Formative Assessment #8

SINOCRUZ, ARVIE

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Github Link: https://github.com/eivra-sm/APM1110/blob/main/FA%208/FA8_SEC1_Sinocruz_Arvie.md

Number 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?

```
Given:

Mean ( ) = 200  V

Variance = 256 → Standard deviation ( ) = sqrt(256) = 16  V
prob_a <- 1 - pnorm(224, mean = 200, sd = 16)

cat("The Probability that the signal will exceed 224 µV is", prob_a, "\n")
```

```
## The Probability that the signal will exceed 224 µV is 0.0668072.
```

(b) What is the probability that it will be between 186 and 224 µV?

```
prob_b <- pnorm(224, 200, 16) - pnorm(186, 200, 16)

cat("The Probability that it will be between 186 and 224 µV is ", prob_b, "\n")
```

```
## The Probability that it will be between 186 and 224 µV is 0.7424058.
```

(c) What is the micro voltage below which 25% of the signals will be?

```
quantile_c <- qnorm(0.25, mean = 200, sd = 16)

cat("The micro voltage below which 25% of the signals is", quantile_c, "\n")
```

```
## The micro voltage below which 25% of the signals is 189.2082.
```

(d) What is the probability that the signal will be less than 240 µV, given that it is larger than 210 µV?

```r
prob_d <- (pnorm(240, 200, 16) - pnorm(210, 200, 16)) / (1 - pnorm(210, 200, 16))

cat("The probability that the signal will be less than 240 µV is", prob_d, "\n")
```

```
## The probability that the signal will be less than 240 µV is 0.9766541.
```

(e) Estimate the interquartile range.

```r
quantile1 <- qnorm(0.25, 200, 16)
quantile3 <- qnorm(0.75, 200, 16)
interqr <- quantile3 - quantile1

cat("The estimated interquantile range is", interqr,  "µV.\n")
```

```
## The estimated interquantile range is 21.58367 µV.
```

(f) What is the probability that the signal will be less than 220 µV, given that it is larger than 210 µV?

```r
prob_f <- (pnorm(220, 200, 16) - pnorm(210, 200, 16)) / (1 - pnorm(210, 200, 16))

cat("The probability that the signal will be less than 220 µV is", prob_f, "\n")
```

```
## The probability that the signal will be less than 220 µV is 0.6027988.
```

(g) If we know that a received signal is greater than 200 µV, what is the probability that it is in fact greater than 220 µV?

```r
prob_g <- (1 - pnorm(220, 200, 16)) / (1 - pnorm(200, 200, 16))

cat("The conditional probability that the signal is greater than 200 µV is", prob_g, "\n")
```

```
## The conditional probability that the signal is greater than 200 µV is 0.2112995.
```

Number 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:

Given: Mean ( ) = 25 minutes

Variance = 144 → Standard deviation ( ) = sqrt(144) = 12 minutes

(a) obtain bounds which will include 95% of the downtime of all the customers;

```r
lower <- qnorm(0.025, 25, 12)
upper <- qnorm(0.975, 25, 12)

cat("The bound which will include 95% of the downtime of all customers: ", lower,
"minutes to", upper, "minutes \n")
```

```
## The bound which will include 95% of the downtime of all customers: 1.480432 minutes
to 48.51957 minutes  .
```

(b) obtain the bound above which 10% of the downtime is included.

```r
bound_b <- qnorm(0.90, 25, 12)

cat("The bound above  which 10% of the downtime is included: ", bound_b, "minutes \n")
```

```
## The bound above  which 10% of the downtime is included: 40.37862 minutes .
```