MA 110 Using Bayes' Formula
Section 7-4

1. A rare but serious disease is known to occur in 1 out of 1000 people, that is, $\frac{1}{1000} = .001$ of people have this disease. A test for the disease is known to be 99% accurate if a person actually has the disease, and 98%accurate if a person does not have the disease. This means that of those who actually have the disease, 99% will test positive (true positive) and 1% will test negative (false negative); while of those who do not have the disease, 98% will test negative (true negative) and 2% will test positive (false positive).

(a) Draw a probability tree for this situation.

(b) A randomly selected person is given the test. What is the probability that the person tests positive?

(c) Suppose that a randomly selected person is given the test and tests positive. Should the person be really worried, that is, what is the probability that the person really has the disease?

2. Suppose it is known that 30% of people who have certain symptoms will have the disease discussed in problem #1 above. The test for the disease is given to people who have these symptoms. If a person in this group tests positive, what is the probability that the person actually has the disease?

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3. This example is based on data about passengers who were on the *Titanic*, which sank in 1912 on its first voyage.

25% of the passengers on the *Titanic* traveled first-class, 27% traveled second-class, and the rest traveled third-class. Of the first-class passengers, 62% survived, while 32% of the second-class passengers and 29% of the third-class passengers survived.

(a) Suppose a person survived. What is the probability that the person was a first-class passenger?

(b) Suppose a person did not survive. What is the probability that the person was a third-class passenger?