MATH 4581 PRACTICE PROBLEMS FOR QUIZ 2

1). From "Chi-square notes" on Blackboard, Problems 5 and 7.

2).

Lab 1	Lab 2	Lab 3	Lab 4
4.13	3.86	4.00	3.88
4.07	3.85	4.02	3.88
4.04	4.08	4.01	3.91
4.07	4.11	4.01	3.95
4.05	4.01	4.04	3.92
4.04	4.02	3.99	3.97
4.02	4.04	4.03	3.92
4.06	3.97	3.97	3.90
4.10	3.95	3.98	3.97
4.04	4.08	3.98	3.90

a) Find the sample means and sample standard deviations for each Lab.
b) Use ANOVA to test if the means are the same in all Labs at the 5% significance level. Give the value of the test statistic, and write down the critical value of the F distribution for this test (what are m and n for the F-distribution in this case?). Give the p-value of the test, and state your conclusion. Give the pooled standard deviation.
c) Use the contrast $C = \mu_1 + \mu_2 - 2\mu_3$ to test if the first two Labs have the same mean as the third Lab at the 5% significance level. Compute the test statistic and write down the critical value of the t-distribution (how many degrees of freedom?). State your conclusion.
d) Perform the Bonferroni test for each pair of Labs to test if all Labs have the same mean at the 5% significance level. Give the test statistic for each pair, and state your conclusion for each.

3). The table below gives the average number of transistors on a computer chip for years following 1975.

Years after 1975	No. transistors
0	4,500
3	29,000
7	90,000
10	229,000
14	1,200,000
18	3,100,000
20	5,500,000

Fit an exponential model $y = ab^x$ to the data. Test at the 5% level to see if the 'slope' is linear. Do your conclusions support Moore's Law?

4). Consider the following conditional pdf for Y given X:

$$f_{Y|X}(y|x) = \frac{x+y}{x+1/2}, \quad 0 \leq x \leq 1,\, 0 \leq y \leq 1$$

Find the regression curve for Y on X.

5). The table on the next page gives data on spending per pupil and graduation rate in a list of Massachusetts school districts.
a) Find the regression curve for Y on X. State estimates for slope and intercept of the curve, and for the sample standard deviation. Find the means of X and Y.
b) Find a 95% confidence interval for the slope of the regression curve.
c) Test at the 5% significance level to see if the slope is zero. State your conclusion from this test.
d) Find 95% confidence intervals for both the mean and expected value of Y when $X = 30$.

X = Spending per pupil (in $1000's)	Y = Graduation rate
$10.0	88.7
$10.2	93.2
$10.2	95.1
$10.3	94
$10.3	88.3
$10.8	89.9
$11	67.7
$11	90.2
$11.2	95.5
$11.6	75.2
$12.1	84.6
$12.3	85
$12.6	94.8
$12.7	56.1
$12.9	54.4
$13	97.9
$13.9	83
$14.5	94
$14.7	91.4
$15.5	94.2
$16.4	97.2
$17.5	94.4
$18.1	78.6
$20.8	87.6
$22.4	93.3
$24	92.3

6). The joint pdf of X and Y is

$$f_{X,Y}(x,y) = x + y, \quad 0 \leq x \leq 1, 0 \leq y \leq 1$$

Compute ρ, the correlation coefficient of X and Y.