Names:

CMPSCI 240
Reasoning Under Uncertainty
Discussion 7

Suppose a person goes for a heart check-up and the doctor tries to ascertain whether that person has a heart condition based on three characteristics, a patient's *gender*, *blood pressure*, and *electrocardiograph (ECG) reading*. The characteristics can take on the following values:

- Gender: Male or Female

- Blood pressure: Low or High

- ECG reading: Normal or Abnormal

We are given the following information:

$P(\text{having a heart condition}) = 0.1$

$P(\text{gender is male} \mid \text{a patient does not have a heart condition}) = 0.8$
$P(\text{gender is male} \mid \text{a patient has a heart condition}) = 0.6$

$P(\text{high blood pressure} \mid \text{a patient does not have a heart condition}) = 0.6$
$P(\text{high blood pressure} \mid \text{a patient has a heart condition}) = 0.7$

$P(\text{abnormal ECG} \mid \text{a patient does not have a heart condition}) = 0.5$
$P(\text{abnormal ECG} \mid \text{a patient has has a heart condition}) = 0.8$

You may assume the patient's gender, blood pressure, and ECG reading are all conditionally independent of each other given the presence or absence of a heart condition.

Question 1:   A female patient has low blood pressure and an abnormal ECG. What are the maximum likelihood and MAP hypotheses regarding whether or not she has a heart condition?

Question 2:   What is the posterior probability of this patient having a heart condition?

Question 3:   A male patient has low blood pressure and a normal ECG. What are the maximum likelihood and MAP hypotheses regarding whether or not he has a heart condition?