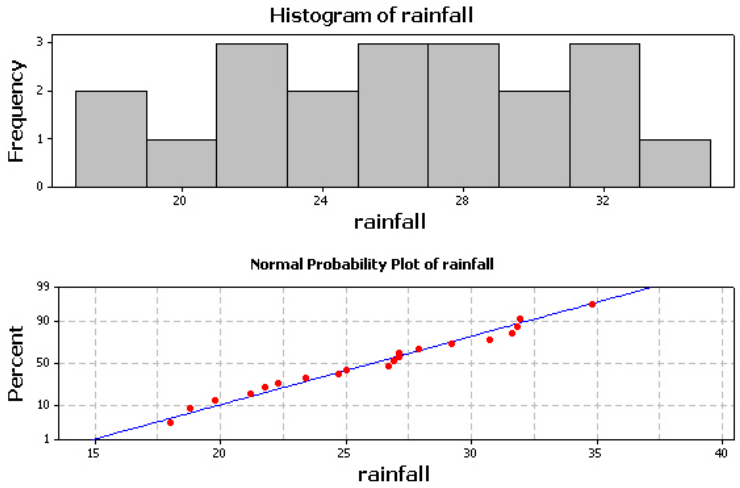
MAT 2377 3X (Spring 2011)

Assignment 5
Not to be submitted.

1. A random sample of 300 circuits generated 13 defectives. We would like to test that $H_0 : p = 0.05$ against $H_1 : p \neq 0.05$ at $\alpha = 5\%$, where p is the population proportion of defectives.
   (a) Use a critical region to perform to test of hypothesis.
   (b) Use a p-value to perform to test of hypothesis.
   (c) Construct a 95% confidence interval for p. Is this confidence interval consistent with your findings from parts 1a and 1b.
2. Cloud seeding has been studied for many decades as a weather modification procedure. The rainfall in acre-feet from 20 clouds that were selected at random and seeded with silver nitrate. We are displaying the data in increasing order below :

18	18.8	19.8	21.2	21.8	22.3	23.4
24.7	25	26.7	26.9	27.1	27.1	27.9
29.2	30.7	31.6	31.8	31.9	34.8	

   (a) Find the sample median and the first and third quartile.
   (b) Are there any outliers ?
   (c) Below is a normal probability plot and histogram of the data. Is it reasonable to assume that the population is normally distributed ?



   (d) Assume that the population is normal. Can you support a claim that mean rainfall from seeded clouds exceeds 25-acre feet ? Use $\alpha = 0.01$.

(e) Use the sample standard deviation from part 2d as the true value of σ. To test $H_0 : \mu = 25$ against $H_1 : \mu > 25$ compute the probability of committing an error of type II, if the true mean rainfall is 27 acre-feet with a sample size of $n = 20$.

3. The following data will be used to study the association between the fretting wear of mild steel and oil viscosity. Here x is oil viscosity and y is wear volume (10^{-4} cubic millimeters).

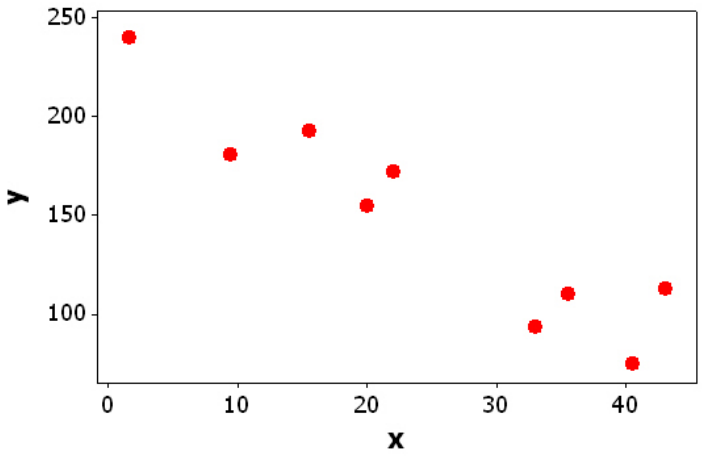
y	240	181	193	155	172	110	113	75	94
x	1.6	9.4	15.5	20.0	22.0	35.5	43.0	40.5	33.0

We summarize the data with the following sums :

$$\sum y_i = 1333, \quad \sum x_i = 220.5, \quad \sum x_i^2 = 7053.67$$

$$\sum y_i^2 = 220549, \quad \sum x_i\, y_i = 26864.4.$$

(a) Below is a scatter plot of y against x. Does it appear to use a simple linear regression model to model the association between y and x.



(b) Compute the sample correlation between the two variables.

(c) Find the least-squares line to describe y as a function of x.

(d) Find an estimate of the variance σ about the line.

(e) Predict fretting wear when viscosity $x = 30$.

(f) Obtain the fitted value of y when $x = 22.0$ and calculate the corresponding residual.