SEC 1-FAE1-DELA ROSA, R

Github Link: https://github.com/rddelarosa/APM1110/blob/main/FA4/DELA%20ROSA%2C%20R-FA4.md?plain=1

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5. A geospatial analysis system has four sensors supplying images. The percentage of images supplied by each sensor and the percentage of images relevant to a query are shown in the following table.

```r
# Given
sensors <- data.frame(
  Sensor = 1:4,
  Percent_Supply = c(15, 20, 25, 40),
  Percent_Relevant = c(50, 60, 80, 85)
)
sensors
```

```
##   Sensor Percent_Supply Percent_Relevant
## 1      1             15               50
## 2      2             20               60
## 3      3             25               80
## 4      4             40               85
```

What is the overall percentage of relevant images?

```r
# Compute
prob_relevance <- sum(sensors$Percent_Supply * sensors$Percent_Relevant) / sum(sensors$Percent_Supply)

# Output the result
cat("The overall percentage of relevant images is ", prob_relevance, "%.")
```

```
## The overall percentage of relevant images is  73.5 %.
```

6. A fair coin is tossed twice. Let E_1 be the event that both tosses have the same outcome, that is $E_1 = (HH, TT)$. Let E_2 be the event that the first toss is a head, that is, $E_2 = (HH, HT)$. Let E_3 be the event that the second toss is a head, that it, $E_3 = (TH, HH)$. Show that $E_1, E_2,$ and E_3 are pairwise independent but not mutually independent.

```r
# Define the sample space
sample <- c("HH", "HT", "TH", "TT")

# Define events
E1 <- c("HH", "TT")  # Both tosses are the same
E2 <- c("HH", "HT")  # First toss is a head
E3 <- c("HH", "TH")  # Second toss is a head

# Calculate probabilities
P_E1 <- length(E1) / length(sample)
P_E2 <- length(E2) / length(sample)
P_E3 <- length(E3) / length(sample)
P_E1_E2 <- length(intersect(E1, E2)) / length(sample)
P_E1_E3 <- length(intersect(E1, E3)) / length(sample)
P_E2_E3 <- length(intersect(E2, E3)) / length(sample)
P_E1_E2_E3 <- length(intersect(intersect(E1, E2), E3)) / length(sample)

# Check for pairwise independence
pairwise_independent <- (P_E1_E2 == P_E1 * P_E2) &
                         (P_E1_E3 == P_E1 * P_E3) &
                         (P_E2_E3 == P_E2 * P_E3)

# Check for mutual independence
mutual_independent <- (P_E1_E2_E3 == P_E1 * P_E2 * P_E3)

# Display results
cat("P(E1) =", P_E1, "\n")
```

```
## P(E1) = 0.5
```

```r
cat("P(E2) =", P_E2, "\n")
```

```
## P(E2) = 0.5
```

```r
cat("P(E3) =", P_E3, "\n")
```

```
## P(E3) = 0.5
```

```r
cat("P(E1 and E2) =", P_E1_E2, "\n")
```

```
## P(E1 and E2) = 0.25
```

```r
cat("P(E1 and E3) =", P_E1_E3, "\n")
```

```
## P(E1 and E3) = 0.25
```

```r
cat("P(E2 and E3) =", P_E2_E3, "\n")
```

```
## P(E2 and E3) = 0.25
```

```r
cat("P(E1 and E2 and E3) =", P_E1_E2_E3, "\n")
```

```
## P(E1 and E2 and E3) = 0.25
```

```r
cat("Pairwise Independent:", pairwise_independent, "\n")
```

```
## Pairwise Independent: TRUE
```

```r
cat("Mutually Independent:", mutual_independent, "\n")
```

```
## Mutually Independent: FALSE
```

```r
# Conclusion
cat("\n The events E1, E2, and E3 are pairwise independent but not mutually independent.")
```

```
##
##  The events E1, E2, and E3 are pairwise independent but not mutually independent.
```