QSCI 482 Story 1

Simon Hans Edasi

2023-10-09

Question 1

1. Using elementary expressions in R, calculate the density for a standard normal when X i = 0

```
library(glue)
X = 0
Y = (1/sqrt(2*pi)) * exp( -(X**2 / 2 ))
glue('Density for standard normal when X_i = 0: {Y}')
```

```
## Density for standard normal when X_i = 0: 0.398942280401433
```

2. Using elementary expressions in R, calculate the density for a standard normal when X i = 2 .

```
X = 2
Y = (1/sqrt(2*pi)) * exp( -(X**2 / 2 ))
glue('Density for standard normal when X_i = 2: {Y}')
```

```
## Density for standard normal when X_i = 2: 0.0539909665131881
```

3. Show the R code demonstrating how you can check your answers using dnorm().

```
X = 2
mu = 0
sd = 1
dnorm(X, mu, sd)
```

```
## [1] 0.05399097
```

Question 2

1. Load the data in "SturgeonData.csv" into R and save it in a variable. Answer all questions in units of millimeters (mm).

```
rm(list = ls())
df <- read.csv('SturgeonData.csv')
```

2. What is the mean length of sturgeon?

```
sturg_mean_len = mean(df$Length)
glue('Mean length of sturgeon: {signif(sturg_mean_len,3)} mm')
```

```
## Mean length of sturgeon: 1360 mm
```

3. What is the median length of sturgeon?

```
sturg_median_len = median(df$Length)
glue('Median length of sturgeon: {signif(sturg_median_len,3)} mm')
```

```
## Median length of sturgeon: 1370 mm
```

4. What is the variance of sturgeon lengths?

```r
sturg_var = var(df$Length)
glue('Variance of sturgeon length: {signif(sturg_var,3)} mm^2')
```

```
## Variance of sturgeon length: 46200 mm^2
```

5. What is the standard deviation of sturgeon lengths?

```r
sturg_std = sd(df$Length)
glue('STD of sturgeon length: {signif(sturg_std,3)} mm')
```

```
## STD of sturgeon length: 215 mm
```

6. What is the coefficient of variation of sturgeon lengths?

```r
sturg_cv = sturg_std / sturg_mean_len
glue('CV of sturgeon length: {signif(sturg_cv,3)} mm')
```

```
## CV of sturgeon length: 0.158 mm
```

7. What is the Z-value for a sturgeon of length 2000 mm?

```r
Z = (2000 - sturg_mean_len) / sturg_std
glue('Z value of sturgeon length: {signif((2000 - sturg_mean_len) / sturg_std,3)}')
```

```
## Z value of sturgeon length: 2.98
```

For parts 8-10, assume that sturgeon lengths follow a normal distribution with the parameters just calculated. 8. What proportion will be shorter than 1000 mm?

```r
prop_less_1000 = pnorm(1000, sturg_mean_len, sturg_std)
glue('Proportion of sturgeon shorter than 1000 mm: {signif(prop_less_1000,3) * 100}%')
```

```
## Proportion of sturgeon shorter than 1000 mm: 4.7%
```

9. What proportion will be longer than 1500 mm?

```r
prop_greater_1500 = 1-pnorm(1500, sturg_mean_len, sturg_std)
glue('Proportion of sturgeon longer than 100 mm: {signif(prop_greater_1500,3) * 100}%')
```

```
## Proportion of sturgeon longer than 100 mm: 25.7%
```

10. What proportion will fall inside the slot limit of 44-50 inches (you'll need to convert to mm)?

```r
l1 = 44*25.4
l2 = 50*25.4
prop_bet_44_50 = pnorm(l2, sturg_mean_len, sturg_std) - pnorm(l1, sturg_mean_len, sturg_std)
glue('Proportion of sturgeon between 44 - 50 in: {signif(prop_bet_44_50,3) * 100}%')
```

```
## Proportion of sturgeon between 44 - 50 in: 20.8%
```

Question 3

```r
signif(pnorm(-1.9, seq(0,0.09,0.01)),3)
```

```
##  [1] 0.0287 0.0281 0.0274 0.0268 0.0262 0.0256 0.0250 0.0244 0.0239 0.0233
```

Question 4

```
bp1 = read.csv('BPbefore.csv')
bp2 = read.csv('BPafter.csv')
```

```
n_sys_before = length(bp1$Systolic)
n_dia_before = length(bp1$Diastolic)
n_sys_after  = length(bp2$Systolic)
n_dia_after = length(bp2$Diastolic)
```

```
mean_sys_before = mean(bp1$Systolic)
mean_sys_after = mean(bp2$Systolic)
mean_dia_before = mean(bp1$Diastolic)
mean_dia_after = mean(bp2$Diastolic)
```

```
std_sys_before = sd(bp1$Systolic)
std_sys_after = sd(bp2$Systolic)
std_dia_before = sd(bp1$Diastolic)
std_dia_after = sd(bp2$Diastolic)
```

```
se_sys_before = std_sys_before / n_sys_before
se_sys_after = std_sys_after / n_sys_after
se_dia_before = std_dia_before / n_dia_before
se_dia_after = std_dia_after / n_dia_after
```

```
alpha = 0.05
t_score_sys_before = qt(p=alpha/2, df=n_sys_before-1,lower.tail=F)
t_score_sys_after = qt(p=alpha/2, df=n_sys_after-1,lower.tail=F)
t_score_dia_before = qt(p=alpha/2, df=n_dia_before-1,lower.tail=F)
t_score_dia_after = qt(p=alpha/2, df=n_dia_after-1,lower.tail=F)
```

```
cil_sys_before = mean_sys_before - (t_score_sys_before*se_sys_before)
cil_sys_after = mean_sys_after - (t_score_sys_after*se_sys_after)
cil_dia_before = mean_dia_before - (t_score_dia_before*se_dia_before)
cil_dia_after = mean_dia_after - (t_score_dia_after*se_dia_after)

ciu_sys_before = mean_sys_before + (t_score_sys_before*se_sys_before)
ciu_sys_after = mean_sys_after + (t_score_sys_after*se_sys_after)
ciu_dia_before = mean_dia_before + (t_score_dia_before*se_dia_before)
ciu_dia_after = mean_dia_after + (t_score_dia_after*se_dia_after)
```

```
glue('Systolic before: [{signif(cil_sys_before,3)}, {signif(ciu_sys_before,3)}]')
```

```
## Systolic before: [136, 137]
```

```
glue('Systolic after: [{signif(cil_sys_after,3)}, {signif(ciu_sys_after,3)}]')
```

```
## Systolic after: [127, 128]
```

```
glue('Diastolic before: [{signif(cil_dia_before,3)}, {signif(ciu_dia_before,3)}]')
```

```
## Diastolic before: [89.6, 90]
```

```
glue('Diastolic after: [{signif(cil_dia_after,3)}, {signif(cil_dia_after,3)}]')
```

```
## Diastolic after: [83.2, 83.2]
```

3. Given that the intervals do not overlap, we can conclude that meds lowered both systolic and diastolic

pressure.

4. Patient A no longer has high blood pressure as systolic is not over 140 after meds and diastolic is under 90 after meds.
5. Patient A responded to medication one such that blood pressure was reduced when medication is taken. For patient A to keep blood pressure under control they should take the medication.