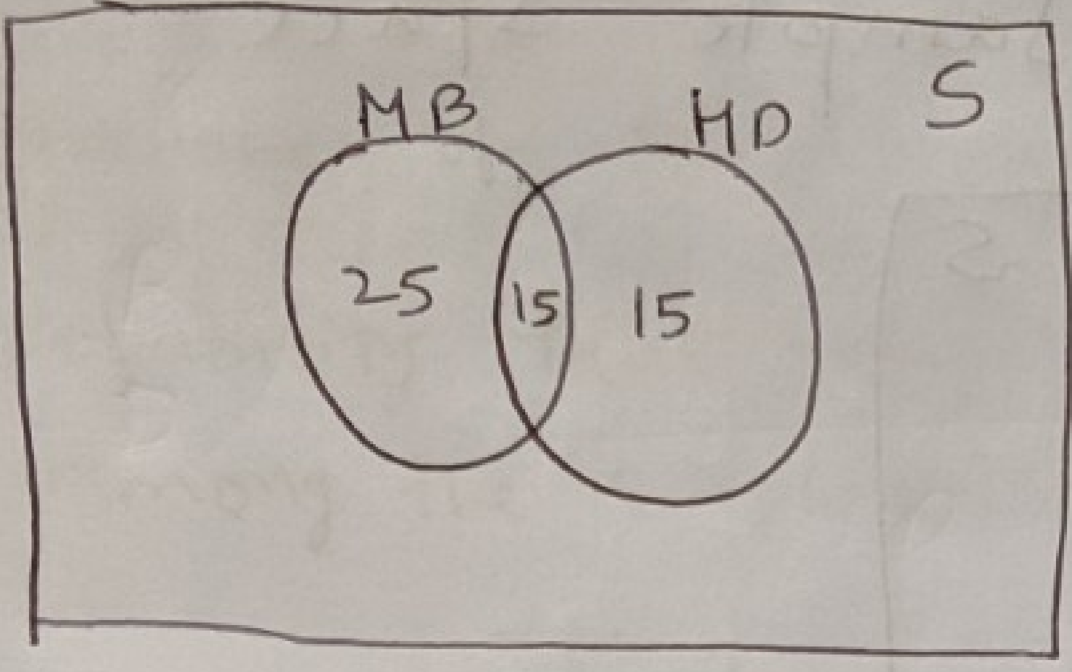
2.2

Lets draw the Venn diagrams for the given question.

The Below Venn diagram depicts the percentage of computers that has MotherBoard (MB) defects and Hard drives (HD) defects.



let S be the Sample Space.

According to the question,

computers that have problem with MotherBoard = 40%.

computers that have problem with Harddisk = 30%.

computers that have problem with Both = 15%.

So, from the Venn diagram

computers that has fully functioning MB and HD = $100 - (25 + 15 + 15)$

$\Rightarrow 100 - 55$

$\Rightarrow 45\%$

In terms of probability it is $\Rightarrow \frac{45}{100}$

$\Rightarrow \boxed{\frac{9}{20}}$.

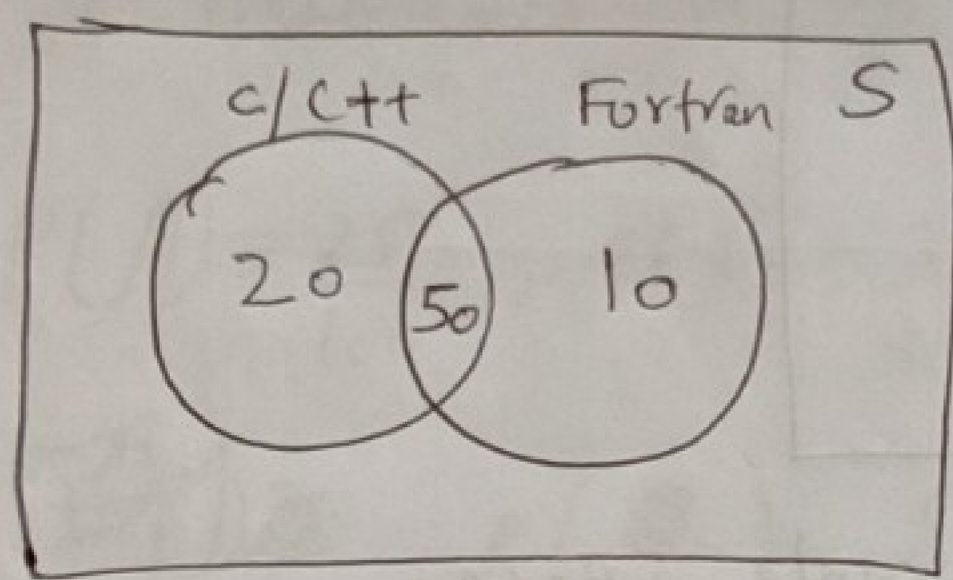
2.4 Lets draw the Venn diagram for the given question.

70% Know c/c++

60% know Fortran

50% know both c/c++ and Fortran.

Let S be the Sample Space.



percentage of people who does not know both c/c++ and Fortran $\Rightarrow 100-(20+50+10)$

$\Rightarrow 100-80$

$\Rightarrow 20\%$.

(a) does not know Fortran

⇓

people who does not know any language + who knows only c/c++ but not fortran

$\Rightarrow 20 + 20$

$= \boxed{40\%}$

(b) does not know Fortran and does not know c/c++.

$\Rightarrow 100-(20+50+10)$

$\Rightarrow 100-80$

$\Rightarrow \boxed{20\%}$

(c) Knows c/c++ but not Fortran
From looking venn diagram, we can say that it is $\boxed{20\%}$

(d) $\boxed{10\%}$ of people/employees know only fortran but not c/c++.

(e) Number of employees who knows fortran = 60%.
probability that they know c/c++ among the employees who knows fortran $= \frac{50}{60}$

$= \boxed{5/6}$.

(f) No. of employees who know c/c++ = 70%
probability that they Fortran too $= \frac{50}{70}$

$= \boxed{\frac{5}{7}}$.

3.6 prediction of weather and the flight arrival are independent events.
In General, $P(A \cap B) = P(A) * P(B)$ if A and B are independent events.

probability that flight arrives on time
$\Downarrow$

$$\frac{60}{100} \times \frac{80}{100} + \frac{40}{100} \times \frac{30}{100}$$

$\Rightarrow 0.48 + 0.12$

$\Rightarrow \boxed{0.6}$

2.8

Given, the three Events are independent.

So $p(A \cap B \cap C) = p(A)\,p(B)\,p(C)$ (general formula)

probability that first key does not fail $= p(K1)$

$$p(K1) = 1 - 0.01$$
$$= 0.99$$

Probability that second key does not fail $= p(K2)$

$$p(K2) = 1 - 0.02 = 0.98$$

Similarly $p(K3) = 1 - 0.02 = 0.98$.

probability that the shuttle will be launched

is $p(K1) \times p(K2) \times p(K3)$

$$\Rightarrow 0.99 \times 0.98 \times 0.98$$
$$\Rightarrow 0.950796$$
$$\Rightarrow \boxed{0.95 \text{ (Approx)}}$$

2.9 Given, the probability of these modules to work are independent.

So $P(A \cap B \cap C) = P(A)P(B)P(C)$ (general formula)

probability that Module 1 works $= P(M1) = 0.96$.

Similarly $P(M2) = 0.95$

$P(M3) = 0.90$

probability that atleast one module fail $= 1 - P(\text{No module fails})$

$\Rightarrow 1 - (0.96 \times 0.95 \times 0.90)$

$\Rightarrow 1 - 0.8208$

$\Rightarrow \boxed{0.1792}$

2.10 Given, probability of a virus damaging the system are independent. So, they are independent events.

probability of virus A damaging the system $= P(A) = 0.4$

Similarly $P(B) = 0.5$

$P(C) = 0.2$

probability of a system getting damaged $= P(A \cup B \cup C)$

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$

$= P(A) + P(B) + P(C) - P(A)P(B) - P(B)P(C) - P(C)P(A) + P(A \cap B \cap C)$

$= 0.4 + 0.5 + 0.2 - (0.5 \times 0.4) - (0.5 \times 0.2) - (0.2 \times 0.4) + 0.4 \times 0.5 \times 0.2$

$= 0.4 + 0.5 + 0.2 - 0.2 - 0.1 - 0.08 + 0.04$

$= \boxed{0.76}$

2.15

Given, the block 1 has Error with probability $= 0.2 = P(E1)$

similarly $P(E2) = 0.3$

The two events are independent.

$$P(E1 \cup E2) = P(E1) + P(E2) - P(E1 \cap E2)$$
$$= P(E1) + P(E2) - P(E1)P(E2)$$
$$= 0.2 + 0.3 - 0.2 * 0.3$$
$$= 0.2 + 0.3 - 0.06$$
$$= 0.44.$$

$P(E1 \cup E2)$ = probability of program returning an Error

$P\left(\frac{E1 \cap E2}{E1 \cup E2}\right)$ = program has returned an Error and the probability that there is an Error in both the blocks.

As per the conditional probability.

$$P(A \cap B) = P(A)\, P\left(\frac{B}{A}\right) \quad \text{(In General)}$$

$$P((E1 \cup E2) \cap (E1 \cap E2)) = P(E1 \cup E2)\, P\left(\frac{E1 \cap E2}{E1 \cup E2}\right)$$

$$P((E1 \cup E2) \cap (E1 \cap E2)) = P(E1 \cap E2) \quad \text{(their intersection Part is } E1 \cap E2\text{)}$$

$$\text{So } P(E1 \cap E2) = P(E1 \cup E2)\, P\left(\frac{E1 \cap E2}{E1 \cup E2}\right)$$

$$\Rightarrow 0.06 = 0.44\, P\left(\frac{E1 \cap E2}{E1 \cup E2}\right)$$

$$= \frac{0.06}{0.44} = P\left(\frac{E1 \cap E2}{E1 \cup E2}\right)$$

$$\Rightarrow \boxed{0.1363}$$

2.17

$P(X)$ = probability that parts has been received from Supplier X.

$P(X) = 24/100$

Similarly $P(Y) = 36/100$, $P(Z) = 40/100$

$P\left(\frac{P}{X}\right)$ = probability that a part from supplier X has a defect

$$P\left(\frac{D}{X}\right) = \frac{5}{100} \times \frac{24}{100} = 0.012$$

Similarly $P\left(\frac{P}{Y}\right) = \frac{10}{100} \times \frac{36}{100} = 0.036$

Similarly $P\left(\frac{P}{Z}\right) = \frac{6}{100} \times \frac{40}{100} = 0.024$

$P\left(\frac{Z}{P}\right)$ = probability that a defective part is found and it is received from supplier Z.

As per the Baeyes Theorem,

$$P\left(\frac{Z}{P}\right) = \frac{P(Z)\,P\left(\frac{P}{Z}\right)}{P(X)\,P\left(\frac{P}{X}\right) + P(Y)\,P\left(\frac{P}{Y}\right) + P(Z)\,P\left(\frac{P}{Z}\right)}$$

$$= \frac{0.4 \times 0.024}{0.24 \times 0.012 + 0.36 \times 0.036 + 0.4 \times 0.024}$$

$$= \frac{0.0096}{0.00288 + .01296 + 0.0096} = \frac{0.0096}{0.02544}$$

$$\Rightarrow \boxed{0.37735}$$

3.19

let $P(I)$ = Probability that an Electronic Inspection occurs.

$= \frac{20}{100} = \frac{1}{5}$.

$P(NI)$ = Probability that an No election inspection (probability that inspection does not occur)

$\Rightarrow 1 - \frac{1}{5} = \frac{4}{5}$.

$P\left(\frac{ND}{I}\right) \Rightarrow$ probability that an inspected part has no defect.

$= 0.95$.

$P\left(\frac{D}{I}\right) \Rightarrow$ probability that an inspected part has a defect

$\Rightarrow 1 - 0.95$

$\Rightarrow 0.05$

$P\left(\frac{ND}{NI}\right)$ = probability that a not inspected part does not have a defect

$= 0.7$

$P\left(\frac{D}{NI}\right)$ = probability that a not inspected part has a defect

$= 1 - 0.7$

$\Rightarrow 0.3$

$P\left(\frac{I}{D}\right)$ = probability that a defective part has been received and it went through an inspection.

As per the Baeyes Theorem,

$$P\left(\frac{I}{D}\right) = \frac{P(I)\, P\left(\frac{D}{I}\right)}{P(I)\, P\left(\frac{D}{I}\right) + P(NI)\, P\left(\frac{D}{NI}\right)}$$

$$= \frac{\frac{1}{5} \times 0.05}{\frac{1}{5} \times 0.05 + \frac{4}{5} \times 0.3} \Rightarrow \frac{0.01}{0.01 + 0.24} \Rightarrow \frac{0.01}{0.25}$$

$$= \boxed{0.04.}$$