

Write R code to solve the following problems:

Q1) A particular brand of tires claims that its deluxe tire averages at least 50,000 miles before it needs to be replaced. From past studies of this tire, the standard deviation is known to be 8000. A survey of owners of that tire design is conducted. From the 28 tires surveyed, the average lifespan was 46,500 miles with a standard deviation of 9800 miles. Do the data support the claim at the 5% level?

A: Code is as follows:

#Q4.1

#Let $H_0: \mu = \mu_0$ (Average lifespan of sample and population of tires ARE EQUAL)

#Let $H_1: \mu \neq \mu_0$ (Average lifespan of sample and population of tires ARE NOT EQUAL)

#i.e. 2 tailed Test

#Proceedings for Z-Test for Single Mean

$\alpha = 0.05$

$z_{\alpha/2} = qnorm(1-\alpha/2)$

$z_{\alpha/2}$

$\mu = 50000$

$\sigma = 8000$

$n = 28$

$\bar{x} = 46500$

$z_{cal} = (\bar{x} - \mu) / (\sigma / \sqrt{n})$

z_{cal}

$abs(z_{cal})$

#As $|Z| > Z_{\alpha/2}$, therefore H_0 is rejected and H_1 is accepted.

#i.e. The claim cannot be supported at 5% level

Output (via Command Window):

```

> #Q4.1
>
> #Let H0: x0 = mu (Average lifespan of sample and population of tires ARE EQUAL)
> #Let H1: x0 != mu (Average lifespan of sample and population of tires ARE NOT EQUAL)
> #i.e. 2 tailed Test
>
> #Proceedings for Z-Test for Single Mean
> alpha = 0.05
> ztab = qnorm(1-alpha/2)
> ztab
[1] 1.959964
> mu = 50000
> sigma = 8000
> n = 28
> x0 = 46500
> zcal = (x0 - mu)/(sigma/sqrt(n))
> zcal
[1] -2.315032
> abs(zcal)
[1] 2.315032
> #As |Z|>Zalpha, therefore H0 is rejected and H1 is accepted.
> #i.e. The claim cannot be supported at 5% level

```

Result: As $|Z| > Z_{\alpha}$, therefore H_0 is rejected and H_1 is accepted. i.e. The claim cannot be supported at 5% level.

Implementation on R Studio Code (via Command Window):

The screenshot displays the RStudio environment with the following components:

- Source Editor:** Contains R code for a Z-test, including variable assignments for alpha, mu, sigma, n, x0, and the calculation of ztab, zcal, and its absolute value.
- Environment Pane:** Shows the values of the variables created in the script:

Variable	Value
alpha	0.05
mu	50000
n	28
sigma	8000
x0	46500
zcal	-2.31503239718152
ztabs	1.95996398454005
- Console:** Shows the output of the R commands, including the values of ztab, zcal, and the final conclusion based on the comparison of |zcal| and ztab.

Q2) In the large city A, 20 per cent of random sample of 900 school children had defective eye-sight. In the large city B, 15 percent of random sample of 1600 school children had the same defective. Is this difference between the two proportions significant? Obtain 95% confidence limits of the difference in the population proportions.

A: Code is as follows:

```
#Q4.2
```

```
x<-c(180,240)
```

```
n<-c(900,1600)
```

```
prop.test(x,n,correct=FALSE)
```

Output (via Command Window):

```
> #Q4.2
```

```
> x<-c(180,240)
```

```
> n<-c(900,1600)
```

```
> prop.test(x,n,correct=FALSE)
```

2-sample test for equality of proportions without continuity correction

data: x out of n

X-squared = 10.302, df = 1, p-value = 0.001329

alternative hypothesis: two.sided

95 percent confidence interval:

0.01855096 0.08144904

sample estimates:

prop 1 prop 2

0.20 0.15

Result: Here there is significance as the P value is less than 0.05 The confidence limits are 1.855% to 8.14%.

Implementation on R Studio Code (via Command Window):

The screenshot displays the RStudio interface with the following components:

- Script Editor:** Contains the following R code:

```
1 #Q4.2
2 x<-c(180,240)
3 n<-c(900,1600)
4 prop.test(x,n,correct=FALSE)
```
- Console:** Shows the execution output:

```
> #Q4.2
> x<-c(180,240)
> n<-c(900,1600)
> prop.test(x,n,correct=FALSE)

2-sample test for equality of proportions without continuity correction

data:  x out of n
X-squared = 10.302, df = 1, p-value = 0.001329
alternative hypothesis: two.sided
95 percent confidence interval:
 0.01855096 0.08144904
sample estimates:
prop 1 prop 2 
0.20  0.15 
> |
```
- Environment Window:** Displays the current environment with the following values:

Variable	Value
n	num [1:2] 900 1600
x	num [1:2] 180 240

Q3) A cigarette manufacturing firm claims its brand A of the cigarettes outsells its brand B by 8%. if it's found that 42 out sample of 200 smoker prefer brand A and 18 out of another random sample of 100 smokers prefers brand B, test whether the 8% difference is a valid claim.

A: Code is as follows:

#Q4.3

```
x<-c(42,18)
```

```
n<-c(200,100)
```

```
prop.test(x,n,alternative="greater",correct=FALSE)
```

Output (via Command Window):

```
> #Q4.3
```

```
> x<-c(42,18)
```

```
> n<-c(200,100)
```

```
> prop.test(x,n,alternative="greater",correct=FALSE)
```

2-sample test for equality of proportions without continuity correction

data: x out of n

X-squared = 0.375, df = 1, p-value = 0.2701

alternative hypothesis: greater

95 percent confidence interval:

-0.04897867 1.00000000

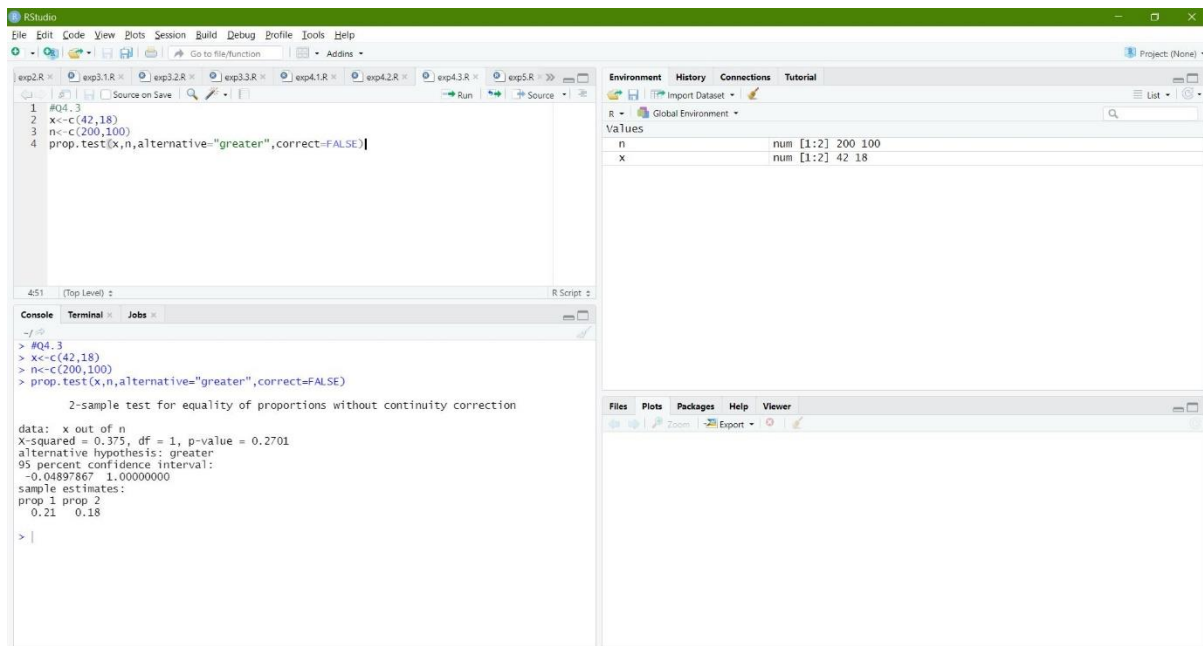
sample estimates:

prop 1 prop 2

0.21 0.18

Result: Here the P value is greater than alpha L.O.S value. Hence accept the null hypothesis.

Implementation on R Studio Code (via Command Window):



The screenshot displays the RStudio environment with the following components:

- Script Editor:** Contains the following R code:

```
1 #Q4.3
2 x<-c(42,18)
3 n<-c(200,100)
4 prop.test(x,n,alternative="greater",correct=FALSE)
```
- Console:** Shows the execution output:

```
> #Q4.3
> x<-c(42,18)
> n<-c(200,100)
> prop.test(x,n,alternative="greater",correct=FALSE)

2-sample test for equality of proportions without continuity correction

data:  x out of n
X-squared = 0.375, df = 1, p-value = 0.2701
alternative hypothesis: greater
95 percent confidence interval:
 -0.04897867  1.00000000
sample estimates:
prop 1 prop 2 
 0.21  0.18 
> |
```
- Environment:** Lists the objects in the global environment:

Object	Class	Attributes
n	num	[1:2] 200 100
x	num	[1:2] 42 18