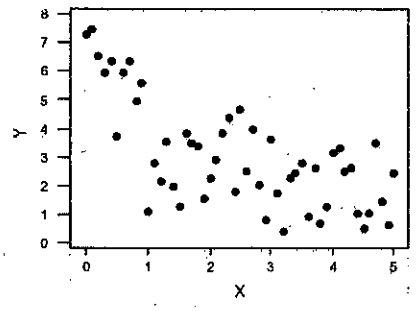
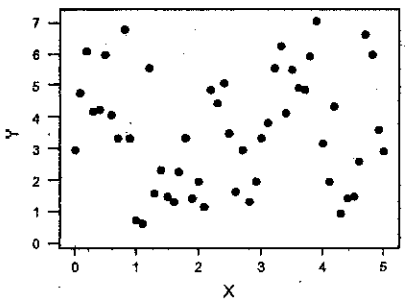
Part II. Match the graphs to the correlations.

r = 0 r = + 0.3 r = – 0.5 r = – 0.7 r = + 0.9 r = 0

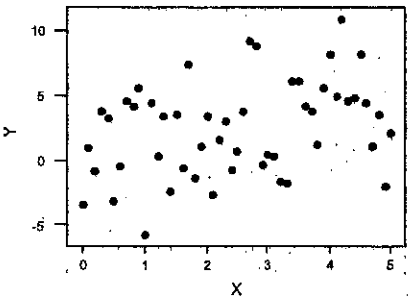
a.



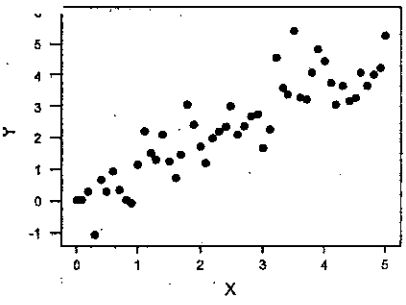
b.



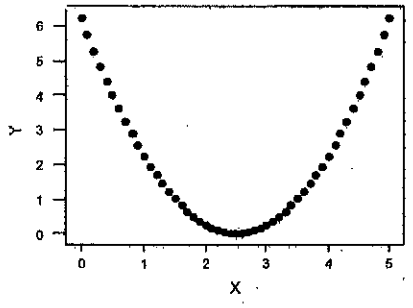
c.



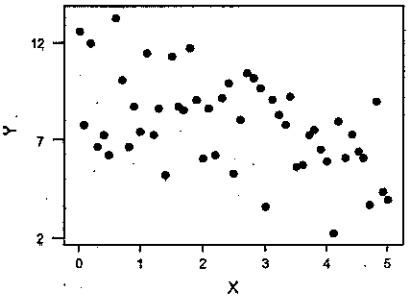
d.



e.



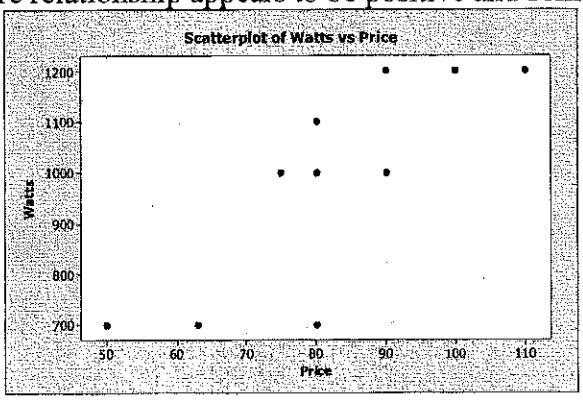
f.



Solution To Correlation

Part I

2. There relationship appears to be positive and somewhat linear, with several unusual points.



3. r = 0.809
4. There is a strong, positive linear relationship between Price and Watts.

Part II

a. r = –0.7
b. r = 0
c. r = +0.3
d. r = +0.9
e. r = 0
f. r = –0.5

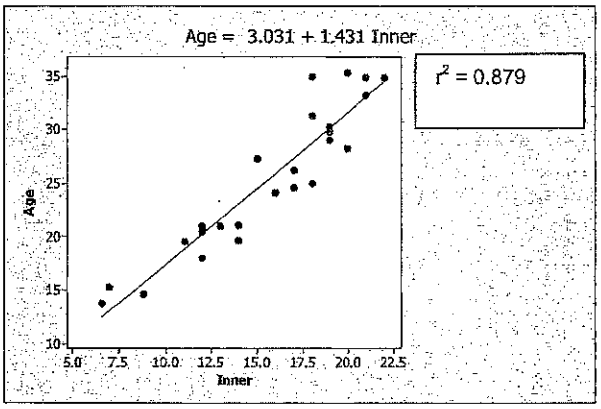
Introduction to Statistics and Data Analysis
Regression

The determination of gestational age is important for pregnancy evaluation. The most reliable method of estimating gestational age is the date of the last menstrual period. Ultrasonography offers a unique opportunity in estimating gestational age since this allows direct visualization of the fetus.

Data were collected on 27 normal pregnant women during routine obstetrical ultrasound examinations. The variables recorded were:

1. menstrual age of the fetus (weeks since last menstrual period),
2. inner orbital diameter (mm), and
3. outer orbital diameter (mm),

where the inner orbital diameter is the distance between the inner (medial) borders of the optical orbits, and the outer diameter is the distance between the outer (lateral) borders.



A. Describe the scatterplot.

B. The regression line is given above the scatterplot. The slope of the line is _____. This indicates that for every one mm increase in Inner Orbital Diameter, we expect Menstrual Age to increase/decrease (circle one) by _____ weeks, on average.

C. The r^2 value is given next to the scatterplot. The value of r^2 is _____. This indicates that _____% of the variability in _____ is explained by the linear relationship with _____.

D. Use the value of r^2 to obtain the value of r. Be sure to give the correct sign (positive or negative) to r. What is the value of the r for this data? _____

E. What Menstrual Age would you predict for a fetus with in Inner Orbital Diameter of 16 mm?

F. There was one fetus in the sample with an inner orbital diameter of 16 mm. The menstrual age of this fetus was 24.1 weeks. Compute the error of your prediction in part E by taking the actual menstrual age and subtracting your prediction.

Data from Serafima Yershov,
B.S. Diagnostic Medical Sonography RIT, 1996

Here is the data for Outer Orbital Diameter and Menstrual Age.

1. Enter the values into two lists in your calculator.

Outer	Age
16	13.7
20	14.6
23	15.3
29	18.0
31	19.6
31	19.7
30	20.4
33	20.6
33	21.0
36	21.0
34	21.1
43	24.1
38	24.6
45	25.0
38	26.3
45	27.3
48	28.3
46	29.1
52	29.9
52	29.9
45	30.4
47	31.3
50	33.3
50	34.9
54	34.9
51	35.0
52	35.4

2. Obtain a scatterplot and describe the graph.

3. Perform a regression on your calculator with Outer as the X variable and Age as the Y variable.

What is the equation of your regression line?

_____

What is the value of r^2? _____

What is the value of r? _____

4. What does the value of the slope indicate? (Write a sentence similar to the one in part C).

5. What does the value of r^2 indicate? (Write a sentence similar to the one in part D).

6. Which regression is "better", the one using Inner as the explanatory variable or the one using Outer? EXPLAIN.

Solution to Regression

A. Scatterplot shows a positive, linear, strong relationship

B. slope = 1.431
increase, 1.431

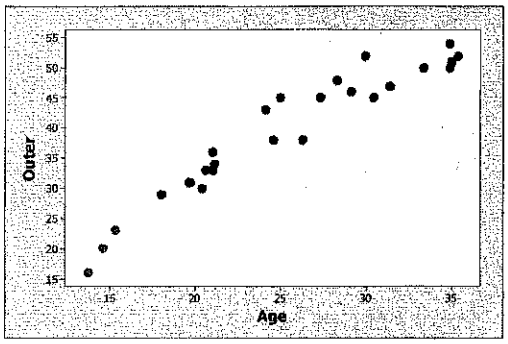
C. $r^2 = 0.879$
87.9%, menstrual age, inner orbital diameter

D. $r = +\sqrt{r^2} = \sqrt{0.879} = 0.938$
Because the relationship is positive, use the positive square root!

E. $\hat{Y} = 3.031 + 1.431X \rightarrow \hat{Y} = 3.031 + 1.431(16) = 25.927$

F. Error = 24.1 – 25.927 = –1.827 This is also called the residual
(Note: The negative error indicates a point below the line)

2.



3. $\hat{Y} = 1.867 + 0.5917X$, $r^2 = 0.912$, $r = 0.955$

4. For every one mm increase in Outer Orbital Diameter, we expect Menstrual Age to increase by 0.5917 weeks, on average.

5. This indicates that 91.2% of the variability in menstrual age is explained by the linear relationship with outer orbital diameter.

6. The regression with outer orbital diameter is better because it has a larger r^2 value!