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.

Table 1: 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% |

What is the overall Percentage of the Relevant Images?

This is one Equation to solve it

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.

Table 1: Coin Toss Outcomes

| Result | Heads | Tails |
| --- | --- | --- |
| Heads | HH | HT |
| Tails | TH | TT |

$$
(E\_1) = \{ \text{HH}, \text{TT} \} \\
\text{E1 is the Event both results are the Same} \\
(E\_2) = \{ \text{HH}, \text{HT} \} \\
\text{E2 is the Event first results are the Heads} \\
(E\_3) = \{ \text{HH}, \text{TH} \} \\
\text{E3 is the Event second results are the Heads} \\
P(E\_1) = P(E\_2) = P(E\_3) = \frac{1}{2} \\
$$

#### To show PAIRWISE INDEPENDENCE we can just show their Union/Probabilities Together

For and :

Similarly:

#### These prove their PAIRWISE INDEPENDENCE, but now to show they are NOT MUTUALLY INDEPENDENT

#### We can apply the same principle of multiplying the probabilities and their unions, and we will see the problem

#### Hence, they are not mutually independent because and themselves don’t carry enough information to help form the probability of .

#### However, having the union of and changes the probability of happening, making it guaranteed.