probability that the fighter was Cambodian?

   Build a Bayesian network to describe the situation: draw the graph (7 points) and specify the prior and conditional probability tables (8 points). Answer the question (10 points). (Note that the *same* P is used in the specific case information and in the base rate data.)

2. Draw an influence diagram (10 points) and specify utility and conditional probability tables (10 points) for the following story:

   I have three possible choices for a day off with my family this weekend. I can go to the Congaree Swamp, go shopping at the mall, or just stay home. The family is happy when we go to the swamp and the weather is fine, but detests it when the weather is bad or very bad. The family is moderately happy to go shopping, regardless of the weather. The family is unhappy to stay home, unless the weather is really bad, in which case family members are happy to stay home. I read the weather report in the paper before deciding what to do with the family this weekend.

   Your numbers in the tables are, of course, somewhat arbitrary, but try to capture the essence of the story. Specify the unit you are using in the utility table.

   Make sure that you include all links, including information links.

3. Draw an influence diagram (15 points) and specify utility and conditional probability tables (15 points) for the following story:

Farmer Joe may treat his field with pesticides once a month, for the six months preceding harvest. Pesticides have a cost. The disease level of the field for month i depends on the disease level for the previous month and on whether treatment with pesticides was carried out during the previous month. Farmer Joe cannot know the disease level precisely at month i, but he can test for it and use the results of the test in deciding whether to apply pesticides at month i. The yield of the crop at month 6 has a utility.

Your numbers in the tables are, of course, somewhat arbitrary, but try to capture the essence of the story. Specify the unit you are using in the utility tables. Make sure to include all information and precedence links.