Homework 5

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Exercise 10

```
# Relevant difference
d <- 13

# Sample standard deviations
s_A <- 15
s_B <- 18

# Type 1 and type 2 error
a <- 0.025
b <- 0.1
```

Since the size of the two groups will be the same we can get the pooled variance by taking the mean of the two sample variances.

```
# Pooled standard deviation
s_p <- sqrt((s_A^2 + s_B^2) / 2)
cat(sprintf("s_p: %s", s_p), "\n")
```

```
## s_p: 16.5680415257809
```

```
# Quantiles of normal distribution
u_a <- qnorm(1-a)
u_b <- qnorm(1-b)
cat(sprintf("u_a: %s, u_b: %s", u_a, u_b), "\n")
```

```
## u_a: 1.95996398454005, u_b: 1.2815515655446
```

```
# Sample size estimation for one-sided t-test, rounded up for conservative approach
n <- ceiling((u_a + u_b)^2 * s_p^2 / d^2)
cat(sprintf("We need %s patients total, %s per group.", 2*n, n))
```

```
## We need 36 patients total, 18 per group.
```

Exercise 11

We do a Kolmogorov-Smirnov test to check for normality.

```
mydata <- c(3,4,5,6,7)

Sn <- c(0.2, 0.4, 0.6, 0.8, 1)
Sn_shift <- c(0, 0.2, 0.4, 0.6, 0.8)

F0 <- pnorm(mydata, mean=3, sd=2)

test_statistic <- max( c(max(abs(Sn - F0)), max(abs(Sn_shift - F0))) )
cat(sprintf("Test statistic sup|Sn(x) - F0(x)| = %s", test_statistic), "\n")
```

```
## Test statistic sup|Sn(x) - F0(x)| = 0.5
```

```
# We get the critical value from the table, for n=5 and alpha=0.1
critical_value <- 0.509
cat(sprintf("The null hypothesis %s be rejected.",
            if (test_statistic > critical_value) "can" else "cannot"))
```

```
## The null hypothesis cannot be rejected.
```

Exercise 12

Here we do a Lilliefors test to check for normality.

```
mydata <- c(3,4,5,6,7)

Sn <- c(0.2, 0.4, 0.6, 0.8, 1)
Sn_shift <- c(0, 0.2, 0.4, 0.6, 0.8)

F0 <- pnorm(mydata, mean=mean(mydata), sd=sd(mydata))

test_statistic <- max( c(max(abs(Sn - F0)), max(abs(Sn_shift - F0))) )
cat(sprintf("Test statistic sup|Sn(x) - F0(x)| = %s", test_statistic), "\n")
```

```
## Test statistic sup|Sn(x) - F0(x)| = 0.136455371567231
```

```
# We get the critical value from the table, for n=5 and alpha=0.1
critical_value <- 0.315
cat(sprintf("The null hypothesis %s be rejected.",
            if (test_statistic > critical_value) "can" else "cannot"))
```

```
## The null hypothesis cannot be rejected.
```