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ISE 390 Final

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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

   (a) the marginal distribution of W; **see table below**
   (b) the marginal distribution of Z; **see table below**
   (c) 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

2. (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:

$$\begin{array}{lccc} \text{Low dose:} & n_1 = 8 & \bar{x}_1 = 1.98 & s_1 = 0.51 \\ \text{High dose:} & n_2 = 13 & \bar{x}_2 = 1.30 & s_2 = 0.35 \end{array}$$

   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

	n-1	s^2	multiplied		n-1	s^2	multiply		add
top	12	0.1225	1.47		7	0.2601	1.8207		3.2907
bottom	19								
	divide	square root							
	0.173195	0.416167		sp	0.416167				

$1.98 – 1.30 \pm t_{8+13-2,\ 0.025} * 0.416sq(1/8 + 1.13)$

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

0.68 ± 0.39125

3. (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.

   H_0: mean content = 10

   H_1: mean content ≠ 10

10.2		Mean	std dev
9.7		10.06	0.245855
10.1			
10.3			
10.1			
9.8			
9.9			
10.4			
10.3			
9.8			

   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.

4. (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

H_0: there is no difference (=)
H_1: is a difference (≠)
$P_u = 63/100 = 0.63$ $P_s = 59/125 = 0.472$ 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:

	Sulfur Monoxide	
Day	Instrument A	Instrument B
1	0.96	0.87
2	0.82	0.74
3	0.75	0.63
4	0.61	0.55
5	0.89	0.76
6	0.64	0.70
7	0.81	0.69
8	0.68	0.57
9	0.65	0.53
10	0.84	0.88
11	0.59	0.51
12	0.94	0.79
13	0.91	0.84
14	0.77	0.63

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.

H_0: results are equal
H_1: results are not equal

Day	A	B	A-B	Sign	Pos	Neg
1	0.96	0.87	0.09	+	1	
2	0.82	0.74	0.08	+	2	
3	0.75	0.63	0.12	+	3	
4	0.61	0.55	0.06	+	4	
5	0.89	0.76	0.13	+	5	
6	0.64	0.7	-0.06	-		1
7	0.81	0.69	0.12	+	6	
8	0.68	0.57	0.11	+	7	
9	0.65	0.53	0.12	+	8	
10	0.84	0.88	-0.04	-		2
11	0.59	0.51	0.08	+	9	
12	0.94	0.79	0.15	+	10	
13	0.91	0.84	0.07	+	11	
14	0.77	0.63	0.14	+	12	
					78	3

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.