FA E1

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Problem 13

A malicious spyware can infect a computer system through the Internet or through email. The spyware comes through the Internet 70% of the time and 30% of the time, it gets in through email. If it enters via the Internet, the anti-virus detector will detect it with probability 0.6, and via email, it is detected with probability 0.8.

(a) Probability that this spyware infects the system

(b) Probability that the detected spyware came through the Internet

```
p_internet <- 0.7
p_email <- 0.3
detect_internet <- 0.6
detect_email <- 0.8

p_not_detected_internet <- 1 - detect_internet
p_not_detected_email <- 1 - detect_email

p_infect <- (p_internet * p_not_detected_internet) + (p_email * p_not_detected_email)

p_detected <- (p_internet * detect_internet) + (p_email * detect_email)

p_internet_given_detected <- (p_internet * detect_internet) / p_detected

p_infect
```

```
## [1] 0.34
```

```
p_internet_given_detected
```

```
## [1] 0.6363636
```

Problem 14

Of the emails you receive, 20% are spam on average. Your spam filter is able to detect 90% of them but also misclassifies as spam 15% of the genuine emails.

(a) Probability that an email marked as spam is actually spam

(b) Probability that an email not marked as spam is actually legitimate

```
p_spam <- 0.2
p_legit <- 0.8
detect_spam <- 0.9
misclassify_legit <- 0.15
```

```r
p_marked_spam <- (p_spam * detect_spam) + (p_legit * misclassify_legit)
p_spam_given_marked_spam <- (p_spam * detect_spam) / p_marked_spam

p_not_marked_spam <- (p_spam * (1 - detect_spam)) + (p_legit * (1 - misclassify_legit))
p_legit_given_not_marked_spam <- (p_legit * (1 - misclassify_legit)) / p_not_marked_spam

p_spam_given_marked_spam
```

```
## [1] 0.6
```

```r
p_legit_given_not_marked_spam
```

```
## [1] 0.9714286
```

Here is the GitHub link: GitHub Repository