Assignment #4

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## 5.

# a)

library(tidyverse)

## Loading tidyverse: ggplot2  
## Loading tidyverse: tibble  
## Loading tidyverse: tidyr  
## Loading tidyverse: readr  
## Loading tidyverse: purrr  
## Loading tidyverse: dplyr

## Conflicts with tidy packages ----------------------------------------------

## filter(): dplyr, stats  
## lag(): dplyr, stats

x=rnorm(10,20,2)  
x

## [1] 18.57036 20.44588 20.05588 19.90869 19.06254 20.82431 22.28530  
## [8] 19.79687 17.32151 17.28280

The values do look reasonable because they tend to be around the mean 20. Also, most of the values are between one standard deviation less than mean and one standard deviation between more than mean (between 18 and 22). This is where 68% of the data is and is also the data that has high probabilities in the normal distribution.

# b)

sim=function(null\_mu,ssize,true\_mu,SD){  
 x=rnorm(ssize,true\_mu,SD)  
 t.test(x,mu=null\_mu)$p.value  
}

Function that generates random normal distribution samples and conducts a two sided t-test. A p-value is returned from the t-test.

# c)

pvals=replicate(1000,sim(20,10,20,2))  
 answer = head(pvals)

Simulates t-test 1000 times.

# d)

table(pvals<=0.05)

##   
## FALSE TRUE   
## 951 49

49 P-values out of the 1000 P-values replicated are 0.05 or smaller. Therefore, since significance level is 0.05, we can still say that the test correctly rejects around 0.05 of the replications. As a result, it does make sense that the null hypothesis is true.

# e)

pvals2=replicate(1000,sim(20,10,22,2))  
 table(pvals2<=0.05)

##   
## FALSE TRUE   
## 198 802

Estimated power is 0.802.

# f)

power.t.test(n=10,delta=-2,sd=2,type="one.sample")

##   
## One-sample t test power calculation   
##   
## n = 10  
## delta = 2  
## sd = 2  
## sig.level = 0.05  
## power = 0.8030962  
## alternative = two.sided

Estimated power is about 0.003 more than exact power.

## 6.

# a)

# Code

proc power;

twosamplemeans

test=diff\_satt

sides=1

meandiff=10

groupstddevs=16|16

groupns=25|25

power=.;

# Output

***The POWER Procedure***

|  |
| --- |
| ***Two-Sample t Test for Mean Difference with Unequal Variances*** |

| **Fixed Scenario Elements** | |
| --- | --- |
| **Distribution** | Normal |
| **Method** | Exact |
| **Number of Sides** | 1 |
| **Mean Difference** | 10 |
| **Group 1 Standard Deviation** | 16 |
| **Group 2 Standard Deviation** | 16 |
| **Group 1 Sample Size** | 25 |
| **Group 2 Sample Size** | 25 |
| **Null Difference** | 0 |
| **Nominal Alpha** | 0.05 |

| **Computed Power** | |
| --- | --- |
| **Actual Alpha** | **Power** |
| 0.0499 | 0.703 |

# Explanation

It is 70.3% likely that we correctly reject a null hypothesis that the treatment and control means are equal.

# b)

# Code

proc power;

twosamplemeans

test=diff\_satt

sides=1

meandiff=10

groupstddevs=16|16

ntotal=.

power=0.8;

# Output

|  |
| --- |
| ***The POWER Procedure*** |
| |  | | --- | | ***Two-Sample t Test for Mean Difference with Unequal Variances*** | |

| **Fixed Scenario Elements** | |
| --- | --- |
| **Distribution** | Normal |
| **Method** | Exact |
| **Number of Sides** | 1 |
| **Mean Difference** | 10 |
| **Group 1 Standard Deviation** | 16 |
| **Group 2 Standard Deviation** | 16 |
| **Nominal Power** | 0.8 |
| **Null Difference** | 0 |
| **Nominal Alpha** | 0.05 |
| **Group 1 Weight** | 1 |
| **Group 2 Weight** | 1 |

| **Computed N Total** | | |
| --- | --- | --- |
| **Actual Alpha** | **Actual Power** | **N Total** |
| 0.0499 | 0.807 | 66 |

# Explanation

The total size that would be needed is 66. This means that there will be 33 in each of the two samples. These sample sizes will help the principal investigator determine whether funding is available to support the collection of the larger sample.