# Assignment 3

Harshal Verma
AI21MTECH02003

## I. Problem 2.6

**Problem**: A manufacturer has three machine operators A, B and C. The first operator A produces $1\%$ defective items, where as the other two operators B and C produce $5\%$ and $7\%$ defective items respectively. A is on the job for $50\%$ of the time, B is on the job for $30\%$ of the time and C is on the job for $20\%$ of the time. A defective item is produced, what is the probability that it was produced by A?

**Solution :**

Let
A : Event that item produced by operator A
B : Event that item produced by operator B
C : Event that item produced by operator C
D : Event that item produced is defective

We need to find out the probability that the item is produced by the operator A is defective
i.e.$P(A|D)$

$$P(A|D) = \frac{P(A).P(D|A)}{P(A).P(D|A) + P(B).P(D|B) + P(C).P(D|C)}$$

$$\begin{aligned}
P(A) &= \text{Probability of item is produced by operator A} \\
&= 50\% = \frac{50}{100} = 0.5 \\
P(B) &= \text{Probability of item is produced by operator B} \\
&= 30\% = \frac{30}{100} = 0.3 \\
P(C) &= \text{Probability of item is produced by operator C} \\
&= 20\% = \frac{20}{100} = 0.2 \\
P(D|A) &= \text{Probability of a defective item is produced by ope} \\
&= 1\% = \frac{1}{100} = 0.01 \\
P(D|B) &= \text{Probability of a defective item is produced by ope} \\
&= 5\% = \frac{5}{100} = 0.05 \\
P(D|C) &= \text{Probability of a defective item is produced by ope} \\
&= 7\% = \frac{7}{100} = 0.07
\end{aligned}$$

Putting the values in the formula :

$$\begin{aligned}
P(A|D) &= \frac{P(A).P(D|A)}{P(A).P(D|A) + P(B).P(D|B) + P(C).P(D|C)} \\
&= \frac{0.5 \times 0.01}{0.5 \times 0.01 + 0.3 \times 0.05 + 0.2 \times 0.07} \\
&= \frac{0.005}{0.005 + 0.015 + 0.014} \\
&= \frac{0.005}{0.034} \\
&= \frac{5}{34} \\
&= 0.147
\end{aligned}$$

Therefore, required probability = 0.147

Code source: https://github.com/harshal9876/AI5002/blob/main/Assignment_3/Codes/Asssignment_3.py