SEC 1-FAE1-DELA ROSA, R

Github Link: https://github.com/rddelarosa/APM1110/blob/main/FA5/DELA%20ROSA%2C%20R-FA5.Rmd

Roland Dela Rosa

2025-03-05

6. An email message can travel through one of three server routes. The percentage of errors in each of the servers and the percentage of messages that travel through each route are shown in the following table. Assume that the servers are independent.

```
# Given

data <- data.frame(
  Server = c("Server 1", "Server 2", "Server 3"),
  Messages = c(0.40, 0.25, 0.35),
  Error_Rate = c(0.01, 0.02, 0.015)
)
data
```

```
##     Server Messages Error_Rate
## 1 Server 1     0.40      0.010
## 2 Server 2     0.25      0.020
## 3 Server 3     0.35      0.015
```

```
pm1 <- 0.40  # Probability of Server 1
pm2 <- 0.25  # Probability of Server 2
pm3 <- 0.35  # Probability of Server 3
e1 <- 0.01  # Error rate for Server 1
e2 <- 0.02  # Error rate for Server 2
e3 <- 0.015 # Error rate for Server 3
```

(a) What is the probability of receiving an email containing an error?

```
p_error <- pm1 * e1 + pm2 * e2 + pm3 * e3

cat("The probability of receiving an email containing an error is ", round(p_error,5), "and the percent
```

```
## The probability of receiving an email containing an error is  0.01425 and the percentage is 1.43 %.
```

(b) What is the probability that a message will arrive without error?

```
p_no_error <- 1 - p_error

cat("The probability that a message will arrive without error is ", round(p_no_error,4), "and the percen
```

```
## The probability that a message will arrive without error is  0.9858 and the percentage is 98.58 %.
```

(c) If a message arrives without error, what is the probability that it was sent through server 1?

```
ps1_no_error <- (pm1 * (1 - e1)) / p_no_error


cat("The probability that a message will arrive without error is", round(ps1_no_error, 4), "and the per
```

```
## The probability that a message will arrive without error is 0.4017 and the percentage is 40.17 %.
```

9. A software company surveyed managers to determine the probability that they would buy a new graphics package that includes three-dimensional graphics. About 20% of office managers were certain that they would not buy the package, 70% claimed that they would buy, and the others were undecided. Of those who said that they would not buy the package, only 10% said that they were interested in upgrading their computer hardware. Of those interested in buying the graphics package, 40% were also interested in upgrading their computer hardware. Of the undecided, 20% were interested in upgrading their computer hardware.

- Let A denote the intention of not buying, B the intention of buying, C the undecided, and G the intention of upgrading the computer hardware.

```
# Given
prob_A <- 0.20  # Probability of not buying
prob_B <- 0.70  # Probability of buying
prob_C <- 0.10  # Probability of undecided
gA <- 0.10  # Probability of upgrading given not buying
gB <- 0.40  # Probability of upgrading given buying
gC <- 0.20  # Probability of upgrading given undecided
```

(a) Calculate the probability that a manager chosen at random will not upgrade the computer hardware ($P(\overline{G})$)

```
prob_not_G <- 1-((prob_A * gA) + (prob_B * gB) + (prob_C * gC))

cat(" The probability that a manager chosen at random will not upgrade the computer hardware is", round
```

```
##  The probability that a manager chosen at random will not upgrade the computer hardware is 0.68 and t
```

(b) Explain what is meant by the posterior probability of B given $G, P(B|G)$.

The posterior probability $P(B|G)$ refers to the likelihood that a manager will purchase the graphics package, assuming they have already decided to upgrade their hardware. This helps in understanding how prior decisions influence subsequent choices.

(c) Construct a tree diagram and use it to calculate the following probabilities: $P(G), P(B|G), P(B|\overline{G}), P(C|G), P(\overline{C}|\overline{G})$

```r
library(data.tree)
```

```
## Warning: package 'data.tree' was built under R version 4.4.3
```

```r
survey <- data.frame(
  Group = c("A", "B", "C"),
  Probability = c(prob_A, prob_B, prob_C),
  Upgrade = c(gA, gB, gC)
)

survey$pathString <- paste("Survey", survey$Group, sep = "/")
tree <- as.Node(survey)

print(tree, "Probability", "Upgrade")
```

```
##   levelName Probability Upgrade
## 1    Survey          NA      NA
## 2     ¦--A          0.2     0.1
## 3     ¦--B          0.7     0.4
## 4     °--C          0.1     0.2
```

```r
prob_g <- (prob_A * gA) + (prob_B * gB) + (prob_C * gC)
prob_b_g <- round((gB * prob_B) / prob_g, 4)
prob_b_neg_g <- round((gA * prob_A) / (1 - prob_g), 4)
prob_c_g <- round((gC * prob_C) / prob_g, 4)
prob_neg_c_neg_g <- round(((prob_A * (1 - gA)) + (prob_B * (1 - gB))) / (1 - prob_g), 4)

cat("P(G) =", round(prob_g * 100, 2), "%\n")
```

```
## P(G) = 32 %
```

```r
cat("P(B|G) =", round(prob_b_g * 100, 2), "%\n")
```

```
## P(B|G) = 87.5 %
```

```r
cat("P(B|-G) =", round(prob_b_neg_g * 100, 2), "%\n")
```

```
## P(B|-G) = 2.94 %
```

```r
cat("P(C|G) =", round(prob_c_g * 100, 2), "%\n")
```

```
## P(C|G) = 6.25 %
```

```r
cat("P(-C|-G) =", round(prob_neg_c_neg_g * 100, 2), "%\n")
```

```
## P(-C|-G) = 88.24 %
```

```
## A malicious spyware can infect a computer system through the Internet or through email. The spyware
```

```
``` r
# Given
prob_I <- 0.70  # Probability of spyware via Internet
prob_E <- 0.30  # Probability of spyware via Email
detect_I <- 0.60  # Detection probability via Internet
detect_E <- 0.80  # Detection probability via Email
```

What is the probability that this spyware infects the system?

```r
prob_infect <- (prob_I * (1 - detect_I)) + (prob_E * (1 - detect_E))

cat(" The probability that this spyware infects the system is", round(prob_infect, 4), "and the percent
```

```
##  The probability that this spyware infects the system is 0.34 and the percentage is 34 %.
```

If the spyware is detected, what is the probability that it came through the Internet?

```r
p_detected <- (prob_I * detect_I) + (prob_E * detect_E)
pI_given_detected <- (prob_I * detect_I) / p_detected

cat(" The probability that it came through the Internet is", round(pI_given_detected, 4), "and the perc
```

```
##  The probability that it came through the Internet is 0.6364 and the percentage is 63.64 %.
```
```