Homework 11

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tinytex::install_tinytex()

Problem 1:

a. The practitioner plans to conduct a two-tailed sign test.

```
set.seed(12201996)
mu<- 29.3
sigma<- 9.9
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
do.test<-function(x) {
 samp<- rnorm(x,mean=mu, sd=sigma)
 v <- sum(samp>29.3)
 n<-length(samp)
 pval<-binom.test(v,n,alternative="two.sided")$p.value

 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

Two_Tail_Sign_Test<-sapply(sizes,rep.test)
names(Two_Tail_Sign_Test)<-sizes
Two_Tail_Sign_Test
```

```
##      7     26     50
## 0.0167 0.0295 0.0365
```

Problem 1:

b. The practitioner plans to conduct a two-tailed sign-rank test

```
mu<- 29.3
sigma<- 9.9
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
do.test<-function(x) {
 samp<- rnorm(x,mean=mu, sd=sigma)

 pval<-wilcox.test(samp, mu=29.3, alternative="two.sided",exact=FALSE)$p.value
 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  round(sum(res)/K,3)
}

Two_Tailed_Rank_Test<-sapply(sizes,rep.test)
names(Two_Tailed_Rank_Test)<-sizes
Two_Tailed_Rank_Test
```

```
##     7    26    50
## 0.032 0.048 0.050
```

Problem 1

(c) The practitioner plans to conduct a two-tailed t-test test.

```
mu<- 29.3
sigma<- 9.9
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
```

```
do.test<-function(x) {
 samp<- rnorm(x,mean=mu, sd=sigma)


 pval<-t.test(samp, mu=29.3, alternative="two.sided")$p.value
 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

T_Test_twoside<-sapply(sizes,rep.test)
names(T_Test_twoside)<-sizes
T_Test_twoside
```

```
##      7     26     50
## 0.0501 0.0491 0.0472
```

Problem 2

Summarize your results from Problem 1 in a tabular-like data structure. What

conclusions can you draw?

```
SampleSize<- c("SampleSize 7","SampleSize 26", "SampleSize 50")
table<- data.frame(SampleSize,
  Two_Tail_Sign_Test,Two_Tailed_Rank_Test,T_Test_twoside)
names(table)<-c("Sample Size" ,
  "two-tailed sign test","two-tailed sign-rank test", "T_Test_twoside")
table
```

```
##      Sample Size two-tailed sign test two-tailed sign-rank test T_Test_twoside
## 7   SampleSize 7               0.0167                     0.032         0.0501
## 26 SampleSize 26               0.0295                     0.048         0.0491
## 50 SampleSize 50               0.0365                     0.050         0.0472
```

Problem 3

(a) The practitioner plans to conduct a two-tailed sign test

```
set.seed(12201996)
mu<- 29.3
sigma<- 9.9
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
do.test<-function(x) {
 samp<- rnorm(x,mean=mu, sd=sigma)
 v <- sum(samp>26.8)
 n<-length(samp)
 pval<-binom.test(v,n,alternative="two.sided")$p.value

 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

Two_Tail_Sign_Test_1<-sapply(sizes,rep.test)
names(Two_Tail_Sign_Test_1)<-sizes
Two_Tail_Sign_Test_1
```

```
##      7     26     50
## 0.0297 0.1210 0.2329
```

Sample size 7 has the smaller power which is 3%. . Sample 26 and sample size 50 have the power of 13% and 24% respectively. Sample Size 26 and 50 are better at detecting false null hypothesis than sample 7 because the powers are bigger and close to 1 than sample 7.

Problem 3

b) The practitioner plans to conduct a two-tailed sign-rank test.

```
mu1<- 29.3
mu0<-26.8
sigma<- 9.9
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
do.test<-function(x) {
 samp<- rnorm(x,mean=29.3, sd=sigma)

 pval<-wilcox.test(samp, mu=26.8, alternative="two.sided",exact=FALSE)$p.value
 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  round(sum(res)/K,3)
}

Two_Tailed_Rank_Test_1<-sapply(sizes,rep.test)
names(Two_Tailed_Rank_Test_1)<-sizes
Two_Tailed_Rank_Test_1
```

```
##     7    26    50
## 0.057 0.220 0.389
```

Power is the probability of rejecting null hypothesis when it is false. Sample 7 has the bigger power than sample size 26 and 50. Sample 7 is better at detecting false null hypothesis than the other two.

Problem 3: T test

Two sided

```
mu<- 29.3
sigma<- 9.9
```

```
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
do.test<-function(x) {
 samp<- rnorm(x,mean=mu, sd=sigma)


 pval<-t.test(samp, mu=26.8, alternative="two.sided")$p.value
 pval<=0.05

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

T_Test_twoside_1<-sapply(sizes,rep.test)
names(T_Test_twoside_1)<-sizes
T_Test_twoside_1
```

```
##      7     26     50
## 0.0877 0.2354 0.4148
```

As the sample size increased, so did the power. sample size 7 has the smallest power so sample size 26 and 50 are better at rejecting the null hypothesis when it is false.

Problem 4: Summarize your results from Problem 3 in a tabular-like data structure. What

conclusions can you draw?

```
SampleSize<- c("SampleSize 7","SampleSize 26", "SampleSize 50")
table<- data.frame(SampleSize,
      Two_Tail_Sign_Test_1,Two_Tailed_Rank_Test_1,T_Test_twoside_1)
names(table)<-c("Sample Size" ,
  "two-tailed sign test","two-tailed sign-rank test", "T_Test_twoside")
table
```

```
##      Sample Size two-tailed sign test two-tailed sign-rank test T_Test_twoside
```

```
## 7   SampleSize 7                0.0297                      0.057          0.0877
## 26 SampleSize 26                0.1210                      0.220          0.2354
## 50 SampleSize 50                0.2329                      0.389          0.4148
```

Overall, Two-tailed sign test has the least power compared to two-tailed sign rank test and T_test_twoside. As the sample increased, so did the power. Twp-tailed sign test has the least power among three tests, so it is not as good as the other tests at rejecting the null hypothesis when it is false

Problem 5:

(a) The practitioner plans to conduct a two-tailed sign test.

```
set.seed(12201996)
mediansamp<-2.365974

K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
Two_sided<-function(x) {
samp<- rchisq(x,3)
v <- sum(samp>2.365974)
n<-length(samp)
 pval<-binom.test(v,n,alternative="two.sided")$p.value

 pval<=0.05


}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

Two_Tail_Sign_Test_2<-sapply(sizes,rep.test)
names(Two_Tail_Sign_Test_2)<-sizes
Two_Tail_Sign_Test_2
```

```
##      7     26     50
## 0.0921 0.2357 0.4113
```

Problem 5

(b) The practitioner plans to conduct a two-tailed sign-rank test

```
set.seed(12201996)
mediansamp<-2.365974
sigma<- sqrt(6)
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
Two_sided<-function(x) {
samp<- rchisq(x,3)
pval<-wilcox.test(samp, mu=2.365974, alternative="two.sided",exact=FALSE)$p.value


}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  round(sum(res)/K,3)
}

Two_Tailed_Rank_Test_2<-sapply(sizes,rep.test)
names(Two_Tailed_Rank_Test_2)<-sizes
Two_Tailed_Rank_Test_2

##     7    26    50
## 0.615 0.999 1.000
```

Problem 6: Summarize your results from Problem 5 in a tabular-like data structure. What

conclusions can you draw?

```
SampleSize<- c("SampleSize 7","SampleSize 26", "SampleSize 50")
table<- data.frame(SampleSize,Two_Tail_Sign_Test_2,
      Two_Tailed_Rank_Test_2)
names(table)<-c("Sample Size" ,"two-tailed sign test",
      "two-tailed sign-rank test")
table
```

```
##      Sample Size two-tailed sign test two-tailed sign-rank test
## 7   SampleSize 7               0.0921                     0.615
## 26 SampleSize 26               0.2357                     0.999
## 50 SampleSize 50               0.4113                     1.000
```

Overall, the 2 sample sizes of two-tailed sign test and two-tailed rank test have the same percentage of power which increased when the sample size increased. Sample size 26 and 50 of 2 tests have the greatest chance of rejecting the null hypothesis because its power is close to 1 (100%). The 3 sample sizes of 2 tests reject null hypothesis, when in fact the null hypothesis is false.

Problem 7:

(a) The practitioner plans to conduct a two-tailed sign test.

```
set.seed(12201996)
mediansamp<-2

K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
Two_sided<-function(x) {
samp<- rchisq(x,3)
v <- sum(samp>2)
 n<-length(samp)

 pval<-binom.test(v,n,alternative="two.sided")$p.value

 pval<=0.05


}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  sum(res)/K
}

Two_Tail_Sign_Test_3<-sapply(sizes,rep.test)
names(Two_Tail_Sign_Test_3)<-sizes
Two_Tail_Sign_Test_3
```

```
##      7     26     50
## 0.6149 0.9987 1.0000
```

Problem 7

b.The practitioner plans to conduct a two-tailed sign-rank test

```
set.seed(12201996)
mediansamp<-2
sigma<- sqrt(6)
K<- 10000
alpha<- 0.05
sizes<- c(7,26,50)
Two_sided<-function(x) {
samp<- rchisq(x,3)
pval<-wilcox.test(samp, mu=2, alternative="two.sided",exact=FALSE)$p.value

}

rep.test<- function(x){
  res<- replicate(10000,do.test(x))
  round(sum(res)/K,3)
}

Two_Tailed_Rank_Test_3<-sapply(sizes,rep.test)
names(Two_Tailed_Rank_Test_3)<-sizes
Two_Tailed_Rank_Test_3
```

```
##     7    26    50
## 0.615 0.999 1.000
```

Problem 8: Summarize your results from Problem 7 in a tabular-like data structure. What

conclusions can you draw?

```
SampleSize<- c("SampleSize 7","SampleSize 26", "SampleSize 50")
table<- data.frame(SampleSize,
      Two_Tail_Sign_Test_3,Two_Tailed_Rank_Test_3)
names(table)<-c("Sample Size" ,"two-tailed sign test",
```

```
          "two-tailed sign-rank test")
table
```

```
##      Sample Size two-tailed sign test two-tailed sign-rank test
## 7   SampleSize 7               0.6149                     0.615
## 26 SampleSize 26               0.9987                     0.999
## 50 SampleSize 50               1.0000                     1.000
```

The median changes from 2.365974. to 2 does not affect the power of the test. The power of three tests remain the same. Sample size 26 and 50 of three tests have the greatest chance of rejecting the null hypothesis because its power is close to 1 (100%). The 3 sample sizes of three tests reject null hypothesis, when in fact the null hypothesis is false

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