# **Moussa Academy**

# **Stat101 – Assignment 4 – 2016**

## True or False:

1. False
2. True
3. True
4. True
5. False
6. False

## Multiple Choice Questions:

1. c
2. d
3. a
4. a
5. c
6. b

## Essay Type Questions:

1. n = 5

r = 0.591

α = 0.05

H0: no linear correlation

H1: there is linear correlation

Test statistic: t = $\frac{r}{\sqrt{\frac{1-r^{2}}{n-2}}}$ = $\frac{0.591}{\sqrt{\frac{1-0.591^{2}}{5-2}}}$ = 1.269

p-value = 0.2937

p-value > α

fail to reject null hypothesis

there is no sufficient evidence to support the claim that there is linear correlation between the two variables

1. F = $\frac{variance between samples}{variance within samples}$

Variance between samples = ns2x̄

n = 16

s2x̄ = $\frac{Σ\left(x-\bar{x}\right)^{2}}{n-1}$ x̄: mean of means = $\frac{2.09+3.48+1.86}{3}$ = 2.48 n = 3

 s2x̄ = $\frac{\left(2.09-2.48\right)^{2}+\left(3.48-2.48\right)^{2}+\left(1.86-2.48\right)^{2}}{3-1}$ = 0.768

 variance between samples = 16 \* 0.768 = 14.016

 variance within samples = s2p = $\frac{0.37+0.61+0.45}{3}$ = 0.477

 F = $\frac{variance between samples}{variance within samples}$ = $\frac{14.016}{0.477}$ = 29.404

1. H0: p1 = 0.301, p2 = 0.176, p3 = .125, ……. p9 = .046

H1: At least one of proportions is not equal to the given value

E = np

χ2 = $Σ\frac{\left(o-E\right)^{2}}{E}$

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Leading digit | p | E = np = 120p | O | O – E | (O – E)2 | $$\frac{\left(o-E\right)^{2}}{E}$$ |
| 1 | 0.301 | 36.12 | 33 | -3.12 | 9.73 | 0.269 |
| 2 | 0.176 | 21.12 | 22 | 0.88 | 0.77 | 0.036 |
| 3 | 0.125 | 15 | 10 | -5 | 25 | 1.667 |
| 4 | 0.097 | 11.64 | 15 | 3.36 | 11.29 | 0.97 |
| 5 | 0.079 | 9.48 | 10 | 0.52 | 0.27 | 0.028 |
| 6 | 0.067 | 8.04 | 9 | 0.96 | 0.92 | 0.114 |
| 7 | 0.058 | 6.96 | 5 | -1.96 | 3.84 | 0.552 |
| 8 | 0.051 | 6.12 | 7 | 0.88 | 0.77 | 0.126 |
| 9 | 0.046 | 5.52 | 9 | 3.48 | 12.11 | 2.194 |
|  |  |  |  |  |  | 5.958 |

χ2 = 5.958

critical value at df = 9 – 1 = 8

χ2critical = 15.507

χ2  does not fall in critical region

fail to reject null hypothesis

there is no sufficient evidence to reject the claim that countries have populations with leading digits that fit Berford’s law.

1. r = $\frac{nΣxy-(Σx)(Σy)}{\sqrt{n\left(Σx^{2}\right)-\left(Σx\right)^{2}}\sqrt{n\left(Σy^{2}\right)-\left(Σy\right)^{2}}}$

 we need to calculate: Σxy , Σx , Σy , Σx2 , Σy2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | y | xy | x2 | y2 |
| 1 | 1 | 1 | 1 | 1 |
| 1 | 3 | 3 | 1 | 9 |
| 3 | 2 | 6 | 9 | 4 |
| 4 | 5 | 20 | 16 | 25 |
| 6 | 4 | 24 | 36 | 16 |
| 7 | 5 | 35 | 49 | 25 |
| 8 | 7 | 56 | 64 | 49 |
| 8 | 8 | 64 | 64 | 64 |
| Σ = 38 | 35 | 209 | 240 | 193 |

 r = $\frac{8\*209-38\*35}{\sqrt{8\left(240\right)-\left(38\right)^{2}}\sqrt{8\left(193\right)-\left(35\right)^{2}}}$ = 0.87766

 Regression Equation:

 ŷ = b0 + b1x

 b1 = r$\frac{Sy}{Sx}$

 Sy = 2.387 Sx = 2.916

 b1 = 0.87766 \* $\frac{2.387}{2.916}$ = 0.718

 b0 = ȳ - b1x̄

 ȳ = 4.375 x̄ = 4.75

 b0 = 4.375 – 0.718 \* 4.75 = 0.962

 Regression Equation:

ŷ = b0 + b1x

ŷ = 0.962 + 0.718x

1. K = 5 n = 10 N = 50

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source of variation | DF | SS | MS | F |
| Between treatments | K – 1 = 4 | 247 | 247/4 = 61.75 | 61.75/0.067 = 926.25 |
| Error | 49 – 4 = 45 | 3 | 3/45 = 0.067 |  |
| Total | N – 1 = 49 | 250 |  |  |

1. Where o = 88

E = $\frac{row total\*column total}{grand total}$ = $\frac{178\*103}{207}$ = 88.57

 Where o = 10

 E = $\frac{row total\*column total}{grand total}$ = $\frac{55\*29}{207}$ = 7.285

 α = 0.05

 H0: Getting infection is independent on treatment

 H1: Getting infection is dependent on treatment

 Test statistic: χ2 = $Σ\frac{\left(o-E\right)^{2}}{E}$

 O = 88 E = 88.57

 O = 10 E = 7.285

 O = 48 E = $\frac{178\*52}{207}$ = 44.7

 O = 42 E = $\frac{178\*52}{207}$ = 44.7

 O = 15 E = $\frac{29\*103}{207}$ = 14.4

 O = 4 E = $\frac{29\*103}{207}$ = 7.285

 χ2 = $Σ\frac{\left(o-E\right)^{2}}{E}$ = 2.925

 Critical value at df = (r-1)(c-1) = (2-1)(3-1) = 1 \* 2 = 2, α = 0.05

χ2critical = 5.991

χ2  does not fall in critical region

fail to reject null hypothesis

there is no sufficient evidence to support the claim that getting an infection is dependent on the treatment method

which means that getting an infection is independent of the treatment group. This suggests that Echinacea is not an effective treatment for colds.