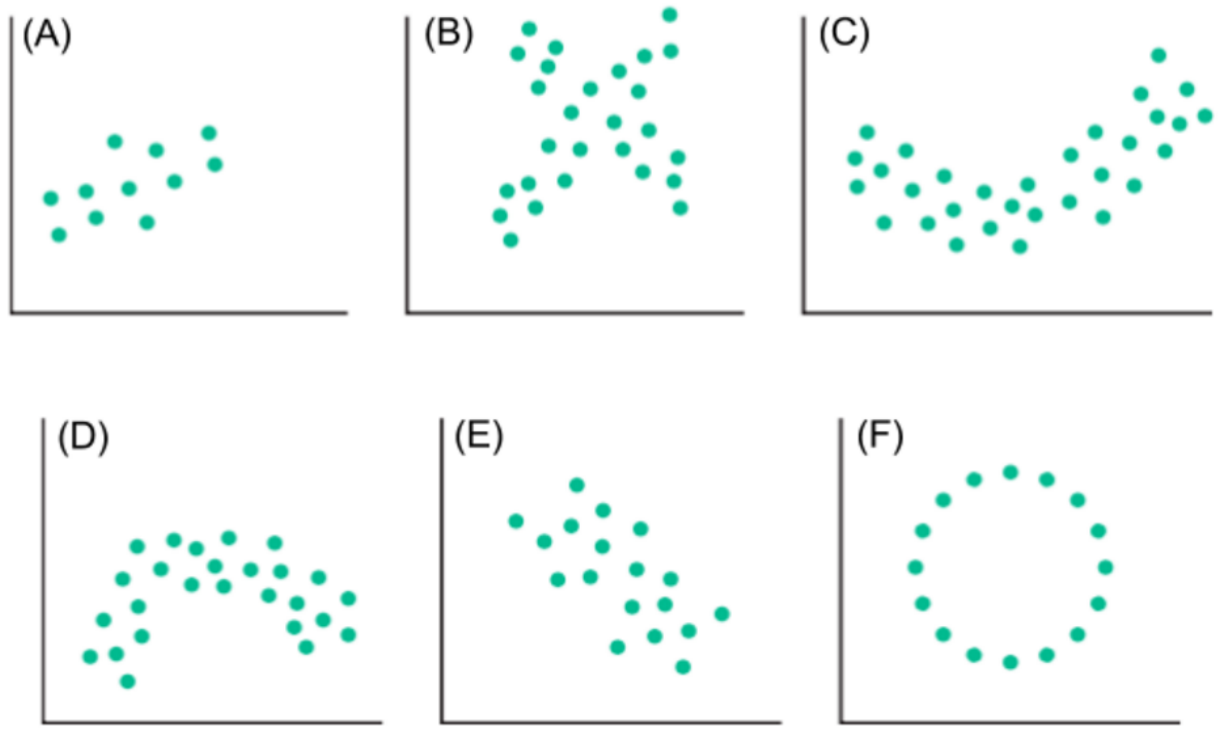
Math 13 - Practice Test 4, Spring 2016

Name: _____ **Class Number:** _____

Write down all your steps and include drawings of normal curves.

1) For which of the following sets of data points can you reasonably determine a regression line? Explain your answer.



a. Yes | No. Why?
b. Yes | No. Why?
c. Yes | No. Why?
d. Yes | No. Why?
e. Yes | No. Why?
f. Yes | No. Why?

2) Use the following terms to fill the blanks in the list of sentences shown below:

predictor variable
least-squares
coefficient of determination
regression line
average point

a. The _____ criterion is that the line that best fits a set of points is the one having the smallest possible sum of squared errors.

b. The _____ is the line that best fits a set of data points according to the least-squares criterion.
c. A variable used to predict or explain the values of the response variable is called _____.
d. The _____ is always on the least-squares line.
e. The _____ is the proportion of variation in the values of the response variable explained by the regression.

3) An area manager in a department store wants to study the relationship between the number of workers on duty and the value of merchandise lost to shoplifters. To do so, she assigned a different number of clerks for each of 10 weeks. The results are as follow:

	workers	loss
1	9.00	420.00
2	11.00	350.00
3	12.00	360.00
4	13.00	300.00
5	15.00	225.00
6	18.00	200.00
7	16.00	230.00
8	14.00	280.00
9	12.00	315.00
10	10.00	410.00

Table 1: Number of workers, and value of lost merchandise

a. Which variable (i.e. "Number of Workers" and "Loss") should be the response (dependent) variable and which should be the predictor (independent) variable?
b. Plot the data in a scatter diagram.
c. Does a linear regression analysis appear reasonable? Why?

4) Fill in the blanks.

a. The symbol used for the linear correlation coefficient is _____.
b. A value of r close to ± 1 indicates that there is a _____ linear relationship between the variables.
c. A value of r close to _____ indicates that there is either no linear relationship between the variables or a weak one.
d. A value of r close to _____ indicates that the the regression equation is extremely useful for making predictions.
e. If y tends to increase linearly as x increases, the variables are _____ linearly correlated.
f. If y tends to decrease linearly as x increases, the variables are _____ linearly correlated.

5) A marketing analyst is studying the relationship between x = amount spent on television advertising and y = increase in sales. The data are reported in thousands of dollars.

a. Compute the sums: $\sum x$, $\sum y$, $\sum x^2$, $\sum y^2$, and $\sum xy$

x	y	x^2	y^2	xy
15	340			
28	260			
19	152			
47	413			
10	130			
92	855			

b. Determine the value of the sample correlation coefficient r

c. Find the values for $\bar{x}$, $\bar{y}$, a and b.

d. Find the values for the intercept a and the slope b of the regression line.

e. Write the equation of the least-squares line.

f. Find the value of the coefficient of determination r^2.

g. Draw a scatter diagram displaying the data; and graph the least squares line on your scatter diagram. Include the point (x, y) as one of the points on the line.

h. Suppose that the amount spent on advertising is \$37 (in thousands). What does the least-squares line predict for the increase in sales?

6) Let x be the weight of a vehicle in hundreds of pounds, and let y be the miles per gallon.

a. Compute the sums: $\sum x$, $\sum y$, $\sum x^2$, $\sum y^2$, and $\sum xy$

x	y	x^2	y^2	xy
26	22			
35	16.1			
29	18.8			
39	15.7			
20	23.4			

b. What is the equation for the least-squares line?

1. y = -32.55 x + 0.448
2. y = -32.55 x - 0.448
3. y = 32.55 x - 0.448
4. y = -0.448 x + 32.55
5. y = 0.448 x - 32.55

c. Select the appropriate coefficient of determination:

1. r^2 = -0.941
2. r^2 = 0.941
3. r^2 = -0.970
4. r^2 = 0.970
5. r^2 = 0.965

d. If a vehicle weighs 22 (hundreds of pounds), what does the least-squares line predict for the miles per gallon?

1. 22.7
2. 66.0
3. 42.4
4. 22.0
5. cannot determine

7) The average number of miles on vehicles traded in at Smith Brothers Motors is 64,000. Smith Brothers Motors has started a new deal offering lower financing charges. They are interested in whether the average mileage on trade-in vehicles has decreased. The result (in thousands) from a random sample are listed below. Perform a hypothesis test using a confidence level of 0.01. 39, 47, 62, 110, 58, 90, 50, 99, 41, 28

a. Find the sample average X.

b. Find the sample standard deviation S.

c. Select the null and alternative hypotheses.

1. $H_0 : \bar{x} = 62,400; \quad H_1 : \bar{x} \neq 62,400$
2. $H_0 : \bar{x} = 64,000; \quad H_1 : \bar{x} > 64,000$
3. $H_0 : \mu = 64,000; \quad H_1 : \mu < 64,000$
4. $H_0 : \mu < 64,000; \quad H_1 : \mu > 64,000$
5. $H_0 : \mu = 64,000; \quad H_1 : \mu \neq 64,000$

d. Select the appropriate z or t value of the sample test statistic:

1. t = -0.52
2. z = -0.18
3. t = -0.08
4. z = -0.02
5. t = -0.58

e. Find the value of the corresponding score associated to the significance level

1. t_0 = 2.821
2. z_0 = -2.33
3. t_0 = -2.821
4. t_0 = -3.250
5. t_0 = -2.764

f. Based on your answers, what is your conclusion?

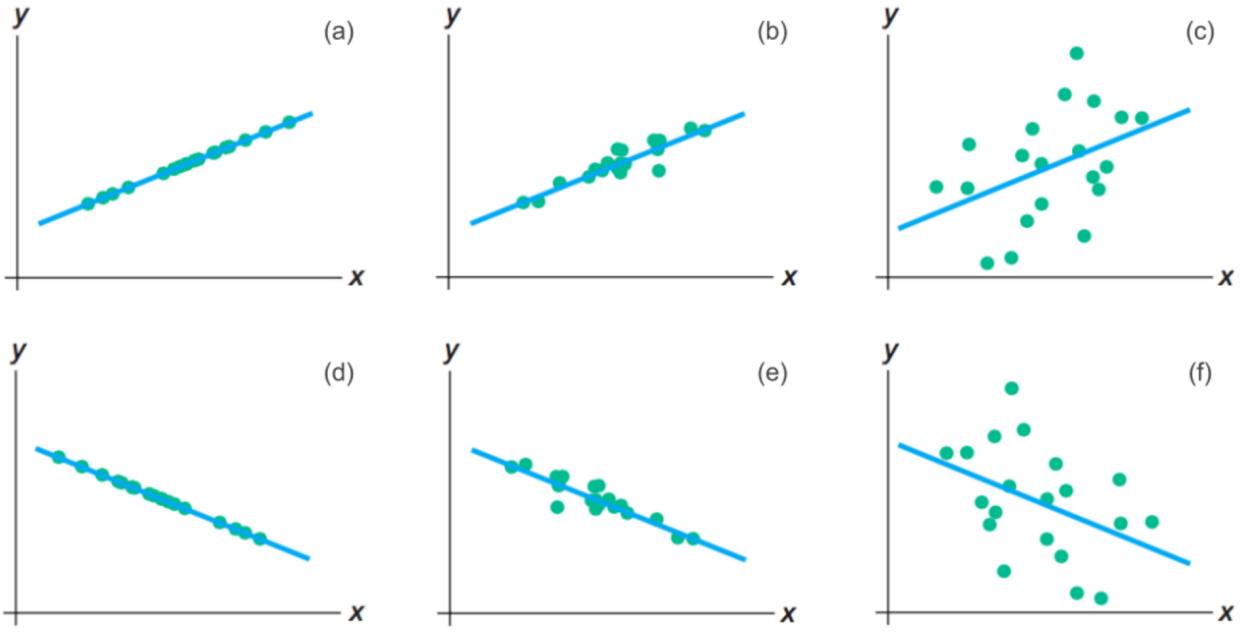
1. Do not reject H_0

2. Reject H_0
3. Cannot determine

8) Suppose two variables are positively correlated. Does the response variable increase or decrease as the explanatory variable increases?

9) Suppose two variables are negatively correlated. Does the response variable increase or decrease as the explanatory variable increases?

10) Look at the following diagrams. Indicate the type of linear correlation: positive or negative , and whether it is perfect, moderate or low linear correlation.



a.

b.

c.

d.

e.

f.

11) The following results are generated by statistical software. The data comes from analyzing the relationship between elevation (in thousands of feet) and average number of frost-free days per year in Colorado.

```
Predictor      Coef
Intercept   318.16
Elevation   -30.87

R-square = 96.3%
```

a. Use the previous printout to write the least-squares equation

b. For each 1000-foot increase in elevation, how many fewer frost-free days are predicted?

c. The printout gives the value of the coefficient of determination R2 (i.e. R-square). What is the value of the correlation r?

12) A random sample of size 20 from a normal distribution has $\sigma = 4$ and $\bar{x} = 8$.

a. Compute that sample test statistic z under the null hypothesis $H0 : \mu = 7$.
b. For $H_1 : \mu \neq 7$, estimate the P-value of the test statistic.
c. For a level of significance of 0.05 and the hypotheses of parts (a) and (b) do you reject or fail to reject the null hypothesis?

13) The body weight of a healthy 3-month-old colt should be about $\mu = 60$ kg.

a. If you want to set up a statistical test to challenge the claim that $\mu = 60$ kg, what would you use for the null hypothesis H_0?
b. Suppose you want to test the claim that the average weight of a wild colt is less than 60 kg. What would you use for the alternative hypothesis H_1? Suppose you want to test the claim that the average weight of a wild colt is different from 60 kg. What would you use for the alternative hypothesis H_1?

14) Over the past 8 weeks, a veterinarian took the following glucose readings from a horse (in mg/100ml):

```
93  88  82  105  99  110    84  89
```

The sample mean is $\bar{x} = 93.8$. We may assume that the glucose level has a normal distribution, and we know from past experience that $\sigma = 12.5$. The mean glucose level for horses should be $\mu = 85$ mg/100ml. Do these data indicate that the analyzed horse has an overall average glucose level higher than 85? Conduct a hypothesis test, using a significance level $\alpha = 0.05$.