BDSC 322
Business Statistics
Fall 2021

Final Exam
100 Points
3 Problems

SHOW YOUR WORK
EXPLAIN YOUR ANSWERS

First/Given Name:_____

Last/Family/Surname:_____

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My signature below indicates that I did not give or receive any assistance on this exam and that the solutions submitted are wholly my own.

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1. (35 points) Consider an experiment with three outcomes (A, B, and C) with the observed data (o_i) of 90 experiments in the table below.

Outcome	o_i
A	25
B	20
C	45
Total	90

Conduct a 1% significance χ^2 **goodness-of-fit test** on the null hypothesis (H_0) the distribution of the three outcomes is **discrete uniform** versus the alternative hypothesis (H_1) that they are not discrete uniform. This is a Goodness-of-Fit test problem. Provide each of the following answers (a)-(d): Hints: This problem is similar to the one discussed in Slide # 75 of Ch9-10 slides.

a) (20 points) Determine the expected number (e_i) and the value $(e_i - o_i)^2/e_i$ of each outcome and provide it in the table below. Remember that expected number for discrete uniform distribution is $(n * 1/k)$, where n and k are number of observations and possible classes, respectively.

Outcome	o_i	e_i	$(e_i - o_i)^2/e_i$
A	25		
B	20		
C	45		
Total	90		

b) (2 points) Determine the degrees of freedom.

c) (10 points) Provide the decision rule and conduct the test.

d) (3 points) Conclusion on rejecting or accepting H_0.

2. (20 points) Consider a poll of two populations with the following results in the table below:

	Population 1	Population 2
Number replying "Yes"	120	80
Number replying "No"	80	100
Total Sampled	200	180

Let p_1 and p_2 be the proportion of the population answering "yes" in Populations 1 & 2, respectively. Find a 95% two-sided confidence interval for $p_1 - p_2$. Some of the following calculations may help you.

$$\sqrt{200} = 14.1421 \qquad \sqrt{\frac{120}{200}\left(1 - \frac{120}{200}\right)} = 0.4899 \qquad z_{0.025} = 1.96$$

$$\sqrt{180} = 13.4164 \qquad \sqrt{\frac{80}{180}\left(1 - \frac{80}{180}\right)} = 0.4969$$

$$\sqrt{\frac{1}{200} + \frac{1}{180}} = 0.1027 \qquad \sqrt{\frac{\frac{120}{200}\left(1 - \frac{120}{200}\right)}{200} + \frac{\frac{80}{180}\left(1 - \frac{80}{180}\right)}{180}} = 0.0507$$

3. (45 points) Dr. Gazi Iqbal is studying the relationship between *monthly expenses* and *monthly income* for Coppin State BDSC 322 Spring 2021 class students. He has collected data from some students. Below is a scatter plot showing an approximately linear relationship between month expenses and monthly income. Limited regression output and some calculations are shown.

$$\sum_{i=1}^{n} x_i = 22651, \quad \sum_{i=1}^{n} x_i^2 = 19671181, \quad \sum_{i=1}^{n} y_i = 13116, \quad \sum_{i=1}^{n} y_i^2 = 6632500,$$

where $n = 29$
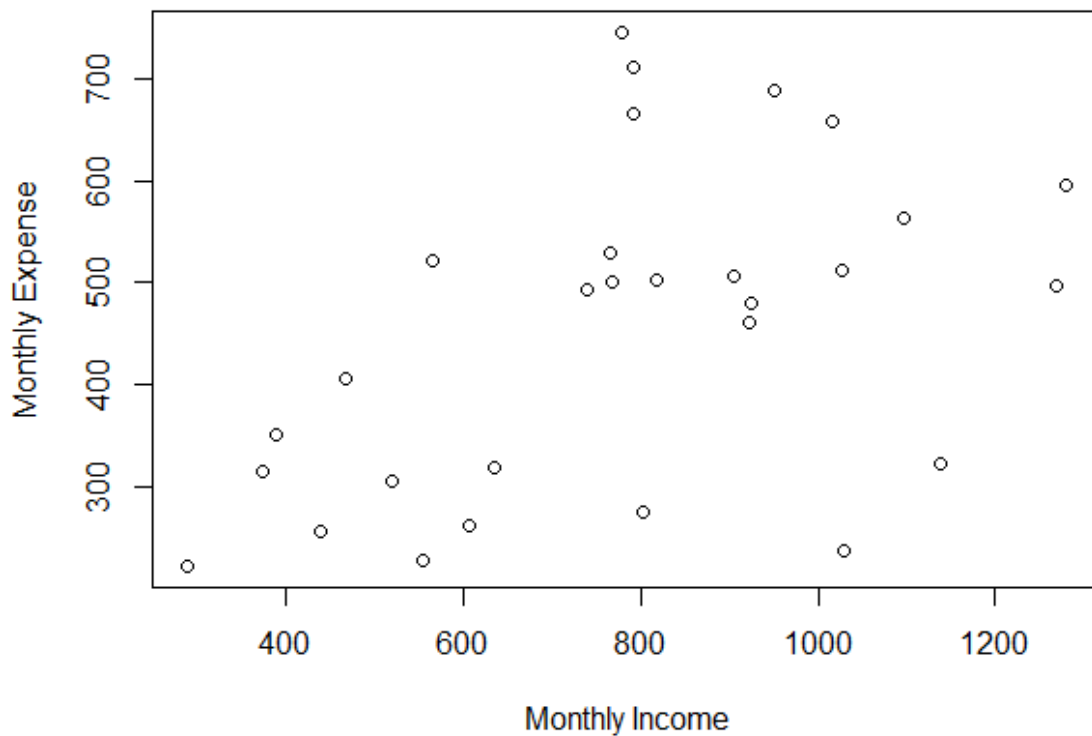
Monthly Income

	DF	Sum Sq	Mean Sq	F Value
Monthly_Income			158519	
Residuals		541931		
Total				

Residual standard error: 141.7 on 27 degrees of freedom

Coefficients:

|	Estimate	Std. Error
(Intercept)	231.2281	82.9398
Monthly_Income	0.2830	0.1007

(i) [20 points] Complete the ANOVA table in the regression output. Show your work in computing SSR, SSTO, MSE, and F-value.

(ii) [6 points] Is the regression significant at $\alpha = 0.05$? Please do the F-test as shown in slide # 35 of Chapter 11 to make a decision.
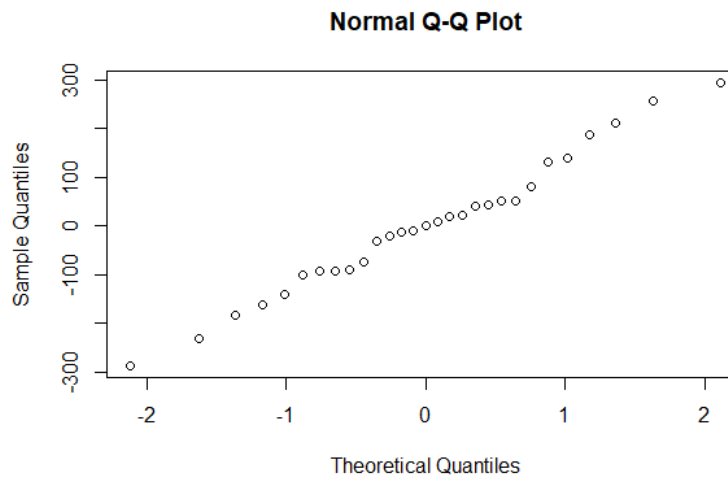
(iii) [6 points] Calculate a 95% one-sided confidence interval which may be used to test if the true slope is above 0.5. State the appropriate null and alternative hypotheses. What do you conclude (in words) ?

(iv) [3 points] For a monthly income of \$750, a 95% prediction interval for monthly expense is (\$147.753, \$739.2133). Interpret this interval in a sentence.

(v) [10 points] Comment on the following figures . Based on these two plots, which model assumptions appear violated and which ones appear satisfied? Explain.
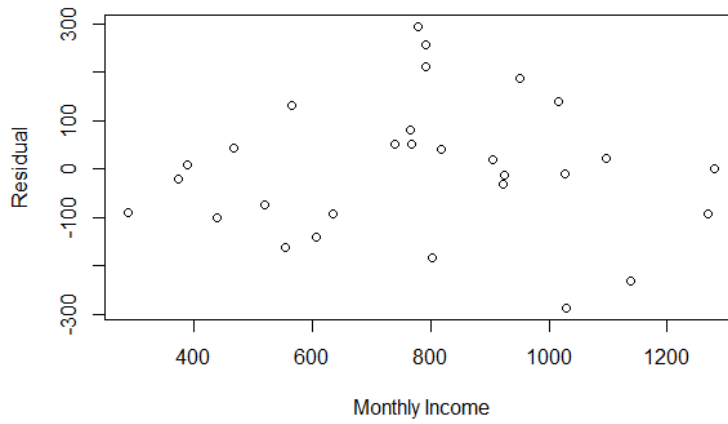
: Residual vs. Monthly Income

Normal Q-Q Plot

: Normal Probability Plot

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