Formative Assessment 4

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2024-03-03

Question Number 5

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.

Sensor	Percentage of Images Supplied	Percentage of Relevant Images	TOTAL
1	15	50	65
2	20	60	80
3	25	80	105
4	40	85	125
TOTAL	100	275	375

What is the overall percentage of relevant images?

Let E be the percentage of relevant images.

Let P(E) be the total probability of overall percentage of relevant images.

P(E) = P(S1img ∩ E) + P(S2img ∩ E) + P(S3img ∩ E) + P(S4img ∩ E)
P(E) = P(S1img)P(E|S1img) + P(S2img)P(E|S2img) + P(S3img)P(E|S3img) + P(S4img)P(E|S4img)
P(E) = ((65/375) x (50/65)) + ((80/375) x (60/80)) + ((105/375) x (80/105)) + ((125/375) x (85/125))

```
  imgS1 <- 65
  imgS2 <- 80
  imgS3 <- 105
  imgS4 <- 125
  imgTotal <- 375
  ES1 <- 50
  ES2 <- 60
  ES3 <- 80
  ES4 <- 85

  ETotal <- ((imgS1/imgTotal)*(ES1/imgS1)) + ((imgS2/imgTotal)*(ES2/imgS2)) + ((imgS3/imgTotal)*(ES3/imgS3)) +
((imgS4/imgTotal)*(ES4/imgS4))

  ETotal
```

```
## [1] 0.7333333
```

Therefore, the total probability of overall percentage of relevant images is 0.7333333 or 73%.

Question Number 6

6. A fair coin is tossed twice.

Let E1 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.

```
sampleSpace <- c("HH", "HT", "TH", "TT")

E1 <- c("HH", "TT")
E2 <- c("HH", "HT")
E3 <- c("TH", "HH")

ProbE1 <- length(E1) / length(sampleSpace)
ProbE2 <- length(E2) / length(sampleSpace)
ProbE3 <- length(E3) / length(sampleSpace)

ProbE1andE2 <- length(intersect(E1, E2)) / length(sampleSpace)
ProbE1andE3 <- length(intersect(E1, E3)) / length(sampleSpace)
ProbE2andE3 <- length(intersect(E2, E3)) / length(sampleSpace)

pw_ind <- (ProbE1andE2 == ProbE1 * ProbE2) &
          (ProbE1andE3 == ProbE1 * ProbE3) &
          (ProbE2andE3 == ProbE2 * ProbE3)

cat(pw_ind)
```

```
## TRUE
```

```
cat("Since the value shows TRUE, therefore they are pairwise independent.")
```

```
## Since the value shows TRUE, therefore they are pairwise independent.
```

```
ProbE1andE2andE3 <- length(intersect(intersect(E1, E2), E3)) / length(sampleSpace)
mutuallyInd <- ProbE1andE2andE3 == ProbE1 * ProbE2 * ProbE3

mutuallyInd
```

```
## [1] FALSE
```

```
cat("Since the value shows FALSE, therefore they are not mutually independent.")
```

```
## Since the value shows FALSE, therefore they are not mutually independent.
```

Thus, it shows that E1, E2, and E3 are pairwise independent but not mutually independent.