Exercises Day 1

Your name

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Exercise 1

Suppose you are running a behavioural experiment, studying the mental speed of young and old people. You know that young people have an average reaction time of 550 with a standart deviation of 120.

a) What is the probability of getting a reaction time of 420 or lower from a single young person?

```
pnorm(420,mean=550,sd=120)
```

```
## [1] 0.1393302
```

b) What is the probability of getting a reaction time of 560 or higher from a single young person?

```
1-pnorm(560,mean=550,sd=120)
```

```
## [1] 0.4667932
```

c) For your study, you need 10 reaction time values for young people. How can you generate a sample with n = 10?

```
x1 <- rnorm(10,mean=550,sd=120)
```

d) You get 15 values from a population of old people. What is the mean and the standart deviation of their underlying normal distribution?

```
x2 <- c(434.7, 671.4, 428.9, 454.4, 806.1, 483.3, 819.1, 630.4, 836.2, 661.4, 511.7, 507.2, 568.0, 707.
mean(x2)
```

```
## [1] 609.4933
```

```
sd(x2)
```

```
## [1] 140.3252
```

e) What is the probability that the 15 values are actually drawn from the same distribution as in 1c

```r
t.test(x2, mu=550)
```

```
##
##  One Sample t-test
##
## data:  x2
## t = 1.642, df = 14, p-value = 0.1228
## alternative hypothesis: true mean is not equal to 550
## 95 percent confidence interval:
##  531.7838 687.2028
## sample estimates:
## mean of x
##  609.4933
```

Exercise 2

You are a researcher studying the intelligence of dragons in the european mountains. You suspect that larger dragons are also smarter and you've collected various samples for intelligence (testscore) and size (bodylength) from different mountains.

a) Is there a significant relationship between intelligence and body size in dragons? Use linear regression.

```r
load("dragons.RData")

Model_lm <- lm(testScore ~ bodyLength, data = dragons)
summary(Model_lm)
```

```
##
## Call:
## lm(formula = testScore ~ bodyLength, data = dragons)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -68.070 -15.792  -0.852  16.786  63.368
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -63.10331   13.18621  -4.786 2.28e-06 ***
## bodyLength    0.61224    0.06529   9.377  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 23.17 on 478 degrees of freedom
## Multiple R-squared:  0.1554, Adjusted R-squared:  0.1536
## F-statistic: 87.94 on 1 and 478 DF,  p-value: < 2.2e-16
```

b) Maybe the location of each recording sample influences the results. Create a LME that accounts for differences between mountain ranges. What is the relationship between intelligence and body size now?

```r
Model_Mountains <- lmer(testScore ~ bodyLength + (1|mountainRange), data = dragons)
summary(Model_Mountains)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: testScore ~ bodyLength + (1 | mountainRange)
##    Data: dragons
##
## REML criterion at convergence: 4187.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.69490 -0.68646 -0.01821  0.67354  2.64609
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  mountainRange (Intercept) 291.2    17.07
##  Residual                  340.1    18.44
## Number of obs: 480, groups:  mountainRange, 8
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept) 31.06599   20.25713   1.534
## bodyLength   0.14447    0.09597   1.505
##
## Correlation of Fixed Effects:
##            (Intr)
## bodyLength -0.954
```

c) You notice that dragons with different colors behave differently. Control in your LME for the color of each dragon. How do the results change?

```r
Model_Color <- lmer(testScore ~ bodyLength + Color + (1|mountainRange), data = dragons)
summary(Model_Color)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: testScore ~ bodyLength + Color + (1 | mountainRange)
##    Data: dragons
##
## REML criterion at convergence: 4014.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.6979 -0.6275  0.0068  0.6859  2.6846
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  mountainRange (Intercept) 337.4    18.37
##  Residual                  237.1    15.40
## Number of obs: 480, groups:  mountainRange, 8
##
## Fixed effects:
##             Estimate Std. Error t value
```

```
## (Intercept) 34.80775   17.54353   1.984
## bodyLength   0.07632    0.08097   0.943
## ColorRed    20.38107    1.42452  14.307
##
## Correlation of Fixed Effects:
##            (Intr) bdyLng
## bodyLength -0.927
## ColorRed    0.005 -0.048
```