To get the most out of this hw assignment, read the given probabilities, and then write them down using function notation. These problems are used to ease you into the tree diagram concept.

1. The Federal Aviation Administration (FAA) routinely performs drug test on air traffic controllers at random to ensure lower use of drugs. A urine test is used as a preliminary indicator because of its low cost and ease of implementation. One urine test used is the Triage Panel for Drugs of Abuse plus TCA, which detects the presence of drugs such as amphetamines, opiates, and barbiturates. If a person for example has taken one these drugs the urine test has a 96% chance that it will detect it. However, it the person has not taken any of these drugs, there is a 7% that the test shows the person has taken these drugs (false–positive).

Given past historical data, the FAA says that any one time 0.007 or (0.7%) of its employees use these drugs at any given time.

The tree diagram that accompanies this information is shown below.

- **Use drugs**
  - Test positive: 0.96
  - Not Test positive: 0.04

- **Not use drugs**
  - Test positive: 0.07
  - Not Test positive: 0.93

a. Write down the given probabilities using function notation.
b. What is the probability that a traffic air controller is using drugs and tests negative?
c. What is the probability that an air traffic controller tests positive?
d. What is the probability that an air traffic controller tests negative?
e. If an air traffic controller tests positive what is the probability that they have used drugs?
f. If an air traffic controller tests negative what is the probability that they have used drugs?
2. In a particular region in the U.S. it is estimated that 0.75% of the women actually have breast cancer. A test used to detect breast cancer, can detect breast cancer 86% (positive result). But this same test will give positive results 12% of the time for women that do not have breast cancer.

a. Write down the given probabilities using function notation.

b. What is the probability that a woman from that region has no cancer and tests positive?

c. What is the probability that a woman from that region tests positive?

d. What is the probability that a woman from this region that tests positive has no cancer?

e. A woman from this region takes the test. It comes back positive. What is the probability that she has cancer?

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\begin{align*}
\text{P(Has Cancer)} &= 0.0075, \\
\text{P(Not Has Cancer)} &= 0.9925, \\
\text{P(Test Positive | Has Cancer)} &= 0.86, \\
\text{P(Test Positive | Not Has Cancer)} &= 0.12.
\end{align*}
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