

ECON 256 – Worksheet 4  
Spring 2017

**Problem 1** For this exercise, we will be computing the correlation between two data series

Data Series	Observation 1	Observation 2	Observation 3
X	15	15	30
Y	10	25	4

Q1.1) Compute the mean (average) value of both series. There are three observations so  $n = 3$  in the functions below.  $x_i$  is the  $i$ th observation of X.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i; \quad \bar{y} = \frac{1}{n} \sum_{i=1}^n y_i$$

Q1.2) Compute the Covariance between X and Y. The covariance is defined as

$$\text{Cov}(X, Y) = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})$$

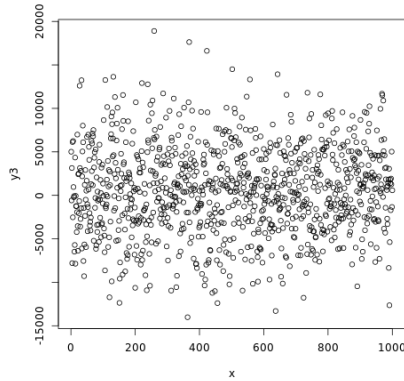
Q1.3) The variance of X is defined as  $\text{Var}[X] = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$ . If we compute it, we find  $\text{Var}[X] = 75$ . Similarly,  $\text{Var}[Y] = 117$ . Using the formula below, compute the correlation,  $r$ , between X and Y.

$$r = \frac{\text{Cov}(X, Y)}{\sqrt{\text{Var}[X]} \times \sqrt{\text{Var}[Y]}}$$

## Problem 2

Look at the following graphs. Classify each graph as having a **Positive correlation** or **Negative correlation**, and whether the correlation is strong (close to 1 or minus -1), medium strength (closer to 0.5 or -0.5), or weak (close to 0). If the correlation is weak, you may not be able to tell whether it is positive or negative, but you can still guess.

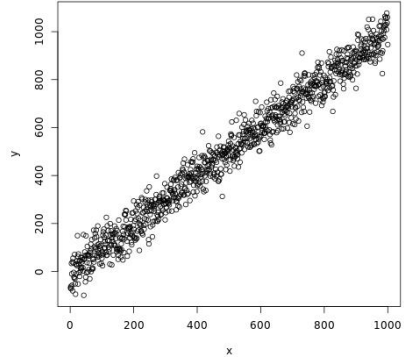
Q2.1)



Is Correlation Positive or Negative?

Is Correlation Strong, Medium, or Weak?

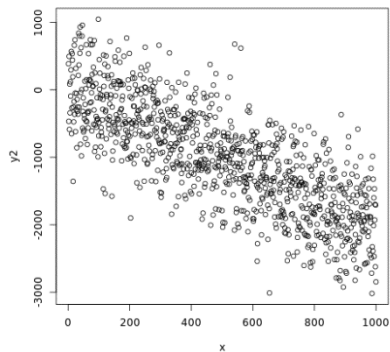
Q2.2)



Is Correlation Positive or Negative?

Is Correlation Strong, Medium, or Weak?

Q2.3)

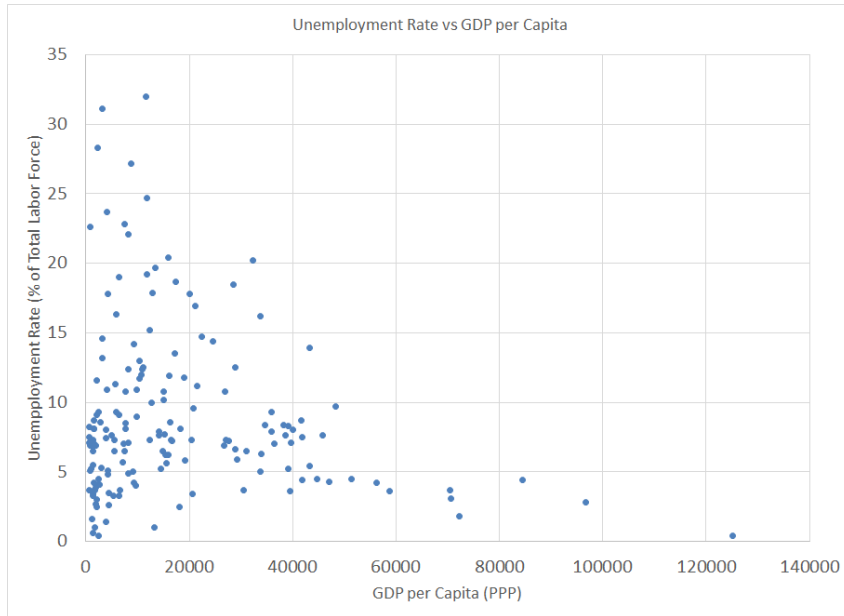


Is Correlation Positive or Negative?

Is Correlation Strong, Medium, or Weak?

### Problem 3

Q3.1) Below is the Unemployment Rate vs GDP per Capita (PPP) in 2010 for all countries with data.



Does the correlation look Positive or Negative?

Does it look like a strong or weak correlation?

Q3.2) Using the following summary statistics, compute the correlation between GDP per Capita and Unemployment for the World. I'll refer to the first series as GDP and the second as Unemp.

$$\begin{aligned}\text{Cov}[\text{GDP}, \text{Unemp}] &= -19739.6 \\ \text{SD}[\text{GDP}] &= \sqrt{\text{Var}[\text{GDP}]} = 19704.8 \\ \text{SD}[\text{Unemp}] &= \sqrt{\text{Var}[\text{Unemp}]} = 6.05\end{aligned}$$

What is the correlation,  $r$ , between GDP per Capita and the Unemployment rate. Is the correlation expected or unexpected?

Q3.3) Let's now compute the correlation between GDP per Capita and the Unemployment Rate separately for countries that have GDP per capita's less than \$10,000/person and countries that have GDP per capita's over that. We'll refer to the first set as Poor countries and the second as Rich countries.

For Poor Countries, we have the following statistics.

$$\begin{aligned}\text{Cov}[\text{GDP}, \text{Unemp}] &= 4153 \\ \text{SD}[\text{GDP}] &= \sqrt{\text{Var}[\text{GDP}]} = 2823.9 \\ \text{SD}[\text{Unemp}] &= \sqrt{\text{Var}[\text{Unemp}]} = 6.46\end{aligned}$$

What is the correlation,  $r$ , between GDP per Capita and the Unemployment rate for the poor countries? How might you explain this?

Q3.4) For Rich Countries, we have the following statistics.

$$\begin{aligned}\text{Cov}[\text{GDP}, \text{Unemp}] &= -54872.8 \\ \text{SD}[\text{GDP}] &= \sqrt{\text{Var}[\text{GDP}]} = 20420.5 \\ \text{SD}[\text{Unemp}] &= \sqrt{\text{Var}[\text{Unemp}]} = 5.63\end{aligned}$$

What is the correlation,  $r$ , between GDP per Capita and the Unemployment rate for the rich countries?