Math 107 (110 points) Test 4 Pledged Key

1. A survey was conducted to determine whether there is a gender gap in the confidence people have in police. The sample results are listed in the table. Use a 0.05 significance level to test the claim that there is such a gender gap. (30 points)

Confidence in Police

	Great Deal	Some	Very Little or None	Total
Men	115	56	29	200
	116	60	24	
Women	175	94	31	300
	174	90	36	
Total	290	150	60	500

Null hypothesis There is no difference in the distributions of responses between men and women

Test statistic 2.195

(Show work here):

$$\chi^2 = \frac{(115-116)^2}{116} + \frac{(56-60)^2}{60} + \frac{(29-24)^2}{24}$$
$$\frac{(175-174)^2}{174} + \frac{(94-90)^2}{90} + \frac{(31-36)^2}{36}$$

$$= .00862 + .26667 + 1.04167$$
$$.00575 + .17778 + .69444 = 2.195$$

Critical Value $\chi^2(2) = 5.991, \alpha = .05$

Conclusion Fail to reject the null hypothesis

Inference: There is no difference in the distributions of reponses between males and females.

2. A survey was conducted to compare the average waiting time at the security checkpoints of three major airports. At each airport, 10 passengers were observed and the results are listed below. Test the claim that the average waiting time at the three airports is the same. Assume that the variances are approximately homogeneous and that data come from approximately normal distributions. (40 points)

New York JFK	Atlanta	Miami
$\overline{x_1} = 6.25\,\text{min}$	$\overline{x_2} = 5.38\,\text{min}$	$\overline{x_3} = 5.1\,\text{min}$
$s_1 = 0.38\,\text{min}$	$s_2 = 0.41\,\text{min}$	$s_3 = 0.36\,\text{min}$
$n_1 = 10$	$n_2 = 10$	$n_3 = 10$

Null hypothesis $\mu_1 = \mu_2 = \mu_3$

ANOVA Table:

	Sum of Squares	Degree of Freedom	Mean Square	Test Statistic
Between the Groups	7.193	2	3.5965	24.1496
Within the Groups	4.021	27	.1489	
Total	11.214	29		

Critical Value = 6.49 at appropriate significance level of .005

F(2,27) ↑

Conclusion and Inference of ANOVA (BE CLEAR):

Reject the null hypothesis

There is a significant difference somewhere

The test statistic of Scheffe Test, comparing JFK and Atlanta is $F_s = 25.4163$

The test statistic of Scheffe Test, comparing Atlanta and Miami is $F_s = 2.6326$

The test statistic of Scheffe Test, comparing JFK and Miami is 44.409

Show the computation of this test statistic:

$H_0: \mu_1 = \mu_3$

$$F_S = \frac{\bar{X}_1 - \bar{X}_3}{S_w^2\left(\frac{1}{n_1} + \frac{1}{n_3}\right)}$$

$$F_S = \frac{(6.25 - 5.1)^2}{.1489\left(\frac{1}{10} + \frac{1}{10}\right)} \doteq 44.409$$

$2(6.49) =$

Critical Value of Scheffe Test = 12.98 at appropriate α = .005

Give the overall inference of the ANOVA and three Scheffe Tests:

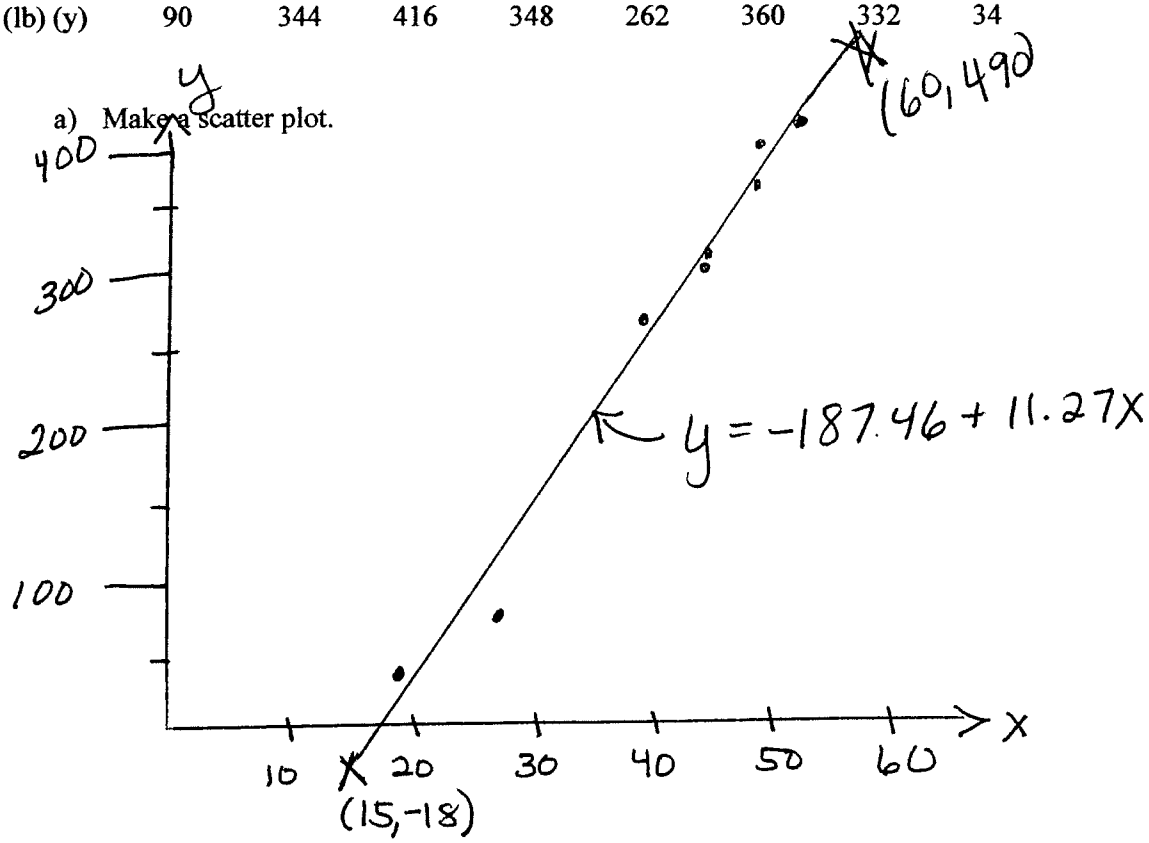
There is a significant difference between JFK and Atlanta and between JFK and Miami. No difference between Atlanta and Miami. There is a longer waiting time for JFK.

3. A researcher wants to study whether there is a relationship between the chest sizes and weights of bears. A random sample of eight bears yields the following data: (40 points)

Chest size (in.) (x)	26	45	54	49	41	49	44	19
Weight (lb) (y)	90	344	416	348	262	360	332	34

a) Make a scatter plot.

x	y
15	-18
60	489



b) Determine the significance by hypothesis testing techniques (the assumptions for linear regression test are met).

Null hypothesis $\rho = 0$ (or $\beta = 0$)

Test statistic 20.167 ($p \doteq .0000009655$)

Critical Value $t(4) = 3.707$ at appropriate alpha level of .01

Conclusion and Inference:

Reject $\rho = 0$, there is a significant relationship

c) Find the correlation coefficient and the regression line and place the line on the scatter plot. Specify the points that you used to draw the regression line.

Correlation Coefficient .9927

Regression Line $y = -187.46 + 11.27x$

d) Is it reasonable to use this model to predict the weight of a bear with a chest size of 52 in.? Give your reasoning clearly. If it is, predict the weight of a bear with a chest size of 52 in. Yes – Significant relationship and 52" is in the range of data:

$y = -187.46 + 11.27(52) \doteq \boxed{399}$

Formulas:

Scheffe Test: $F_s = \dfrac{\left(\overline{x_1} - \overline{x_2}\right)^2}{S_w^2\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}$

Contingency Table: $\chi^2 = \sum \dfrac{(O-E)^2}{E}$, $d.f. = (R-1)(C-1)$

T test for correlation coefficient: $d.f. = n - 2$