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**ISE 390 Final**

**August 5, 2022**

**Summer 2022 Opened Book**

**I understand that I am not allowed to talk to another student during this exam.**

**I understand that looking at someone else’s exam is cheating.**

**I understand if I talk during the exam to another student or look at their paper, I will receive a zero on this exam and that academic misconduct charges will be filed against me. If I am found guilty of academic misconduct, I acknowledge I will receive an F in this course and may also have other sanctions imposed on me (see student handbook).**

**Signature:**

**Jaiden Gann**

**Write neatly. If I cannot read it, you will receive no credit.**

**It would be best to take this quiz in pencil but if you use a pen that you cannot erase you better get the right answer the first time!**

1. (20 points) A coin is tossed twice. Let *Z* denote the number of heads on the first toss and *W* the total number of heads on the 2 tosses. If the coin is unbalanced and a head has a 40% chance of occurring, find

* + 1. the marginal distribution of *W*; **see table below**
    2. the marginal distribution of *Z*; **see table below**
    3. the probability that at least 1 head occurs. **0.64**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Z | |  |
| W | F(w,z) | 0 | 1 |  |
| 0 | 0.36 | 0 | 0.36 |
| 1 | 0.24 | 0.24 | 0.48 |
| 2 | 0 | 0.16 | 0.16 |
|  |  | 0.6 | 0.4 |  |

P(t) = 0.6

P(heads) = 0.4

P(heads ≥ 1) = P(HT) + P(TH) + P(HH)

0.6\*0.4 + 0.6\*0.4 + 0.4\*0.4 = 0.24 + 0.24 + 0.16 = 0.64

* 1. (20 points) Two levels (low and high) of insulin doses are given to two groups of diabetic rats to check the insulin binding capacity, yielding the following data:



Assume that the variances are equal. Give a 95% confidence interval for the difference in the true average insulin-binding capacity between the two samples.

**The CI is 0.68 ± 0.39125**

High does is X. Low is Y

Graphical user interface, application, table

Description automatically generated

1.98 – 1.30 ± t8+13-2, 0.025 \* 0.416sq(1/8 + 1.13)

T = 2.093 -> 2.093 \* 0.416sq(1/8 + 1.13) = 0.39125

**0.68 ± 0.39125**

* 1. (20 points) Test the hypothesis that the average content of containers of a particular lubricant is 10 liters if the contents of a random sample of 10 containers are 10.2, 9.7, 10.1, 10.3, 10.1, 9.8, 9.9, 10.4, 10.3, and 9.8 liters.

Use a 0.01 level of significance and assume that the distribution of contents is normal.

H0: mean content = 10

H1: mean content ≠ 10

Application, table, Excel

Description automatically generated

N = 10, Df = 9

z = (10.06 – 10)/(0.2458/sq(10)) = 0.7719 bc we know deviation

Z value = 0.7794 -> P value of 0.4412 bc we do sum of areas in the tails

**0.4412 > 0.01 which means we fail to reject the null hypothesis. Therefore there is not enough evidence to suggest the containers average content won’t be equal to 10.**

* 1. (15 points) In a study to estimate the proportion of residents in a certain city and its suburbs who favor the construction of a nuclear power plant, it is found that 63 of 100 urban residents favor the construction while only 59 of 125 suburban residents are in favor. Is there a significant difference between the proportions of urban and suburban residents who favor construction of the nuclear plant? Use a

0.05 level of significance.

63/100 urban

59/125 suburban

H0: there is no difference (=)

H1: is a difference (≠)

Pu = 63/100 = 0.63 Ps = 59/125 = 0.472 P = 63+59/ 100+125 = 0.542

Z = 0.63 – 0.472 / sq(0.542(1-0.542)(1/100 + 1/125)) = 0.158 / 0.06684 = 2.36

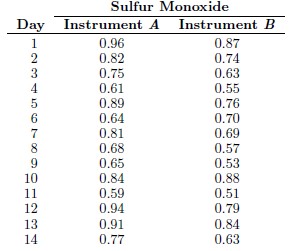
0.9909 -> 1 – 0.9909 = 0.0091

0.0091

P value = 0.0091\*2 = 0.0182 < 0.05

**We reject the null hyp and can conclude that there is a difference between the suburban and urban favor of the plant with the urban population having a larger proportion in favor of it.**

5. (25 points) Two types of instruments for measuring the amount of sulfur monoxide in the atmosphere are being compared in an air-pollution experiment. The following readings were recorded daily for a period of 2 weeks:



Using the normal approximation to the binomial distribution, perform a sign test to determine whether the different instruments lead to different results. Use a 0.05 level of significance.

H0: results are equal

H1: results are not equal

Table

Description automatically generated

P value ≈ 0.0520

**The p value is right at the significance level so we can reject the null hypothesis meaning there is enough evidence to suggest that different instruments give different results.**