FA3

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FA3 Questions

1. **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;
(b) A 1 was transmitted given than a 1 was received.

```
root <- Node$new("Communication Channel")

transmit0 <- root$AddChild("Transmitted 0 (70%)")
transmit1 <- root$AddChild("Transmitted 1 (30%)")

received_0T0 <- transmit0$AddChild("Received 0 (95%)")
received_1T0 <- transmit0$AddChild("Received 1 (5%)")

received_0T1 <- transmit1$AddChild("Received 0 (25%)")
received_1T1 <- transmit1$AddChild("Received 1 (75%)")

prob_transmit_0 <- 0.7
prob_transmit_1 <- 0.3
prob_receive_0_given_0 <- 0.95
prob_receive_1_given_1 <- 0.75

prob_receive_0 <- prob_transmit_0 * prob_receive_0_given_0 +
                  prob_transmit_1 * (1 - prob_receive_1_given_1)
prob_receive_1 <- prob_transmit_0 * (1 - prob_receive_0_given_0) +
                  prob_transmit_1 * prob_receive_1_given_1

prob_transmit_1_given_receive_1 <- (prob_transmit_1 * prob_receive_1_given_1) / prob_receive_1

cat("Probability of receiving 1:", prob_receive_1, "\n")
```

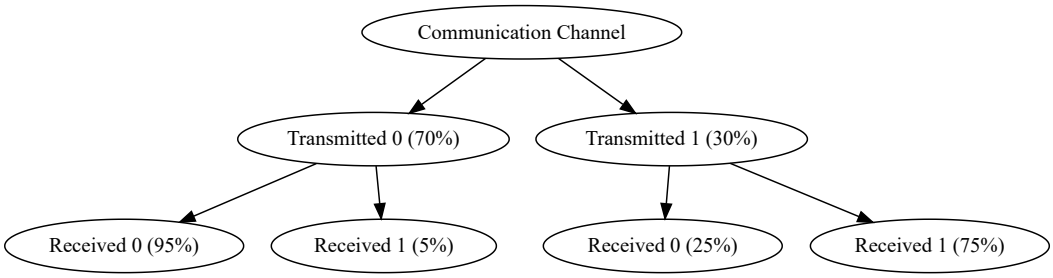
The B answer will be implementing Bayes Theorem and is a Posterior Probability

```
## Probability of receiving 1: 0.26
```

```
cat("Probability of transmitting 1 given receiving 1:", prob_transmit_1_given_receive_1, "\n")
```

```
## Probability of transmitting 1 given receiving 1: 0.8653846
```

```
plot(root)
```



2. 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?

```
root1 <- Node$new("It Company Employees")

Jane <- root1$AddChild("Jane Works (10%)")
Amy <- root1$AddChild("Amy Works (30%)")
Ava <- root1$AddChild("Ava Works (60%)")

errJane <- Jane$AddChild("Jane Error (8%)")
sucJane <- Jane$AddChild("Jane Success (92%)")
errAmy <- Amy$AddChild("Amy Error (5%)")
sucAmy <- Amy$AddChild("Amy Success (95%)")
errAva <- Ava$AddChild("Ava Error (1%)")
sucAva <- Ava$AddChild("Ava Success (99%)")

Jane$work <- 0.10
Amy$work <- 0.30
Ava$work <- 0.60

Jane$err <- 0.08
Amy$err <- 0.05
Ava$err <- 0.01

Jane$suc <- 1 - Jane$err
Amy$suc <- 1 - Amy$err
Ava$suc <- 1 - Ava$err

cumulativeSuccess <- c(
  Jane$work * Jane$suc,
  Amy$work * Amy$suc,
  Ava$work * Ava$suc
)

cumulativeError <- c(
  Jane$work * Jane$err,
  Amy$work * Amy$err,
  Ava$work * Ava$err
)

cat("Jane, Amy, Ava respectively Successes ", cumulativeSuccess)
```

```
## Jane, Amy, Ava respectively Successes  0.092 0.285 0.594
```

```
cat("Jane, Amy, Ava respectively Errors", cumulativeError)
```

```
## Jane, Amy, Ava respectively Errors 0.008 0.015 0.006
```

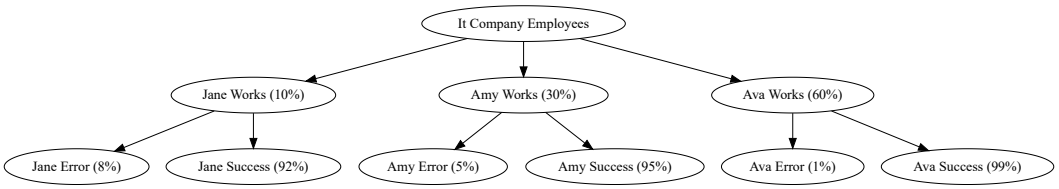
```
cat("Amy has the most Error and the Sum of the errors in their work is:", sum(cumulativeError))
```

```
## Amy has the most Error and the Sum of the errors in their work is: 0.029
```

```
cat("Ava is the hardest Worker and their Total Success is:", sum(cumulativeSuccess))
```

```
## Ava is the hardest Worker and their Total Success is: 0.971
```

```
plot(root1)
```


It Company Employees
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Amy Works (30%)
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Jane Error (8%)
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Ava Success (99%)