Theory Assignment-3
due for submission on Moodle by 12th March

Q1. Let
H = event that person has disease,
S = event that test result is positive
R1 = event that positive test result came from Machine 1
R2 = event that positive test result came from Machine 2

$P(H)=0.001$, $P(R1)=0.2$, $P(R2)=0.8$,
$P(R1|H)=0.89$, $P(R2|H)=0.99$, $P(R1|\bar{H})=0.025$, $P(R2|\bar{H})=0.005$

Given that person has a disease and test result is positive. What is the probability that the result came from Machine 2?

Q2. We believe there are three types of managers:
underperformers, in-line performers, and outperformers. The underperformers (MU) beat the market only 25% of the time, the in-line performers (MI) beat the market 50% of the time, and the outperformers (MO) beat the market 75% of the time.

Initially we believe a given manager is most likely to be an in-line performer, and is less likely to be an underperformer or an outperformer. Specifically, our prior belief is that a manager has a 60% chance of being an in-line performer, a 20% chance of being an underperformer, and a 20% chance of being an outperformer. We can summarize this as:

$P[MU]=P[p=0.25]=20\%$, $P[MI]=P[p=0.50]=60\%$, $P[MO]=P[p=0.75]=20\%$ ….(1)

a.) By taking the values given in (1), suppose the manager beats the market two years in a row. What should our updated beliefs be?

b.) After updating the beliefs from part (a), what if the manager again beats the market next year, what should be the updates now?

c.) By taking the values given in (1), suppose the manager beats the market three years in a row. What should our updated beliefs be? How is it different from part (b)?