FA8 Espiritu

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1. An analogue signal received at a detector, measured in microvolts, is normally distributed with mean of 200 and variance of 256.
   (a) What is the probability that the signal will exceed 224 μV?
   (b) What is the probability that it will be between 186 and 224 μV?
   (c) What is the micro voltage below which 25% of the signals will be?
   (d) What is the probability that the signal will be less than 240 μV, given that it is larger than 210 μV?
   (e) Estimate the interquartile range.
   (f) What is the probability that the signal will be less than 220 μV, given that it is larger than 210 μV?
   (g) If we know that a received signal is greater that 200 μV, what is the probability that is in fact greater than 220 μV?

Figure 1: FA8 Question 1

Letter A Answer:

```r
print(prob224)
```

```
## [1] 0.0668072
```

```r
cat("It has a " ,  round(prob224*100,2), "% probability that the signal will exceed 224 microvolts")
```

```
## It has a  6.68 % probability that the signal will exceed 224 microvolts
```

Letter B Answer:

```r
print(pnorm(224, mean1, sqrt(var1)))
```

```
## [1] 0.9331928
```

```r
print(pnorm(186, mean1, sqrt(var1)))
```

```
## [1] 0.190787
```

```r
print(prob224to186)
```

```
## [1] 0.7424058
```

```r
cat("It has a " ,  round(prob224to186*100,2), "% probability that the signal will be between 186 to 224
```

```
## It has a  74.24 % probability that the signal will be between 186 to 224 microvolts
```

Letter C Answer:

```r
print(percentile25)
```

```
## [1] 189.2082
```

```r
cat("The micro voltage below 25% percentile is", percentile25)
```

```
## The micro voltage below 25% percentile is 189.2082
```

Letter D Answer:

```r
print(pnorm(240, mean1, sqrt(var1)))
```

```
## [1] 0.9937903
```

```r
print(pnorm(210, mean1, sqrt(var1)))
```

```
## [1] 0.7340145
```

```r
print(prob240to210)
```

```
## [1] 0.2597759
```

```r
cat("It has a " ,  round(prob240to210*100,2), "% probability that the signal will be less than 240 but g
```

```
## It has a  25.98 % probability that the signal will be less than 240 but greater than 210 microvolts
```

Letter E Answer:

```r
print(interquartile)
```

```
## [1] 189.2082 210.7918
```

```r
cat("The interquartile Range is:", interquartile[2]-interquartile[1])
```

```
## The interquartile Range is: 21.58367
```

Letter F Answer:

```r
print(pnorm(220, mean1, sqrt(var1)))
```

```
## [1] 0.8943502
```

```r
print(pnorm(210, mean1, sqrt(var1)))
```

```
## [1] 0.7340145
```

```r
print(prob220to210)
```

```
## [1] 0.1603358
```

```r
cat("It has a " ,  round(prob220to210*100,2), "% probability that the signal will be less than 220 but g
```

```
## It has a  16.03 % probability that the signal will be less than 220 but greater than 210 microvolts
```

Letter G Answer:

```r
print(1 - pnorm(200, mean1, sqrt(var1)))
```

```
## [1] 0.5
```

```r
print(1 - pnorm(220, mean1, sqrt(var1)))
```

```
## [1] 0.1056498
```

```r
print(probgreater200then220)
```

```
## [1] 0.3943502
```

```r
cat("It has a " ,  round(probgreater200then220*100,2), "% probability that the signal will be greater th
```

```
## It has a  39.44 % probability that the signal will be greater than 200 microvolts but also be greater
```

2. A manufacturer of a particular type of computer system is interested in improving its customer support services. As a first step, its marketing department has been charged with the responsibility of summarizing the extent of customer problems in terms of system failures. Over a period of six months, customers were surveyed and the amount of downtime (in minutes) due to system failures they had experienced during the previous month was collected. The average downtime was found to be 25 minutes and a variance of 144. If it can be assumed that downtime is normally distributed:
   (a) obtain bounds which will include 95% of the downtime of all the customers;
   (b) obtain the bound above which 10% of the downtime is included.

Letter G Answer:

```r
# Given parameters
mean_downtime <- 25
variance_downtime <- 144

# (a) Obtain bounds which will include 95% of the downtime of all the customers
lower_bound_95 <- qnorm(0.025, mean_downtime, sqrt(variance_downtime))
upper_bound_95 <- qnorm(0.975, mean_downtime, sqrt(variance_downtime))

# (b) Obtain the bound above which 10% of the downtime is included
bound_above_10 <- qnorm(0.90, mean_downtime, sqrt(variance_downtime))

# Output the results
print(paste("Bounds including 95% of downtime:", round(lower_bound_95, 2), "to", round(upper_bound_95, 2
```

```
## [1] "Bounds including 95% of downtime: 1.48 to 48.52"
```

```r
print(paste("Bound above which 10% of downtime is included:", round(bound_above_10, 2)))
```

```
## [1] "Bound above which 10% of downtime is included: 40.38"
```