HW 2

T = test Positive

D = has disease

1) Given $P(T|D) = 0.99$

$P(!T|!D) = 0.99$

$P(D) = 0.0001$

Solve $P(D|T) = \frac{P(T|D) \cdot P(D)}{P(T)}$

$= \frac{(P(T|D)\ P(D))}{P(T|D)\ P(D) + P(T|D!)\ P(!D)}$

$= \frac{.99 \times .0001}{.99 \times .0001 + .01 \times .99}$

$= .00984$

the probability that lily has the disease. given she tested positive is 0.009804 = 0.98%

2) $P(F1=a \mid +) = 1/2$ $\quad P(F1=a \mid -) = 1/3$

$P(F2=c \mid +) = 1/2$ $\quad P(F2=c \mid -) = 2/3$

$P(F3=b \mid +) = 0$ $\quad P(F3=b \mid -) = 1/3$

a)

For positive case

$P(+ \mid F1=a, F2=c, F3=b)$

$= p(+)\, p(F1=a \mid +)\, p(F2=c \mid +)\, p(F3=b \mid +)$

$= 2/5 \times 1/2 \times 1/2 \times 0$

$= 0$

For negative case

$P(- \mid F1=a, F2=c, F3=b)$

$= p(-)\, p(F1=a \mid -)\, p(F2=c \mid -)\, p(F3=b \mid -)$

$= 3/5 \times 1/3 \times 2/3 \times 1/3$

$= 0.0444$

Thus test example a is going to be classified as negative since positive = 0 negative 0.0444

b) For positive case

$P(+|F1=b, F2=b, F3=a)$

$= p(+)\, p(F1=b|+)\, p(F2=b|+)\, p(F3=a|+)$

$= 0 \times 0 \times 0$

$= 0$

For negative case

$P(-|F1=\ , F2=\ , F3=\ )$

$= p(-)\, p(F1=b|-)\, p(F2=b|-)\, p(F3=a|-)$

$= 0.6 \times 1/3 \times 0 \times 2/3$

$= 0$

Since both posteriors are $= 0$ the classifier cannot assign a class based on the current data. it does suggest the example doesn't fit the data well