

World Happiness Report

X Æ A-Xii

6.12.2021.

Motivacija i opis problema

World Happiness Report je publikacija Mreže rješenja za održivi razvoj Ujedinjenih naroda koja sadrži podatke o osjećaju sreće pojedinih nacija. Podatci su dobiveni kroz ankete koje provode Gallup i Lloyd's Register Foundation. Prvi je izvještaj objavljen 2012. godine, a od 2016. se objavljuje na Međunarodni dan sreće 20. ožujka.

Učitavanje podataka o svjetskom bogatstvu 2021. godine

```
wealth_data <- read_excel("E:/FER/Statistička analiza podataka/Projekt/files/credit_suisse_global_wealth")
```

```
## New names:
## * ' ' -> ...6
## * ' ' -> ...7
## * ' ' -> ...8
## * ' ' -> ...9
```

```
dim(wealth_data)
```

```
## [1] 169 10
```

```
head(wealth_data)
```

```
## # A tibble: 6 x 10
##   'Country name' 'Adults (thousands)' 'Mean wealth per adult' 'Median wealth per adult'
##   <chr>          <dbl>          <dbl>          <dbl>
## 1 <NA>          NA          NA          NA
## 2 Afghanistan  18356        1744         734
## 3 Albania      2187        30524        15363
## 4 Algeria      27620        8871         2302
## 5 Angola       14339        3529         1131
## 6 Argentina    30799        7224         2157
## # ... with 6 more variables:
## #   Distribution of adults (%) by wealth range (USD) <chr>, ...6 <chr>,
## #   ...7 <chr>, ...8 <chr>, ...9 <chr>, Gini (%) <dbl>
```

Učitavanje podataka o globalnoj sreći 2020. godine

You can also embed plots, for example:

```
whr2020_data <- read_excel("E:/FER/Statistička analiza podataka/Projekt/files/WHR_2020.xlsx")

dim(whr2020_data)

## [1] 153 9

head(whr2020_data)

## # A tibble: 6 x 9
##   'Country name' 'Regional indicator' 'Ladder score' 'Logged GDP per capita'
##   <chr>         <chr>                <dbl>             <dbl>
## 1 Finland      Western Europe          7.81             10.6
## 2 Denmark      Western Europe          7.65             10.8
## 3 Switzerland  Western Europe          7.56             11.0
## 4 Iceland      Western Europe          7.50             10.8
## 5 Norway        Western Europe          7.49             11.1
## 6 Netherlands  Western Europe          7.45             10.8
## # ... with 5 more variables: Social support <dbl>,
## #   Healthy life expectancy <dbl>, Freedom to make life choices <dbl>,
## #   Generosity <dbl>, Perceptions of corruption <dbl>
```

Učitavanje podataka o globalnoj sreći 2021. godine

You can also embed plots, for example:

```
whr2021_data <- read_excel("E:/FER/Statistička analiza podataka/Projekt/files/WHR_2021.xlsx")

dim(whr2021_data)

## [1] 149 11

head(whr2021_data)

## # A tibble: 6 x 11
##   'Country name' 'Regional indicator' 'Ladder score' 'Logged GDP per capita'
##   <chr>         <chr>                <dbl>             <dbl>
## 1 Finland      Western Europe          7.84             10.8
## 2 Denmark      Western Europe          7.62             10.9
## 3 Switzerland  Western Europe          7.57             11.1
## 4 Iceland      Western Europe          7.55             10.9
## 5 Netherlands  Western Europe          7.46             10.9
## 6 Norway        Western Europe          7.39             11.1
## # ... with 7 more variables: Social support <dbl>,
## #   Healthy life expectancy <dbl>, Freedom to make life choices <dbl>,
## #   Generosity <dbl>, Perceptions of corruption <dbl>, Income Gini <dbl>,
## #   Wealth Gini <dbl>
```

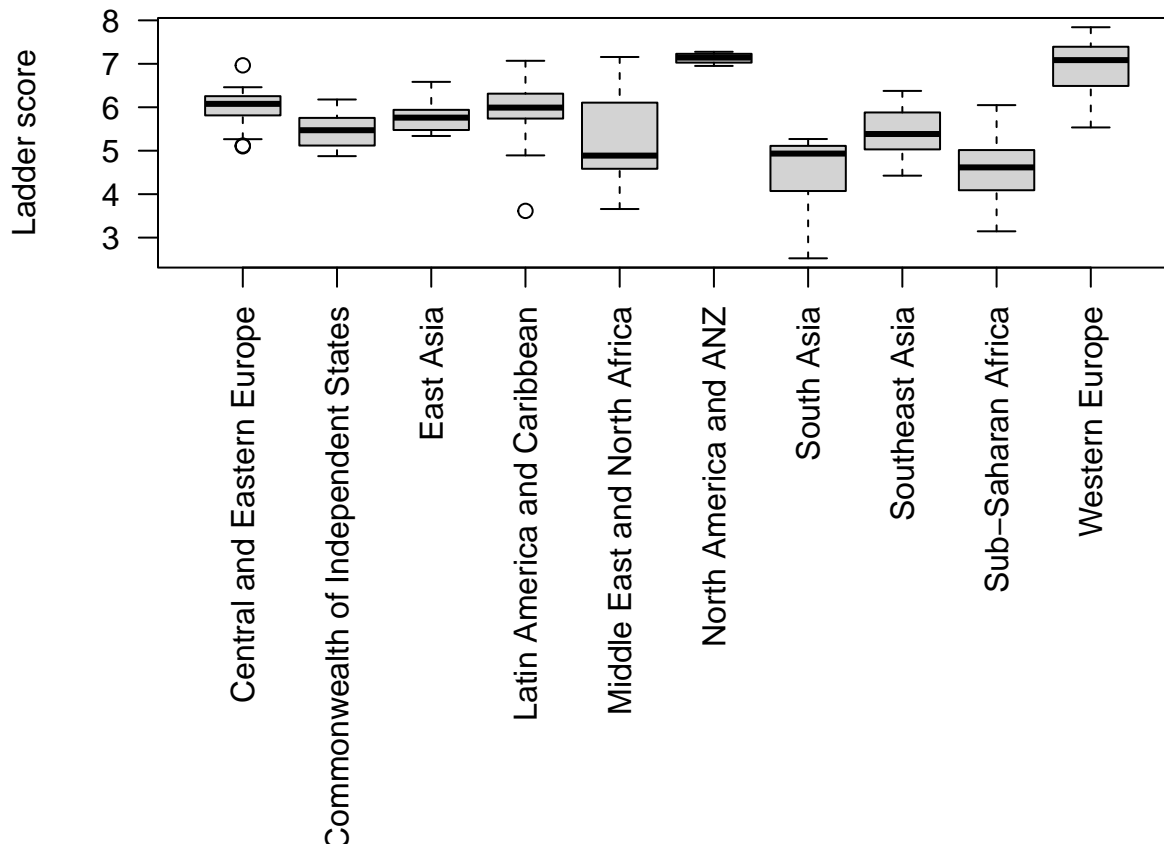
Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

Postoje li razlike u iskazanoj sreći među različitim regijama?

Na ovo pitanje ćemo odgovoriti korištenjem jednofaktorskom ANOVA metodom.

U sljedećem isječku ćemo prikazati box plot dijagrame sreće po pojedinim regijama.

```
par(mar=c(15,5,1,1))
boxplot(`Ladder score`~`Regional indicator`,data = whr2021_data, las = 2, xlab = "" )
```



Boxplot nas upućuje da postoje razlike u iskazanim srećama po regijama. To ćemo potvrditi ANOVA metodom.

Uvjeti za ANOVA-u su normalnost i nezavisnost podataka, te homogenost varijanci među regijama. Nezavisnost podataka možemo pretpostaviti. Normalnost podataka po regijama ćemo provjeriti s Kolmogorov-Smirnovim testom. Hipoteze su nam sljedeće:

H_0 : podaci su normalno distribuirani

H_1 : podaci nisu normalno distribuirani

te

$$\alpha = 0.05$$

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Central and Eastern Europe'], "N",
```

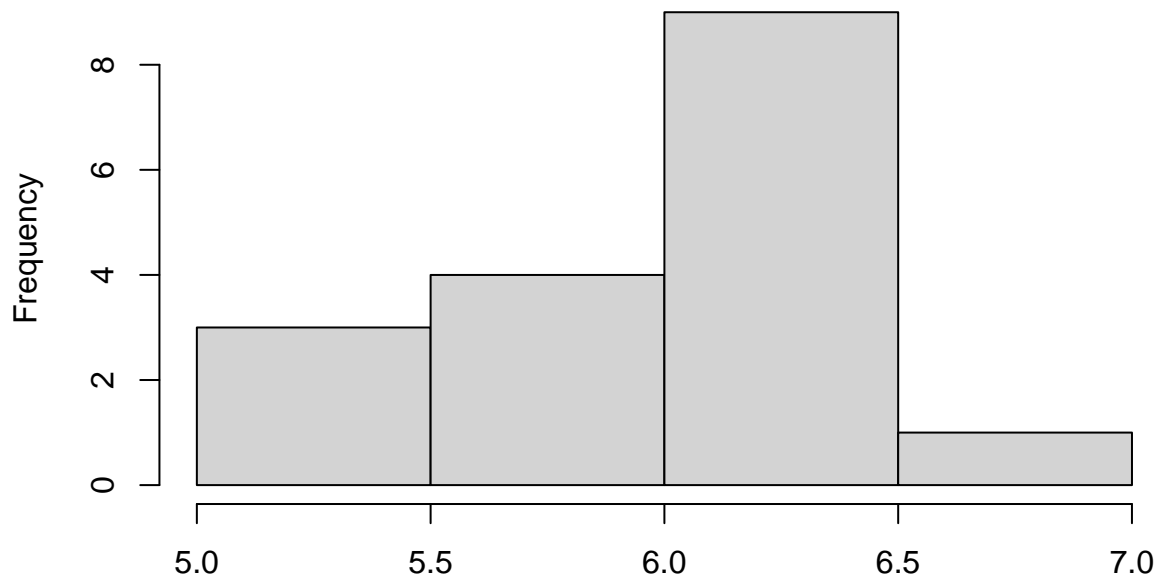
```
##
```

```
## One-sample Kolmogorov-Smirnov test
```

```
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Central and Eastern Europe"]
## D = 0.15266, p-value = 0.7689
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Central and Eastern Europe'])
```

whr2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Central and Eastern Europe"]



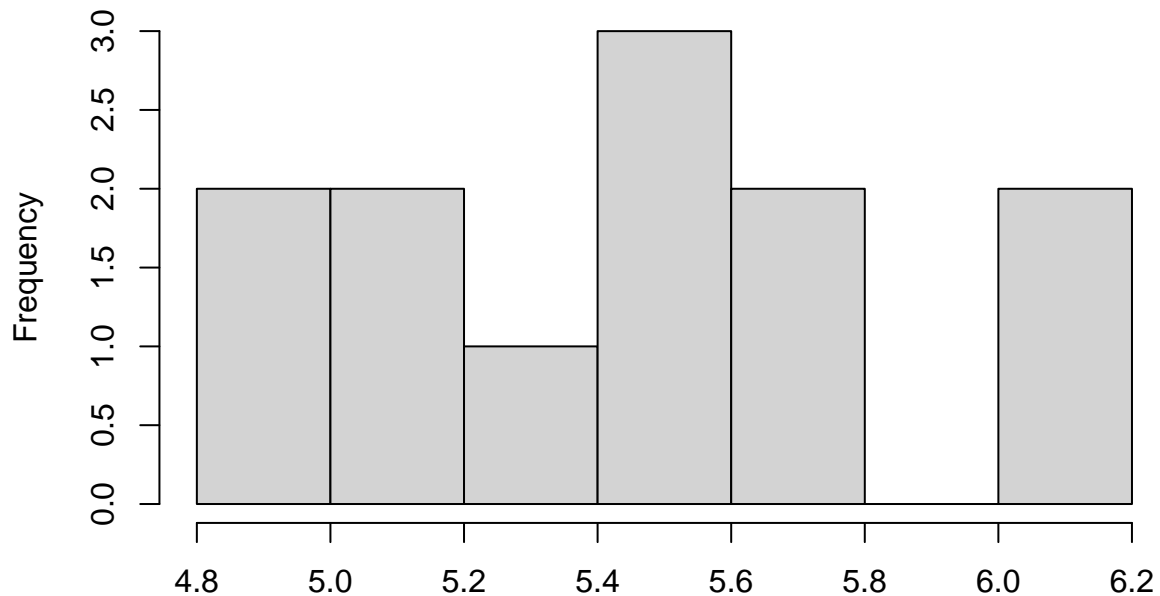
whr2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Central and Eastern Europe"]

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Commonwealth of Independent States'],
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Commonwealth of Independent States"]
## D = 0.1077, p-value = 0.9962
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Commonwealth of Independent States
```

```
ata$`Ladder score`[whr2021_data$`Regional indicator` == "Commonwe
```



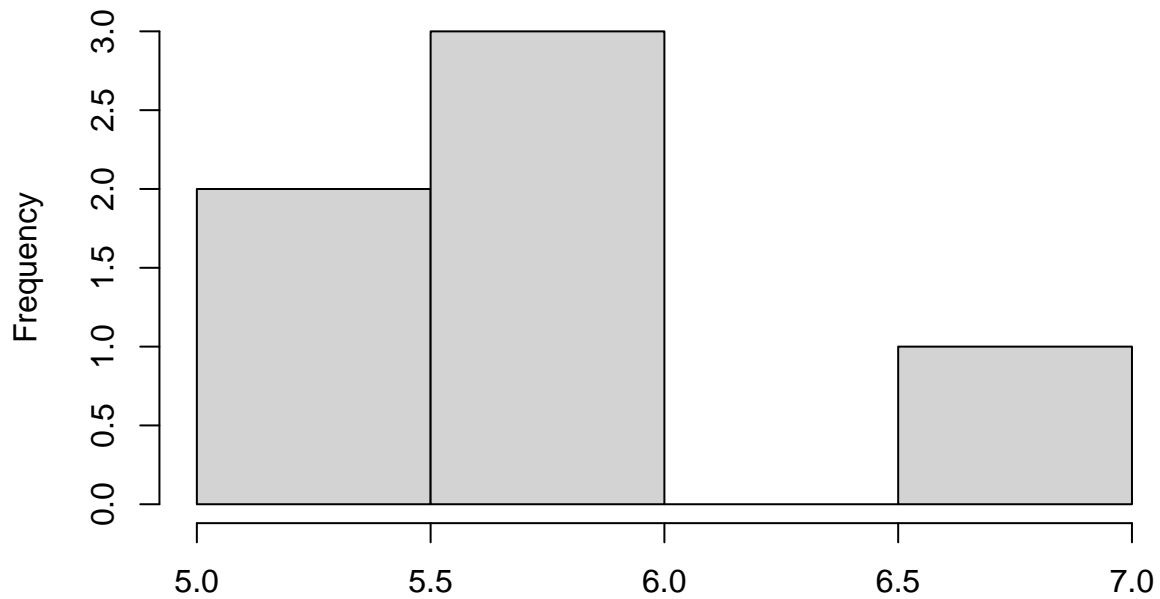
```
_data$`Ladder score`[whr2021_data$`Regional indicator` == "Commonwealth of Indepe
```

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='East Asia'], "pnorm", mean(whr2
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "East Asia"]
## D = 0.21724, p-value = 0.8868
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='East Asia'])
```

l of whr2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` =

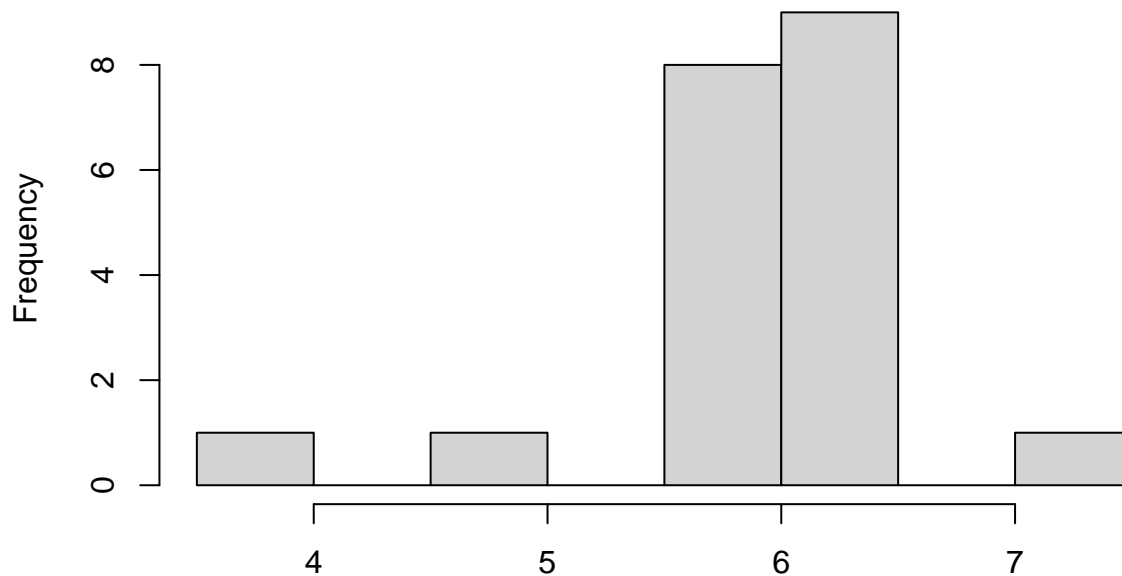


whr2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "East Asia"]

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Latin America and Caribbean'],
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Latin America and Caribbean"]
## D = 0.20631, p-value = 0.3171
## alternative hypothesis: two-sided

hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Latin America and Caribbean'])
```

21_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Latin A



2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Latin America and Ca

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Middle East and North Africa'],
```

```
##
```

```
## One-sample Kolmogorov-Smirnov test
```

```
##
```

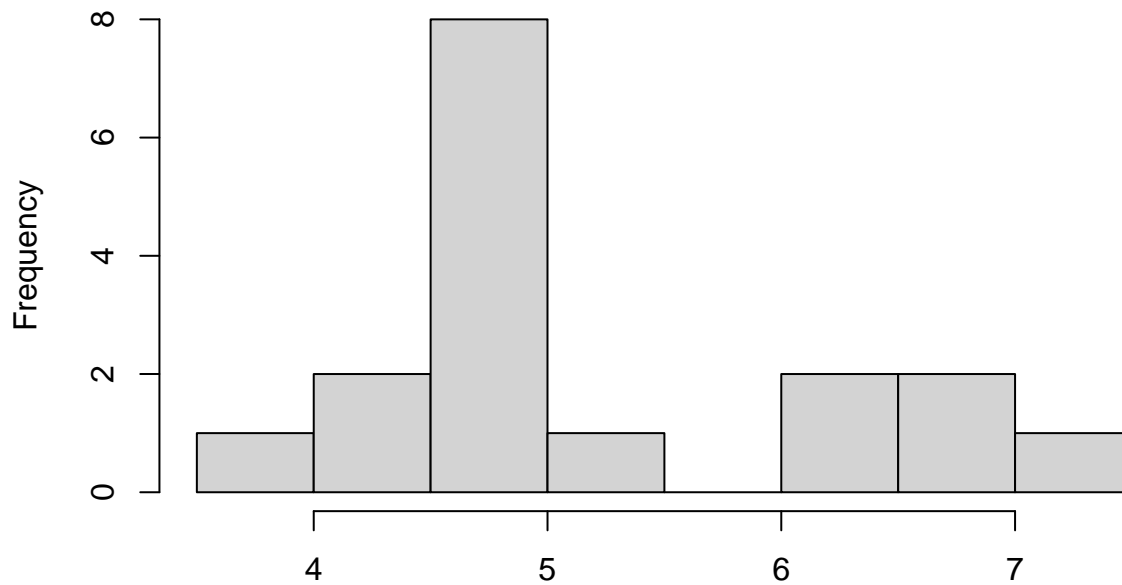
```
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Middle East and North Africa"]
```

```
## D = 0.25437, p-value = 0.186
```

```
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Middle East and North Africa'])
```

21_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Middle



2021_data\$`Ladder score`[whr2021_data\$`Regional indicator` == "Middle East and Nort

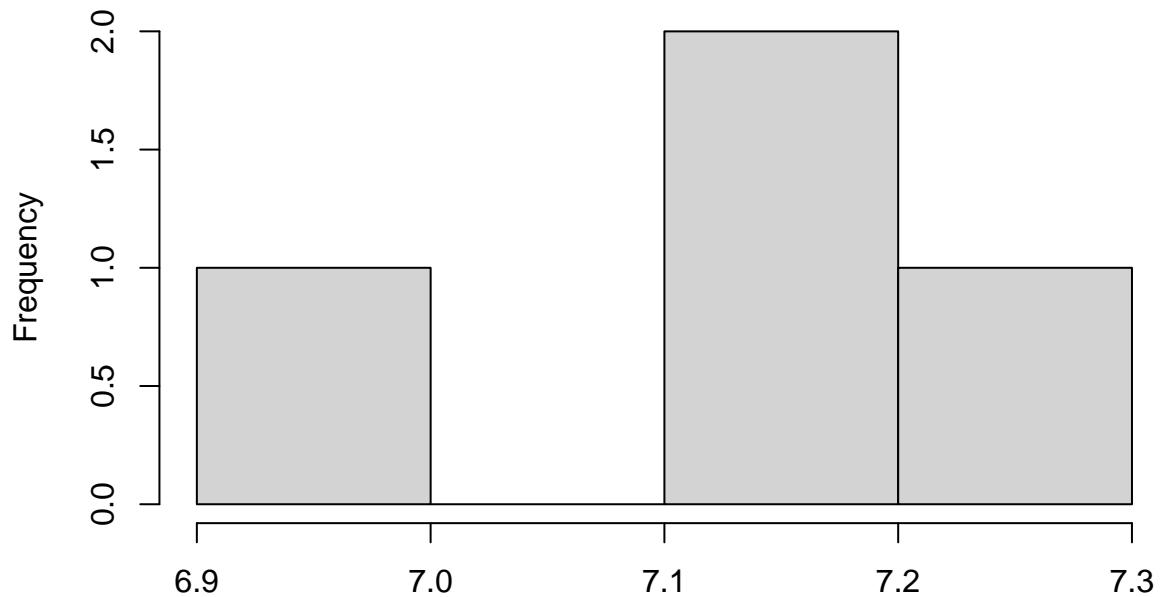
```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='North America and ANZ'], "pnorm
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "North America and ANZ"]
## D = 0.17678, p-value = 0.9972
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='North America and ANZ'])
```



```
whr2021_data$Ladder score[whr2021_data$Regional indicator == "North America and the Caribbean"]
```



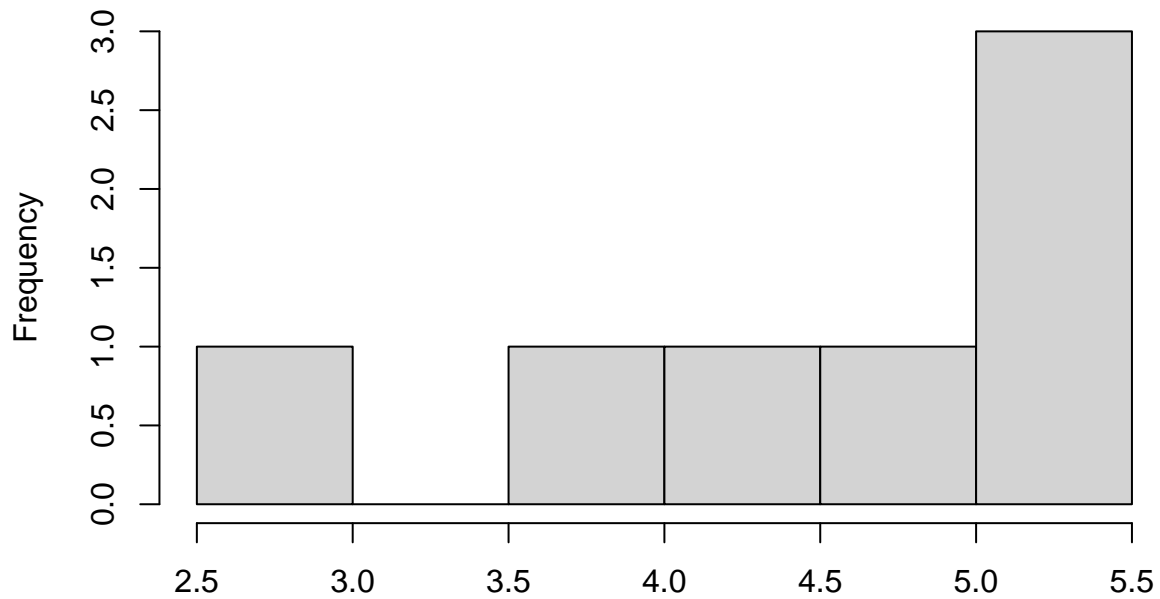
```
whr2021_data$Ladder score[whr2021_data$Regional indicator == "North America and the Caribbean"]
```

```
ks.test(whr2021_data$Ladder score[whr2021_data$Regional indicator == 'South Asia'], "pnorm", mean(whr2021_data$Ladder score[whr2021_data$Regional indicator == 'South Asia']))
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$Ladder score[whr2021_data$Regional indicator == "South Asia"]
## D = 0.26133, p-value = 0.6354
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$Ladder score[whr2021_data$Regional indicator == 'South Asia'])
```

of whr2021_data\$Ladder score`[whr2021_data\$`Regional indicator` ==



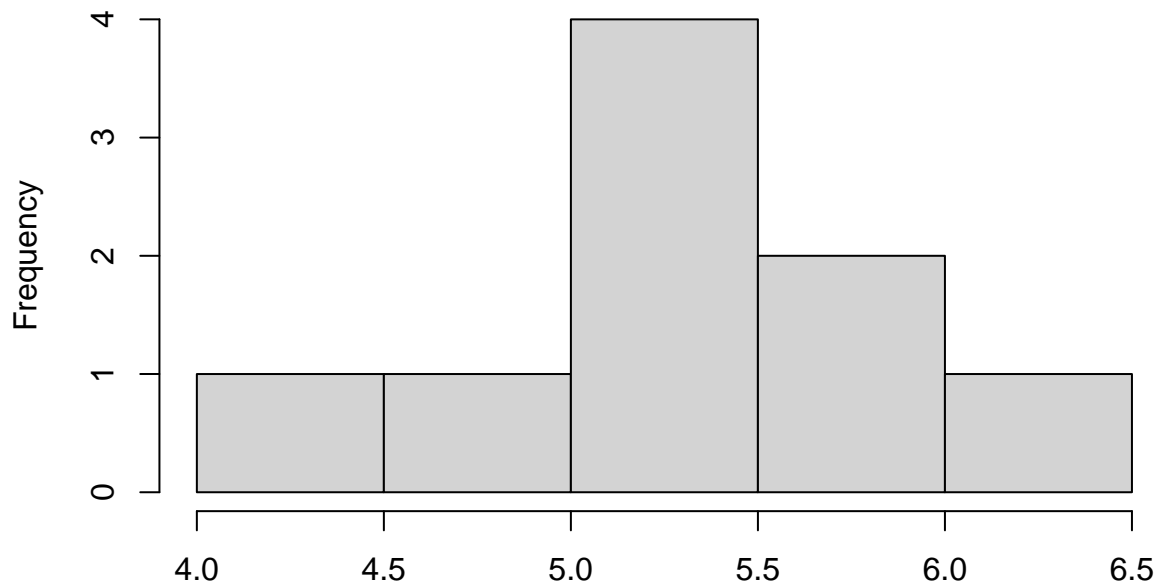
whr2021_data\$Ladder score`[whr2021_data\$`Regional indicator` == "South Asia"]

```
ks.test(whr2021_data$Ladder score`[whr2021_data$`Regional indicator`=='Southeast Asia'], "pnorm", mean
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$Ladder score`[whr2021_data$`Regional indicator` == "Southeast Asia"]
## D = 0.16447, p-value = 0.9367
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$Ladder score`[whr2021_data$`Regional indicator`=='Southeast Asia'])
```

```
whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "
```



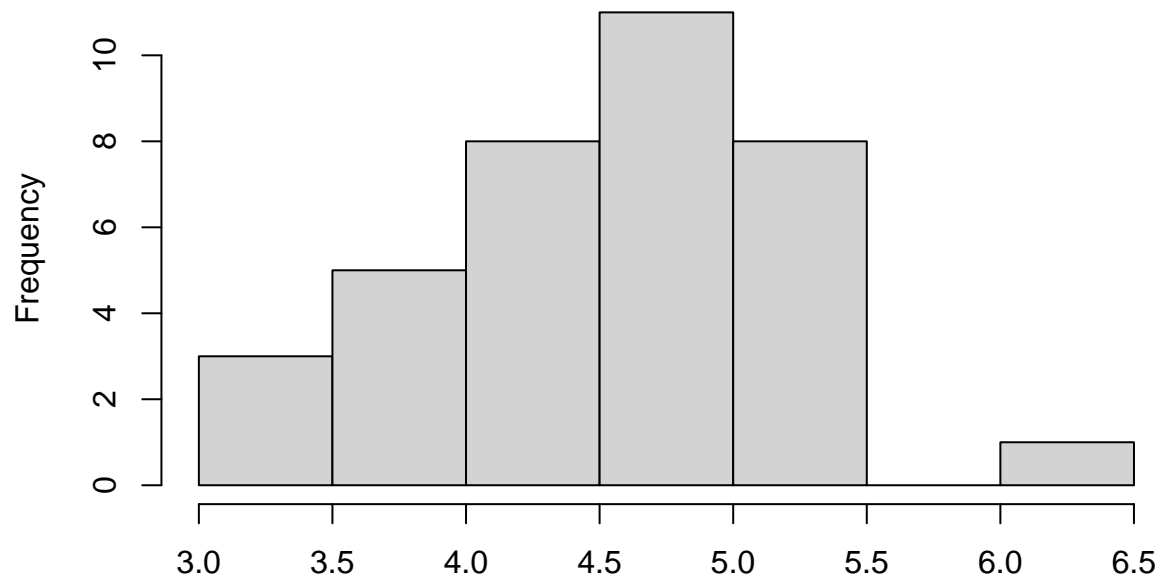
```
whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Southeast Asi
```

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Sub-Saharan Africa'], "pnorm", n
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Sub-Saharan Africa"]
## D = 0.1039, p-value = 0.7942
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Sub-Saharan Africa'])
```

```
hr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Su
```



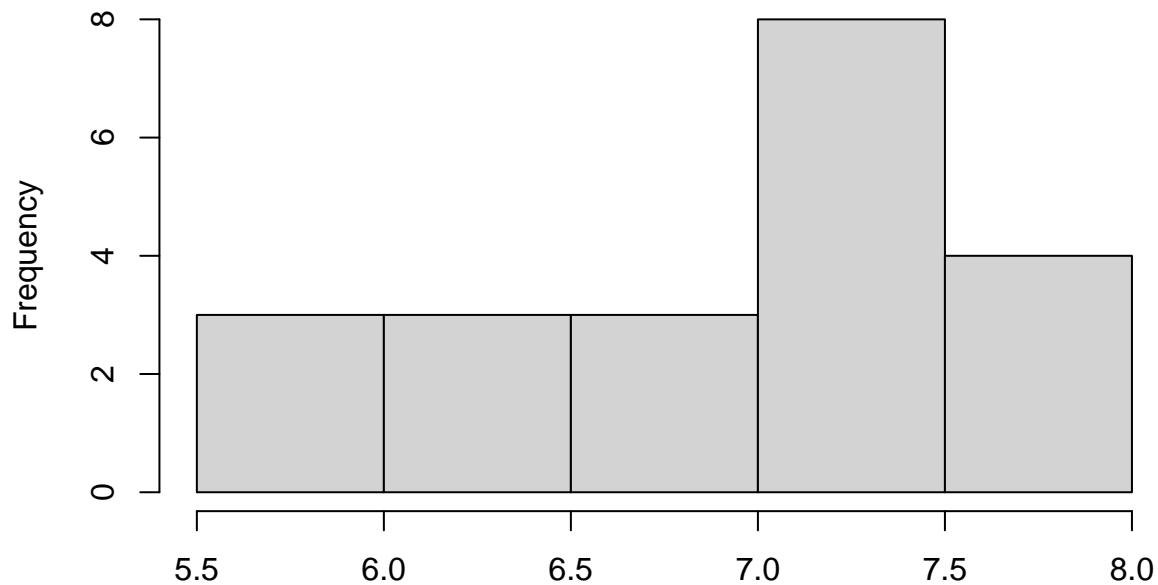
```
whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Sub-Saharan Af
```

```
ks.test(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Western Europe'], "pnorm", mean
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Western Europe"]
## D = 0.16103, p-value = 0.5918
## alternative hypothesis: two-sided
```

```
hist(whr2021_data$`Ladder score`[whr2021_data$`Regional indicator`=='Western Europe'])
```

`whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Western Europe"]`



`whr2021_data$`Ladder score`[whr2021_data$`Regional indicator` == "Western Europe"]`

P-vrijednosti na svim testovima su nam veće od kritične vrijednosti te ne odbijamo nul hipotezu.

Sada trebamo analizirati homogenost varijanci regija što ćemo napraviti s Bartlettovim testom. Hipoteze su nam sljedeće:

$$H_0 : \sigma_1^2 = \sigma_2^2 = \dots = \sigma_k^2$$

$$H_1 : \neg H_0.$$

te

$$\alpha = 0.05$$

```
bartlett.test(whr2021_data$`Ladder score` ~ whr2021_data$`Regional indicator`)
```

```
##
## Bartlett test of homogeneity of variances
##
## data: whr2021_data$`Ladder score` by whr2021_data$`Regional indicator`
## Bartlett's K-squared = 21.976, df = 9, p-value = 0.008955
```

P-vrijednost je manja od kritične vrijednosti tako da ne odbacujemo nul hipotezu.

Sada možemo napraviti jednofaktorsku ANOVA-u. Hipoteze su nam sljedeće:

$$H_0 : \mu_1 = \mu_2 = \dots = \mu_k$$

$$H_1 : \neg H_0.$$

te

$$\alpha = 0.05, k = 10$$

```
luck = aov(whr2021_data$`Ladder score` ~ whr2021_data$`Regional indicator`)
summary(luck)
```

```
##                                Df Sum Sq Mean Sq F value Pr(>F)
## whr2021_data$`Regional indicator`    9 106.05  11.783    25.34 <2e-16 ***
## Residuals                          139  64.64   0.465
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Kao što je sugerirano u grafu s početka, ANOVA potvrđuje da postoji razlika u iskazanoj sreći među regijama.