Question 1

1) Probability of a Positive Result for a Sick Person

From the table: $P(+|D) = 0.009$

So, the probability that the test will return a positive result for a sick person is **0.009** or 0.9%.

2) Probability of Having the Disease Given a Positive Test Result.

$P(D|+) = ?$

We calculate this using Bayes Theorem

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

Where,

$P(+|D) = \mathbf{0.009}$

$P(D) = P(+|D) + P(-|D)$

$= 0.009 + 0.001 = \mathbf{0.01}$

$P(+) = P(+|D) \cdot P(D) + P(+|\neg D) \cdot P(\neg D)$

$= (0.009 \cdot 0.01) + (0.099 \cdot 0.99)$

$= 0.00009 + 0.09801$

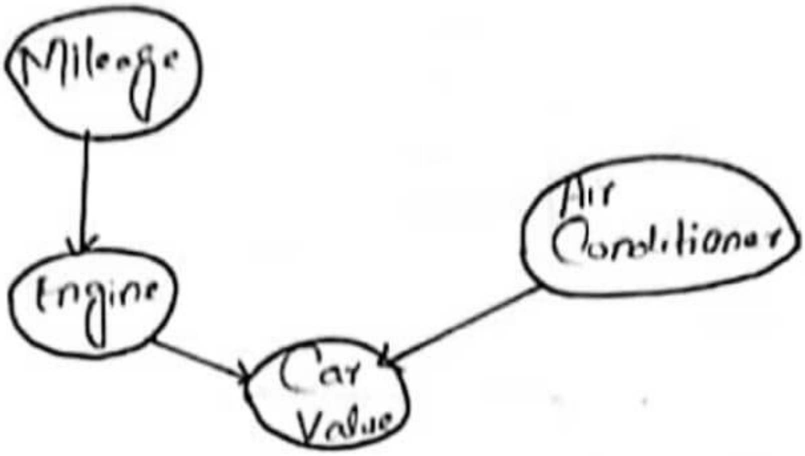
$= \mathbf{0.0981}$

Now, we can calculate $P(D|+)$,

$$P(D|+) = \frac{0.009 \cdot 0.01}{0.0981} = \frac{0.00009}{0.0981}$$

$\boxed{= 0.000917}$

So, the probability that you have the disease given a positive test result is **0.0917% or 0.09%**



1) Milaege

P(milaege = = Hi) = 20/40 = 0.5
P(milaege = = lo) = 20/40 = 0.5

Milage	Probability
Hi	0.5
low	0.5

2) Air Conditioner

working = 3+4+1+5+9+0+1+2 = 25
Broken = 1+2+0+4+5+1+0+2 = 15
P(working) = 25/40 = 0.625
P(Broken) = 15/40 = 0.375

Air Cond.	Pro
Working	0.625
Broken	0.375

3) Engine

P(Hi, Good) = 3+1+4+2 = 10 = 10/20 = 0.5
P(Hi, Bad) = 1+0+5+4 = 10 = 10/20 = 0.5
P(Lo, Good) = 9+5+0+1 = 15 = 15/20 = 0.75
P(Lo, Bad) = 2+2+1+0 = 5 = 5/20 = 0.25

Mileage	Engine	P(Engine)
Hi	Good	0.5
Hi	Bad	0.5
Lo	Good	0.75
Lo	Bad	0.25

4) Car value

(1) Engine = Good, air-Conditioner = working.

Car-value = Hi = 3+9 = 12

Car value = lo = 4+0 = 4

(2) Engine = Good, air-conditioner = Broken

Car-value = Hi = 1+5 = 6

Car-value = lo = 2+1 = 3

(3) Engine = Bad, air-Conditioner = working

Car-Value = Hi = 1+1 = 2

Car-Value = Lo = 5+2 = 7

(4) Engine = Bad, air-Conditioner = Broken

Car-value = Hi = 0+0 = 0

Car-value = lo = 4+2 = 6

Engine	Air-Conditioner	Car-value	P(Car-value)
Good	working	Hi	12/16 = 0.75
Good	working	lo	4/16 = 0.25
Good	Broken	Hi	6/9 = 0.667
Good	Broken	Lo	3/9 = 0.333
Bad	working	Hi	2/9 = 0.222
Bad	working	Lo	7/9 = 0.776
Bad	Broken	Hi	0/6 = 0
Bad	Broken	Lo	6/6 = 1.00

Question no 3

Training Set = $\{(1,1,1,+), (1,0,1,-), (0,1,0,-1), (0,0,\#,-)\}$

- ~~h_1 if a~~

for h_1:

$a_1 = 1$

probability $h_1 = P(+ \mid h_1) = \frac{4}{5}$

$, P(- \mid h_1) = \frac{1}{5}$

h_2 : $P(+ \mid h_2) = \frac{4}{5}$

$, P(- \mid h_2) = \frac{1}{5}$

h_3 : $P(+ \mid h_3) = \frac{1}{3}$, $P(- \mid h_3) = 2/3$

Using Naive Bayes

$$P(+) = P(h_1) . P(+ \mid h_1) \times P(h_2) \times P(+ \mid h_2) \times P(h_3) \times P(+ \mid h_3)$$

$$= \frac{1}{3} \times \frac{4}{5} \times \frac{1}{3} \times \frac{4}{5} \times \frac{1}{3} \times \frac{1}{3}$$

$$= 0.00790$$

$$P(-) = P(h_1) \times P(- \mid h_1) \times P(h_2) \times P(- \mid h_2) \times P(h_3) \times P(- \mid h_3)$$

$$= \frac{1}{3} \times \frac{1}{5} \times \frac{1}{3} \times \frac{1}{5} \times \frac{1}{3} \times \frac{2}{3}$$

$$= 0.000987$$

As $P(+) > P(-)$

So, Naive Bayes Classifier classify

$x = (1, 1, 0)$ as $+$.