Statistical Inference Theory - Lab 7

Code

CB.SC.I5DAS20032

Problem 1

Suppose the mean weight of King Penguins found in an Antarctic colony last year was 15.4 kg. In a sample of 25 penguins same time this year in the same colony, the mean penguin weight is 14.6 kg. Assume the sample standard deviation is 2.5 kg. At .05 significance level, can we reject the null hypothesis that the mean penguin weight does not differ from last year?

Solution

Hide

```
xbar = 14.6
m0 = 15.4
s = 2.5
n = 25
t = (xbar-m0)/(s/sqrt(n))

t
```

```
[1] -1.6
```

Hide

```
a = .05
t.a.half = qt(1 - a/2, df = n-1)
c(-t.a.half, t.a.half)
```

```
[1] -2.063899  2.063899
```

-2.063899 <= -1.6 <= 2.063899
We **do not reject** the null hypothesis.

Problem 2

Suppose 60% of citizens voted in last election. 85 out of 148 people in a telephone survey said that they voted in current election. At 0.5 significance level, can we reject the null hypothesis that the proportion of voters in the population is above 60% this year?

Solution

Hide

```
pbar = 85/148
p0 = 0.6
n = 148
z = (pbar - p0)/sqrt(p0*(1 - p0)/n)

z
```

```
[1] -0.6375983
```

Hide

```
a = .05
z.a = qnorm(1 - a)

-z.a
```

```
[1] -1.644854
```

-0.6375983 !< -1.644854
We **do not reject** the null hypothesis.

Alternative Solution

Hide

```
p = pnorm(z)

p
```

```
[1] 0.2618676
```

0.2618676 > .05
We **do not reject** the null hypothesis.

Problem 3

Suppose that 12% of apples harvested in an orchard last year was rotten. 30 out of 214 apples in a harvest sample this year turns out to be rotten. At .05 significance level, can we reject the null hypothesis that the proportion of rotten apples in harvest stays below 12% this year?

Solution

Hide

```
pbar = 30/214
p0 = 0.12
n = 214

z = (pbar - p0)/sqrt(p0*(1 - p0)/n)

z
```

```
[1] 0.908751
```

Hide

```
z.a
```

```
[1] 1.644854
```

0.908751 !< 1.644854
We **do not reject** the null hypothesis.

Alternative Solution

Hide

```
p = pnorm(z, lower.tail = FALSE)

p
```

```
[1] 0.1817408
```

0.1817408 > 0.05
We **do not reject** the null hypothesis.

Problem 4

Suppose a coin toss turns up 12 heads out of 30 trials. At .05 significance level, can one reject the null hypothesis that the coin toss is fair?

Hide

```
pbar = 12/30
p0 = .5
n = 30
z = (pbar - p0)/sqrt(p0*(1 - p0)/n)

z
```

```
[1] -1.095445
```

Hide

```
a = .05
z.a.half = qnorm(1 - a/2)
c(-z.a.half, z.a.half)
```

```
[1] -1.959964  1.959964
```

-1.959964 <= -1.095445 <= 1.959964
We **do not reject** the null hypothesis.

Alternative Solution

Hide

```
p = 2*pnorm(z, lower.tail = FALSE)

p
```

```
[1] 1.726678
```

1.726678 > 0.05
We **do not reject** the null hypothesis.

Problem 5

From the following data set, test whether two serum uric acid population have the same mean.

sample1 : 1.2, 0.8, 1.1, 0.7, 0.9, 1.1, 1.5, 0.8, 1.6, 0.9 sample2 : 1.7, 1.5, 2.0, 2.1, 1.1, 0.9, 2.2, 1.8, 1.3, 1.5

Solution

Hide

```
sample1 = c(1.2, 0.8, 1.1, 0.7, 0.9, 1.1, 1.5, 0.8, 1.6, 0.9)
sample2 = c(1.7, 1.5, 2.0, 2.1, 1.1, 0.9, 2.2, 1.8, 1.3, 1.5)
```

Hide

```
t.test(sample1, sample2)
```

```
	Welch Two Sample t-test

data:  sample1 and sample2
t = -3.3046, df = 16.145, p-value = 0.004431
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.902565 -0.197435
sample estimates:
mean of x mean of y 
     1.06      1.61 
```

0.004431 < 0.05
We **reject** the null hypothesis.

Problem 6

A quality control supervisor for an automobile manufacturer is concerned with uniformity in the number of defects in cars coming off the assembly line. If one assembly line has significantly more variability in the number of defects, then changes have to be made.

A -> N = 23 mean = 15 Std. Dev = 20 B -> N = 23 mean = 17 Std. Dev = 16

Hide

```
s1 = 20
s2 = 16

N = 23

df = N - 1

F = s1^2 / s2^2

F
```

```
[1] 1.5625
```

Hide

```
critical_val = qf(0.05, df, df, lower.tail = FALSE)

critical_val
```

```
[1] 2.04777
```

1.5625 < 2.04777 We **do not reject** the null hypothesis.