# Planejamento e Análise de Experimentos (EEE933)
# Estudo de Caso 1

Pedro Vinícius, Samara Silva e Savio Vieira

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```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

## Descrição do Problema

### Parte 1: Teste Sobre o Custo Médio

#### Planejamento dos Experimentos

$$\begin{cases} H_0 : \mu = 50 \\ H_1 : \mu < 50 \end{cases}$$

```
# Define the sample size to be used in this experiment
(params <- power.t.test(delta = delta_star,
             sd = sigma_n,
             sig.level = alpha,
             power = pi,
             type = "one.sample",
             alternative = "one.sided"))
```

```
##
##      One-sample t test power calculation
##
##               n = 65.45847
##           delta = 4
##              sd = 10
##       sig.level = 0.01
##           power = 0.8
##     alternative = one.sided
```

```
# Number of observations
n <- ceiling(params$n)
```

#### Coleta dos Dados

```
data_generation <- function(n){

  mre <- list(name = "recombination_bin", cr = 0.9)
  mmu <- list(name = "mutation_rand", f = 2)
  mpo <- 100
```

```
  mse <- list(name = "selection_standard")
  mst <- list(names = "stop_maxeval", maxevals = 10000)
  mpr <- list(name = "sphere", xmin = -seq(1, 20), xmax = 20 + 5 * seq(5, 24))

  sample <- c()
  # Generate n observations
  for (i in 1:n){
    observation <- ExpDE(mpo, mmu, mre, mse, mst, mpr,
                         showpars = list(show.iters = "none"))$Fbest
    sample <- c(sample, observation)
  }

  return(sample)

}
```

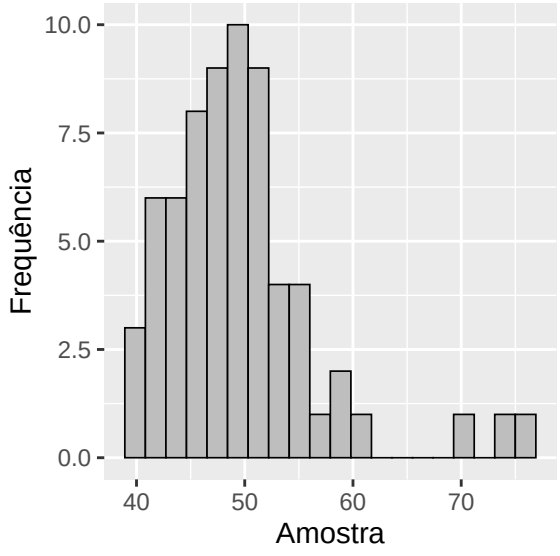
```
# Random seed
set.seed(1007)

# Collect the sample with n observations
sample <- data_generation(n = n)

# Saves data to the csv file
write.table(sample, file = 'sample.csv', row.names = FALSE, col.names = FALSE)
```

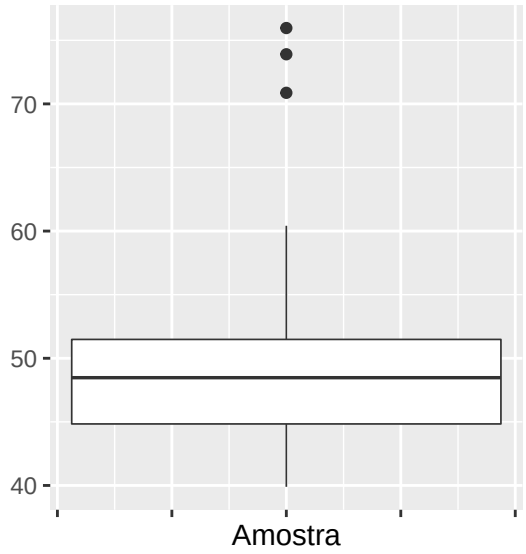
**Análise Exploratória de Dados**

```
# Histogram
histogram <- ggplot(data = as.data.frame(sample), mapping = aes(x = sample))
histogram + geom_histogram(lwd = 0.3, bins = 20, color = 'black', fill = 'gray') +
            scale_x_continuous(name = 'Amostra') +
            scale_y_continuous(name = 'Frequência')
```

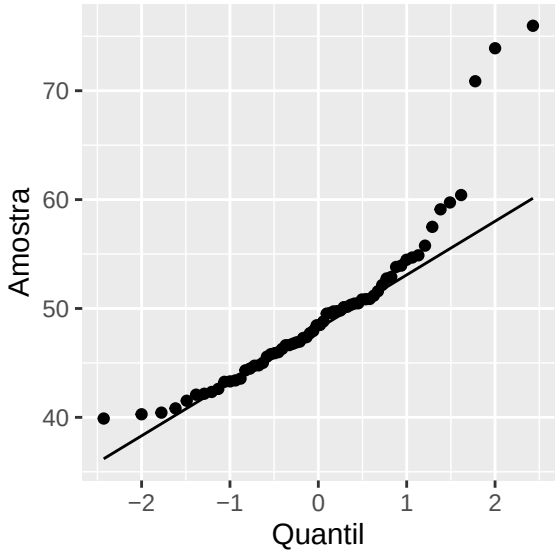



```
# Boxplot
boxplot <- ggplot(data = as.data.frame(sample), mapping = aes(y = sample))
```

```
boxplot + geom_boxplot(lwd = 0.3) +
          scale_x_continuous(name = 'Amostra') +
          scale_y_continuous(name = '') +
          theme(axis.text.x = element_blank())
```




```
# QQ-Plot
qqplot <- ggplot(data = as.data.frame(sample), mapping = aes(sample = sample))
qqplot + geom_qq_line() +
         geom_qq() +
         scale_y_continuous(name = 'Amostra') +
         scale_x_continuous(name = 'Quantil')
```




**Análise Estatística**

```
# ------------ Hypothesis Testing ------------ #
(t_test <- t.test(x = sample,
```

```
                mu = mu_c,
                alternative = "less",
                conf.level = conf_level))
```

```
##
##  One Sample t-test
##
## data:  sample
## t = -0.5742, df = 65, p-value = 0.2839
## alternative hypothesis: true mean is less than 50
## 99 percent confidence interval:
##     -Inf 51.5952
## sample estimates:
## mean of x
##  49.49419
```

```
# Confidence Interval
CI <- t_test$conf.int[1:2]
```

### Validação de Premissas

```
# Wilcoxon Signed-Ranks Test, because it does not assume normality
(wilcoxon_test <- wilcox.test(x = sample,
                alternative = "less",
                mu = mu_c,
                paired = FALSE,
                exact = NULL,
                correct = TRUE,
                conf.int = FALSE,
                conf.level = conf_level))
```

```
##
##  Wilcoxon signed rank test with continuity correction
##
## data:  sample
## V = 820, p-value = 0.03433
## alternative hypothesis: true location is less than 50
```

## Parte 2: Teste Sobre a Variância do Custo

## Planejamento dos Experimentos

$$\begin{cases} H_0 : \sigma^2 = 100 \\ H_1 : \sigma^2 < 100 \end{cases}$$

### Conclusões