Sensor Data

Percentage of Images Supplied and Relevant Images

Sensor	Images Supplied	Relevant Images
1	15%	50%
2	20%	60%
3	25%	80%
4	40%	85%

Coin Toss Outcomes

Result	Heads	Tails
Heads	HH	HT
Tails	TH	TT

FA-4 R 6.1

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Exercises 6.1

5. **A geospatial analysis system has four sensors supplying images. The percent- age of images supplied by each sensor and the percentage of images relevant to a query are shown in the following table.** What is the overall Percentage of the Relevant Images?

This is one Equation to solve it

$$P_{\text{overall}} = \frac{\sum(P_{\text{supplied},i} \times P_{\text{relevant},i})}{\sum P_{\text{supplied},i}}$$

```r
percentSupplied <- c(15, 20, 25, 40)
percentRelevant <- c(50, 60, 80, 85)

overallPercentage <- sum(percentSupplied * percentRelevant) / sum(percentSupplied)

cat("Overall percentage of the Relevant images:", overallPercentage, "%\n")
```

```
## Overall percentage of the Relevant images: 73.5 %
```

6. **A fair coin is tossed twice.** Let E be the event that both tosses have the same outcome, that is, E1 = (HH, TT). Let E2 be the event that the first toss is a head, that is, E2 = (HH, HT). Let E3 be the event that the second toss is a head, that is, E3 = (TH, HH). Show that E1, E2, and E3 are pairwise independent but not mutually independent.

$(E_1) = \{\mathrm{HH}, \mathrm{TT}\}$E1 is the Event both results are the Same$(E_2) = \{\mathrm{HH}, \mathrm{HT}\}$E2 is the Event first results are the Heads(E_3)

$$P(E_i \cap E_j) = P(E_i) \times P(E_j)$$

For E_1 and E_2:

$$P(E_1 \cap E_2) = P(\mathrm{HH}) = \frac{1}{4}$$
$$P(E_1) \times P(E_2) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Similarly:

$$P(E_1 \cap E_3) = P(\mathrm{HH}) = \frac{1}{4}$$
$$P(E_1) \times P(E_3) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$
$$P(E_2 \cap E_3) = P(\mathrm{HH}) = \frac{1}{4}$$
$$P(E_2) \times P(E_3) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

These prove their PAIRWISE INDEPENDENCE, but now to show they are NOT MUTUALLY INDEPENDENTWe can ap

$$P(E_1 \cap E_2 \cap E_3) = P(E_1) \times P(E_2) \times P(E_3)$$

$$P(E_1 \cap E_2 \cap E_3) = P(\mathrm{HH}) = \frac{1}{4}$$

$$P(E_1) \times P(E_2) \times P(E_3) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

Hence, they are not mutually independent because E_2 and E_3 themselves don't carry enough information to help form the p

However, having the union of E_2 and E_3 changes the probability of E_1 happening, making it guaranteed.