Instructions: This is an individual lab. We may have some class time today to work on this lab, and you may offer assistance to one another, but the entire lab must be completed and turned in to me by every individual by the end of the 1st half of class on Monday, May 13, for credit.

Professor Butterworth, a math teacher, has taught Statistics for many years and believes that the best predictor for the final exam score (pts out of 400) are the exam scores (pts out of 300). Answer the following questions to help her find a model to make the prediction in the end:

Exam Score	277.5	217	279	240	244	127.5	283.5	281.5	179.5	253.5	246	292
Final Exam Score	354	252	330	196	282	158	316	326	128	320	336	356
Exam Score	220.5	261	229	262.5	182.5	259.5	209.5	266.5	199.5	221.5	226.5	272.5
Final Exam Score	278	288	332	192	232	344	217.5	332	266	284	268	336

a) Using either your TI-83/84 with connect capability or EXCEL, create a scatter plot of the data and print it out. Attach the printout to this sheet (drawn by hand, connectivity or picture of calculator) & label it as page 1.

See attached

b) Does the data appear to have any type of correlation? What type?

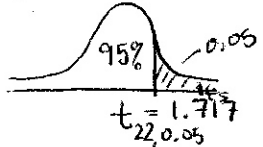Yes, there appears to be fairly strong positive linear correlation.

c) By hand, calculate the **sample correlation coefficient, r**. You may use your calculator to calculate the Σx, Σy, Σxy, Σx^2, Σy^2, but the **plug in and intermediate steps** for the numerator and both pieces of the denominator must be shown, ending with the final value for r.

$\Sigma x = 5732$ $\Sigma y = 6723.5$
$\Sigma x^2 = 1405274$ $\Sigma y^2 = 1978,310.25$
$n = 24$ $\Sigma xy = 1649823.25$
$\bar{x} = 238.8\overline{33}$ $\bar{y} = 280.14583\overline{3}$

$$r = \frac{24(1649823.25) - (5732)(6723.5)}{\sqrt{24(1405274) - 5732^2}\sqrt{24(1978310.25) - 6723.5^2}} = \frac{1056656}{\sqrt{870752}\sqrt{2273493.75}}$$

$$= 0.7509166772 \approx 0.751$$

d) At the 95% confidence level, test the claim that there is underline positive linear correlation. Write the **hypotheses** here. Show the calculations for the **t-test statistic** and give the **critical value** on a graphical representation. State your **decision** and **conclusion**.

$H_0: \rho \leq 0$

$H_A: \rho > 0$

95% -0.05
$t_{22,0.05} = 1.717$

T.S.
$$t = \frac{0.7509167}{\sqrt{\frac{1 - 0.7509167^2}{22}}} = \frac{0.7509167}{0.1405543047} = 5.34253 \approx 5.343$$

Reject H_0 & Accept H_A since T.S. is in R.R.

At the 95% CL there is enough evidence to support the claim of positive linear correlation.

e) Give the **slope** of the linear regression equation. Show your calculation for that slope. **Label it appropriately** with the notation used by a TI-83/84. This is not a plug it into the calculator exercise.

$$\text{Slope} = b_1 = \frac{1056656^*}{870752_{**}} = 1.213498218 \approx 1.213$$

* See numerator of r in part c)

** See denominator of r in part c)

f) Give the **y-intercept** of the linear regression equation. <u>Show your calculation</u> for that slope. **Label it appropriately** with the notation used by a TI-83/84. This is not a plug it into the calculator exercise.

$$y\text{-int} = b_0 = 280.145833 - (1.213498)(238.833333) \doteq -9.6779$$
$$\approx -9.678$$

g) Give the whole **regression equation** using appropriate notation.

$$\hat{y} = 1.213x - 9.678$$

h) For a score of 245 points, what is the **prediction for the Final Exam** score according to your regression equation. Show your work.

$$\hat{y} = 1.213(245) + -9.678 \doteq 287.507 \approx 287.51$$

i) Which is more appropriate for estimating the test score   y-bar   (g) ?

Explain your answer:

The regression equation in g is more appropriate because there is statistically significant linear correlation. If there were not statistically significant correlation then $\bar{y}$ would be the better predictor

j) What percentage of the variability in the dependent variable is described by regression equation? Hint: Coefficient of Determination

The Coefficient of Determination, r^2, indicates the percentage of variability in the dependent variable, y, that is described by the regression equation.

$$r^2 \doteq (0.750917)^2 \doteq 0.563876$$
$$\approx 56.4\%$$

Scatterplot of Exam by Final Exam