R Notebook

This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.

Try executing this chunk by clicking the *Run* button within the chunk or by placing your cursor inside it and pressing *Ctrl+Shift+Enter*.

Add a new chunk by clicking the *Insert Chunk* button on the toolbar or by pressing *Ctrl+Alt+I*.

When you save the notebook, an HTML file containing the code and output will be saved alongside it (click the *Preview* button or press *Ctrl+Shift+K* to preview the HTML file).

The preview shows you a rendered HTML copy of the contents of the editor. Consequently, unlike *Knit*, *Preview* does not run any R code chunks. Instead, the output of the chunk when it was last run in the editor is displayed.

# Problem 5.76

## Solution

mu = 68  
s = 22  
n = 500  
x = 70  
  
z = (x-mu)/(s/sqrt(n))  
  
# Probability of the average amount exceeding $70 is P(z>70) = 1-P(Z<70)  
  
p = 1 - pnorm(z)  
print(paste("Probability of the average amount exceeding $70 is", round(p,5)))

## [1] "Probability of the average amount exceeding $70 is 0.02104"

# Problem 5.82

## A) Solution:

### In a binomial setting with n trials and success probability p, the probability of exactly x successes is

### 𝑃(𝑋=𝑥)= (𝑛!/(𝑥!(𝑛−𝑥)!)) 𝑝^𝑥 \* (1−𝑝)^(𝑛−𝑥)

# Here  
n = 12  
x = 9  
p = 3/4  
  
ans = (factorial(n)/(factorial(x)\*factorial(n-x)))\*(p^x)\*(1-p)^(n-x)  
print(paste("The probability that exactly 9 out of 12 of these plants have red blossoms is",round(ans,4)))

## [1] "The probability that exactly 9 out of 12 of these plants have red blossoms is 0.2581"

## B) Solution:

### The mean number of red-blossomed plants when 120 plants of this type are grown from seeds red-blossomed plants is obtained below:

### The expected value of X can be obtained as follows:

### mu = n\*p

#Here  
n = 120  
p = 3/4  
mu = n\*p  
  
print(paste("The mean number of red-blossomed plants when 120 plants of this type are grown from seeds red-blossomed plants is",mu))

## [1] "The mean number of red-blossomed plants when 120 plants of this type are grown from seeds red-blossomed plants is 90"

## C) Solution:

### Standard deviation of sample 𝜎\_𝑥=√(𝑛\*𝑝(1−𝑝) )

sx = sqrt(n\*p\*(1-p))  
sx

## [1] 4.743416

### we know that Z = (X-mu)/sx

# Here  
X = 80  
z = (X-mu)/sx  
z

## [1] -2.108185

# The probability of obtaining at least 80 red-blossomed plants when 120 plants are grown from seeds  
  
print(paste("The probability of obtaining at least 80 red-blossomed plants when 120 plants are grown from seeds is",round(1- pnorm(z),5)))

## [1] "The probability of obtaining at least 80 red-blossomed plants when 120 plants are grown from seeds is 0.98249"

# Problem 5.83

## Solution:

# Here  
mu = 66  
s0 = 6  
n = 12  
# We know standard error s = mu/√n  
s = s0/sqrt(n)  
s

## [1] 1.732051

### Calculate the probability that the weight of a carton falls between 755 and 830.

*p(755<x<830)* *=p(755/12<x<830/12)*

# Here lower bound & upper bound  
lb = 755  
ub = 830  
# Fit into normal distribution  
lbn = lb/12  
ubn = ub/12  
  
z\_lbn = (lbn-mu)/s  
z\_ubn = (ubn-mu)/s  
print(paste("lower Z value",z\_lbn))

## [1] "lower Z value -1.78016333000135"

print(paste("upper Z value",z\_ubn))

## [1] "upper Z value 1.82827585243382"

### so the probability would be

*P(-1.78016333000135 < Z < 1.82827585243382)* *= P(Z< 1.82827585243382) - P(Z < -1.78016333000135)*

pnorm(z\_lbn)

## [1] 0.03752462

pnorm(z\_ubn)

## [1] 0.9662459

print(paste("The probability that the weight of a carton falls between 755 and 830 is", round(pnorm(z\_ubn) - pnorm(z\_lbn),5)))

## [1] "The probability that the weight of a carton falls between 755 and 830 is 0.92872"

## Alternate solution:

# Here  
mu = 66  
s0 = 6  
n = 12  
  
#lower bound & upper bound  
lb = 755  
ub = 830  
# variance of the sum of 12 such random variable  
v = n \* (s0^2)  
# standard deviation of the sum of 12 such random variables  
s = sqrt(v)  
# mean of the sum of 12 such random variables  
n\_mu = n\*mu  
  
z\_lb = (lb-n\_mu)/s  
z\_ub = (ub-n\_mu)/s  
print(paste("lower Z value",z\_lb))

## [1] "lower Z value -1.78016333000135"

print(paste("upper Z value",z\_ub))

## [1] "upper Z value 1.82827585243381"

print(paste("The probability that the weight of a carton falls between 755 and 830 is", round(pnorm(z\_ub) - pnorm(z\_lb),5)))

## [1] "The probability that the weight of a carton falls between 755 and 830 is 0.92872"

# Problem 5.86

## A) Solution:

# From given data N(32,6) for early-speaking group  
mu\_x = 32 # Mean of population as well as sample  
s\_x = 6 # Standard deviation of the population  
n =25 # Sample size  
# Standard deviation of the sample  
s\_x\_n = s\_x/sqrt(n)  
s\_x\_n

## [1] 1.2

# From given data N(29,5) for delayed-speaking group  
mu\_y = 29 # Mean of population as well as sample  
s\_y = 5 # Standard deviation of the population  
n =25 # Sample size  
# Standard deviation of the sample  
s\_y\_n = s\_y/sqrt(n)  
s\_y\_n

## [1] 1

## B) Solution:

# Difference of y and x between mean scores in the two groups from repeated experiments  
mu\_y\_x = mu\_y - mu\_x  
mu\_y\_x

## [1] -3

# Variance for early-speaking group  
v\_x\_n = s\_x\_n ^2  
# Variance for delayed-speaking group  
v\_y\_n = s\_y\_n ^2  
  
s\_y\_x =sqrt(v\_x\_n+v\_y\_n)  
s\_y\_x

## [1] 1.56205

print(paste0("So sampling distribution of the difference y¯−x¯ between the mean scores in the two groups from repeated expetiments is N(",mu\_y\_x,", ",round(s\_y\_x,5), ")"))

## [1] "So sampling distribution of the difference y¯-x¯ between the mean scores in the two groups from repeated expetiments is N(-3, 1.56205)"

## C) Solution:

#### Now the probabilty of the mean score for delayed speaking is at least as large as that for early speaking

#### P(mu\_y >= mu\_x)

#### = P(mu\_y\_x >= 0)

#### = 1 - P(mu\_y\_x < 0)

# Let new mean difference yx and probability of the misleading experiment is P  
  
yx = 0  
  
# As Z = (X-mean)/Std. deviation  
Z= round(((yx- mu\_y\_x)/s\_y\_x),5)  
Z

## [1] 1.92055

P = round((1 - pnorm(Z)),5)  
print(paste("the probabilty of the mean score for delayed speaking is at least as large as that for early speaking is",P))

## [1] "the probabilty of the mean score for delayed speaking is at least as large as that for early speaking is 0.02739"

# Problem 5.87

## A) Solution:

# For female  
# sample size for female  
n\_f = 400  
# sample proportion for female (p^F)  
p\_f = .82  
# Standard deviation for female  
std\_f = sqrt(p\_f\*(1-p\_f)/n\_f)  
print(paste0("The approximate distribution of the proportion p^F of women who worked last summer is N(",p\_f,", ",std\_f, ")" ))

## [1] "The approximate distribution of the proportion p^F of women who worked last summer is N(0.82, 0.0192093727122985)"

# For male  
# sample size for male  
n\_m = 400  
# sample proportion for male (p^M)  
p\_m = .88  
# Standard deviation for male  
std\_m = sqrt(p\_m\*(1-p\_m)/n\_m)  
print(paste0("The approximate distribution of the proportion p^M of men who worked last summer is N(",p\_m,", ",std\_m, ")" ))

## [1] "The approximate distribution of the proportion p^M of men who worked last summer is N(0.88, 0.0162480768092719)"

## B) Solution:

# sample proportion for male and women comparison (p^M−p^F, mean)  
p\_m\_f = round(p\_m - p\_f,2)  
# Standard deviation for male and women comparison (√(variance of Male + variance of Female))  
std\_m\_f = round(sqrt(std\_m^2 + std\_f^2),6)  
print(paste0("The difference in the proportions who worked, p^M−p^F is N(",p\_m\_f,", ",std\_m\_f, ")" ))

## [1] "The difference in the proportions who worked, p^M-p^F is N(0.06, 0.025159)"

## C) Solution:

### The probability that in the sample a higher proportion of women than men worked last summer would be

### P(p^F > p^M)

### = P(pM−pF < 0)

### = P(Z < (0-p\_m\_f)/std\_m\_f) as Z = (X-mean)/sd

# So  
Z = round((0-p\_m\_f)/std\_m\_f,4)  
print(paste("The probability that in the sample a higher proportion of women than men worked last summer would be",round(pnorm(Z),6)))

## [1] "The probability that in the sample a higher proportion of women than men worked last summer would be 0.008544"