Problem 1

Of the entire population, 2% has a certain disease X. A test Y, which indicates whether or not a person has the disease, is not 100% accurate. If a person has the disease, there is a 6% chance that it will go undetected by the test. However, there is also a 9% chance of "false alarm" (meaning that the person does not have the disease but the test indicates otherwise). A person Z takes a test which later comes out positive (meaning that the test says he has the disease). What is the probability of this person having the disease in reality?
Problem 2

Consider the following Bayesian network:

a) Are D and E necessarily independent given evidence about both A and B?

b) Are A and C necessarily independent given evidence about D?

c) Are A and H necessarily independent given evidence about C?
Problem 3

Consider the following Bayesian network. A, B, C, and D each could have a value of either true or false. If we know that A is true, what is the probability of D being true?

\[
\begin{align*}
P(A) &= 0.75 \\
P(B | A) &= 0.2 \\
P(B | \text{not } A) &= 0.5 \\
P(C | A) &= 0.7 \\
P(C | \text{not } A) &= 0.25 \\
P(D | B \text{ and } C) &= 0.3 \\
P(D | B \text{ and (not } C)) &= 0.25 \\
P(D | \text{not } B \text{ and } C) &= 0.1 \\
P(D | \text{not } B \text{ and (not } C)) &= 0.35
\end{align*}
\]