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Assignment problems from chapter-2

2.2

given,

problems with mother board = P{MB} = 40%
= 0.4.

problems with hard drives = P{HD} = 30% = 0.3.

problems with both MB and HD = P{MB ∩ HD}
= 15% = 0.15

P{MB ∪ HD} = P{MB} + P{HD} − P{MB ∩ HD}

∴ according to Probability of a union.

P{MB ∪ HD} = 0.4 + 0.3 − 0.15
= 0.7 − 0.15 = 0.55

the probability that a 10-year old computer still has fully functioning is 1 − 0.55
= 0.45

2.4

Employee with c/c++ = 70% = 0.7 = P{C}

Employee with fortan = 60% = 0.6 = P{F}

Employee with both P{C ∩ F} = 50% = 0.5

(a) does not known fortan.

P{F} = 0.6

P{F̄} = ?

P{F̄} = 1 − P{F} ∴ Complement rule.

P{F̄} = 1 − 0.6

= 0.40

Employee does not known fortan = 0.4

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

$P\{\bar{F} \cap \bar{C}\} = 1 - P\{F \cup C\}$ [∴ Complement rule].

$\Rightarrow 1 - P\{F \cup C\}$
$\Rightarrow 1 - (P\{F\} + P\{C\} - P\{F \cap C\})$
$\Rightarrow 1 - ((0.6) + (0.7) - 0.5)$
$\Rightarrow 1 - (0.8)$
$\Rightarrow \underline{0.2}$

does not know fortan and does not know c/c++ is $\underline{\underline{0.2}}$

(c) knows c/c++ but not fortan.
$P\{C\} = 0.7$, $P\{F \cap C\} = 0.5$.
$P\{C / F\} = P\{C\} - P\{F \cap C\}$
$= 0.7 - 0.5 = 0.2$.
knows c/c++ but not fortan = 0.2 //.

(d) knows fortan but not c/c++.
$P\{F\} = 0.6$, $P\{F \cap C\} = 0.5$
$P\{F / C\} = P\{F\} - P\{F \cap C\}$
$= 0.6 - 0.5 = \underline{0.1}$
The protion of programms knows fortan but not c/c++ = $\underline{\underline{0.1}}$.

(e) If someone knows fortan, what is the probability that he/she knows c/c++.

$P\{C | F\} = \dfrac{P\{C \cap F\}}{P\{F\}}$ ∴ conditional rule.

$P\{C | F\} = \dfrac{0.5}{0.6} = 0.8333333$

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(d) If someone knows c/c++, what is the probability that he/she knows fortan too.

$$P\{F \mid C\} = \frac{P\{F \cap C\}}{P\{C\}} \Rightarrow \frac{0.5}{0.7} \Rightarrow 0.7142857\underline{1}$$

2.6 flight arrived on good weather condition = 80%.
$P\{GT\} = 80\% = 0.80$
flight arrived on bad weather condition = 30%.
$P\{BT\} = 0.30$.
Tomorrow chance of good weather is = 60%.
$P\{G.W\} = 0.6$
$P\{G.W\} + P\{B.W\} = 1$
∴ G.W = good weather, B.W = Bad weather.
$0.6 + P\{B.W\} = 1$
$P\{B.W\} = 1 - 0.6 \Rightarrow 0.4$.
Then the probability of flight that is arrived on time is, $P\{T\}$ =
$\Rightarrow P\{GT\} + P\{BT\}$
$\Rightarrow P\{GT\} * P\{G.W\} + P\{B.T\} * P\{B.W\}$
$\Rightarrow 0.8 * 0.6 + 0.3 * 0.4$
$\Rightarrow 0.48 + 0.12$
$\Rightarrow \underline{0.6}$
The probability that the flight will arrive on time, when there is a chance of 60% good weather is = 0.6

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2.8 Let the probability for the first key be $P\{\bar{A}\}$

$P\{A\} = 0.01$

the probability for the second key be $P\{\bar{B}\}$

$P\{B\} = 0.02$

the probability for the third key be $P\{\bar{C}\}$

$P\{C\} = 0.02$.

probability for the shuttle to be launched on time =

$1 - P(\bar{A} \cap \bar{B} \cap \bar{C})$

$(1 - P\{\bar{A}\})(1 - P\{\bar{B}\})(1 - P\{\bar{C}\})$

$= (0.99) * (0.98) * (0.98)$

$\Rightarrow 0.950796$

The probability for the Shuttle to be launched on time = 0.9508.

2.7 Probability for module 1 to work properly is

$P\{A\} = 0.96$.

Probability for module 2 to work properly is

$P\{B\} = 0.95$

Probability for module 3 to work properly is

$P\{C\} = 0.90$

The probability that at least one of these modules fails to work properly is =

$P\{A\} * P\{B\} * P\{C\}$

$= (0.96)(0.95)(0.90)$

$= 0.8208$

atleast one of the modules fails =

$1 - 0.8208$

$= 0.1792$

The probability that atleast one of these modules fails to work properly is 0.1792

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2.16 Probability of virus A damages the system is
$P\{A\} = 0.4$.
Probability of virus B damages the system is
$P\{B\} = 0.5$.
Probability of virus C damages the system is
$P\{C\} = 0.2$.
Probability that system get damage is.

for a independent event A and B you have

$P(A \cap B) = P(A) \cdot P(B)$

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

$P(A \cap B) = P(A) \cdot P(B) = (0.4)(0.5) = 0.2$

$P(A \cap C) = P(A) \cdot P(C) = (0.4)(0.2) = 0.08$

$P(B \cap C) = P(B) \cdot P(C) = (0.5)(0.2) = 0.1$

Substituting in the formula:

$P(A \cup B \cup C) = (0.4) + (0.5) + (0.2) - (0.2)$
$\quad - (0.08) - (0.1) + ((0.4)(0.5)(0.2))$

$= \cancel{(0.02)} - \cancel{(0.2)} \cancel{(0.08)} - \cancel{(0.1)} + \cancel{(}$

$= (1.1) - (0.2) - (0.08) - (0.1)$
$\quad + (0.04)$

$\Rightarrow \underline{0.76}$

The probability that system may get damaged - $\underline{0.76}$.

(2.15) Probability of first block having error is
$P\{F\} = 0.2$.
Probability of second block having error is
$P\{S\} = 0.3$.

The probability that there is an error in both blocks are.

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$P\{F \cap S\} = P\{F\} \cdot P\{S\}$
$= (0.2)(0.3)$
$= \underline{0.06}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$= 0.3 + 0.2 - \underline{0.06}$

$P\{F|S\} = 0.06 / 0.44 = 0.\underline{13636364}$

Q.17 Parts received from the supplier x is = 24% ⇒ 0.24
Parts received from the supplier y is = 36% 0.36
Parts received from the supplier z is = 40% 0.4.
defective parts from x is 5% = 0.05
defective parts from y is 10% = 0.10.
defective parts from z is 6% = 0.06.

$P\{x\} = 0.24$, $P\{y\} = 0.36$ $P\{z\} = 0.40$
$P\{D/x\} = 0.05$, $P\{D/y\} = 0.10$, $P\{D/z\} = 0.06$

$P\{D_p\} = P\{x\} \cdot P\{D/x\} + P\{y\} P\{D/y\} + P\{z\} \times P\{D/z\}$
$= (0.24)(0.05) + (0.36)(0.10) + (0.40)(0.06)$
$= 0.012 + 0.036 + 0.024$
$= 0.072$

Now, probability that it was from z
$P\{z/D_p\} = P\{z/D_p\} / P\{D_p\}$
$P\{z\} \times P\{D/z\} / P\{D_p\}$
$(0.40)(0.60) / (0.072)$
$= \underline{0.333}$

The probability that this part was received from supplier z is $\underline{0.333}$.

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2.19 Plant part subjected to electronic inspection = 20%.
Probability with no defects = 0.95.
Probability not inspected electronically = 0.7.
$P(I) = 0.2$.
Not subjected to inspection $= P(\bar{I}) =$
$P(I) + P(\bar{I}) = 1$
$\Rightarrow (0.2) + P(\bar{I}) = 1$
$1 - 0.2 = P(\bar{I}) \Rightarrow \underline{0.8}$
$\Rightarrow$ Probability with nodefects = 0.95
$P(N.D / I) = 0.95 \rightarrow P(D/I) = 0.05$
Probability with inspected $= P\{\overline{N.D} / I\}$
$P\{N.D / I\} + P\{\overline{N.D} / I\} = 1$
$0.95 + P\{\overline{N.D} / I\} = 1$
$1 - 0.95 = P\{\overline{N.D}\} \Rightarrow \underline{0.05}$
The probability that this part went through an electronic inspection. is

$$P(\text{defective part}) = \frac{P(I) \cdot P(D / I)}{P(I) \cdot P(D/I) + P(\bar{I}) \cdot P(D/\bar{I})}$$

$$\Rightarrow P(\text{defective part}) = \frac{(0.2) \cdot (0.05)}{(0.2) \times (0.05) + (0.8) \times (0.3)}$$

$$\Rightarrow \frac{0.01}{0.01 + 0.24} \Rightarrow 0.04.$$

The probability that this part went through an electronic inspection is $\underline{0.04}$