SEC 1-FA8 - DELA ROSA, R

GitHub Link:(https://github.com/rddelarosa/APM1110/blob/main/FA8/SEC_1-FA8-DELA-ROSA%2C-R.md?plain=1)

Roland Dela Rosa

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1. An analogue signal received at a detector, measured in microvolts, is normally distributed with a mean of 200 and variance of 256.

Given variables:

```
mu <- 200
vu <- sqrt(256)
```

(a) What is the probability that the signal will exceed 224 μV?

```
p_exceed <- 1 - pnorm(224, mu, vu)
p_exceed
```

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

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

```
p_between <- pnorm(224, mu, vu) - pnorm(186, mu, vu)
p_between
```

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

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

```
v25_percent <- qnorm(0.25, mu, vu)
v25_percent
```

```
## [1] 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
numerator_240 <- pnorm(240, mu, vu) - pnorm(210, mu, vu)
denominator_240 <- 1 - pnorm(210, mu, vu)
cond_prob_240 <- numerator_240 / denominator_240
cond_prob_240
```

```
## [1] 0.9766541
```

(e) Estimate the interquartile range.

```r
Q1 <- qnorm(0.25, mu, vu)
Q3 <- qnorm(0.75, mu, vu)
IQR <- Q3 - Q1
IQR
```

```
## [1] 21.58367
```

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

```r
numerator_220 <- pnorm(220, mu, vu) - pnorm(210, mu, vu)
denominator_220 <- 1 - pnorm(210, mu, vu)
cond_prob_220 <- numerator_220 / denominator_220
cond_prob_220
```

```
## [1] 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
numerator_200 <- 1 - pnorm(220, mu, vu)
denominator_200 <- 1 - pnorm(200, mu, vu)
cond_prob_200 <- numerator_200 / denominator_200
cond_prob_200
```

```
## [1] 0.2112995
```

2. A manufacturer of a particular type of computer system is interested in improving its customer support services. Over a period of six months, customers were surveyed and the amount of downtime (in minutes) due to system failures was recorded.

Given variables

```r
md <- 25
vd <- sqrt(144)
```

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

```r
lower_bound <- qnorm(0.025, md, vd)
upper_bound <- qnorm(0.975, md, vd)
cat("The lower bound is",lower_bound,"\nThe upper bound is", upper_bound)
```

```
## The lower bound is 1.480432
## The upper bound is 48.51957
```

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

```r
downtime_90th_percentile <- qnorm(0.90, md, vd)
downtime_90th_percentile
```

```
## [1] 40.37862
```