2. A binary communication channel carries data as one of two sets of signals denoted by 0 and 1. Owing to noise, a transmitted 0 is sometimes received as a 1, and a transmitted 1 is sometimes received as a 0. For a given channel, it can be assumed that a transmitted 0 is correctly received with probability 0.95, and a transmitted 1 is correctly received with probability 0.75. Also, 70% of all messages are transmitted as a 0. If a signal is sent, determine the probability that:

(a) a 1 was received;

```
# Probability of transmitting

p_t0 <- 0.7
p_t1 <- 0.3

# Probability of receiving

p_r1_t0 <- 0.05 # since it is given that a transmitted 0 is correctly received with probability 0.95
p_r1_t1 <- 0.75

# Probability of receiving a 1

p_r1 <- (p_r1_t0 * p_t0) + (p_r1_t1 * p_t1)
cat("The probability of receiving a 1 or P(R=1) is", p_r1,
    "\nor you can say that there is a", p_r1 * 100,"% chance to receive a 1.")
```

```
## The probability of receiving a 1 or P(R=1) is 0.26
## or you can say that there is a 26 % chance to receive a 1.
```

(b) a 1 was transmitted given than a 1 was received.

```
p_t1_given_r1 <- (p_r1_t1*p_t1)/p_r1
cat("The probability of a 1 being transmitted given that a 1 was recieved is or P(T=1|R=1) is",
    round(p_t1_given_r1, 4),
    "\n or you can say that there is a", round(p_t1_given_r1 * 100, 2),
    "% chance that a 1 was transmitted if a 1 is received.")
```

```
## The probability of a 1 being transmitted given that a 1 was recieved is or P(T=1|R=1) is 0.8654
##  or you can say that there is a 86.54 % chance that a 1 was transmitted if a 1 is received.
```

7. There are three employees working at an IT company: Jane, Amy, and Ava, doing 10%, 30%, and 60% of the programming, respectively. 8% of Jane's work, 5% of Amy's work, and just 1% of Ava's work is in error. What is the overall percentage of error? If a program is found with an error, who is the most likely person to have written it?

```
# P(X)
p_jane <- 0.1
p_amy <- 0.3
p_ava <- 0.6

# P(E|X)
```

```r
jane_error <- 0.08
amy_error <- 0.05
ava_error <- 0.01

# Calculate the total probability or the total percentage of error

p_error <- (p_jane*jane_error) + (p_amy*amy_error) + (p_ava*ava_error)
cat("The overall percentage of error or P(E) is", round(p_error*100,2),"%.")
```

```
## The overall percentage of error or P(E) is 2.9 %.
```

```r
# Individual probabilities for error using Bayes' Theorem

jane_given_error <- (p_jane*jane_error)/p_error
amy_given_error <- (p_amy*amy_error)/p_error
ava_given_error <- (p_ava*ava_error)/p_error
```

These are the individual probabilities that these people wrote the program given that an error occurred or P(X|E):

```r
cat("Jane:", round(jane_given_error*100,2), "% \nAmy:", round(amy_given_error*100,2), "% \nAva",
    round(ava_given_error*100,2), "%")
```

```
## Jane: 27.59 %
## Amy: 51.72 %
## Ava 20.69 %
```

So it seems that Amy is the most likely person to have written the program given that there is an error with a probability of 0.5172 or 51.72%.

Github Link: https://github.com/SylTana/APM1110-QUIJANO-JULIAN_PHILIP/tree/main/FA3