Solution: Homework 4

1.

* Parameter - A Parameter is a numerical value that describes one of the characteristics of a probability distribution or population.

* Estimator - A statistic or measure from a sample, intended to estimate some parameter of the population that the sample came from.

* Estimate - A numerical value of a statistic obtained from a collection of sample statistics.

* Bias - Any systematic error in data collection or measurement.

* Precision - Precision is the degree of accuracy with which a parameter is estimated by an estimator. Precision is usually measured by the standard deviation of the estimator and is known as the standard error.

* Yes, an estimator can be unbiased but imprecise (ie: when sampling with a small sample size)
  For the list:
  The unbiased estimator of the population average will be mean of them.

$$\bar{x} = \frac{\Sigma(x_i)}{n} = 5.3$$

The precision:

$$se(\bar{x}) = \frac{s}{\sqrt{n}} = \frac{2.6378}{\sqrt{20}} = 0.5898$$

2.

To compute R(X,Y), you can use the following equation

$$r = \frac{n * \Sigma(xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$, where n = number of pair of (x, y)

So you will need the following values

x	y	x_sq	y_sq	xy
1	0	1	0	0
3	1	9	1	3
5	4	25	16	20
7	7	49	49	49
9	8	81	64	72
$\Sigma x=25$	$\Sigma y=20$	$\Sigma x^2=165$	$\Sigma y^2=130$	$\Sigma(xy)=144$

Then, plug in the number: $r = \frac{5 * 144 - (25)(20)}{\sqrt{[5 * 165 - (25)^2][5 * 130 - (20)^2]}} = 0.9839$

3.

line 1 passes through points (-3, 5) and (1, 2)

line 2 passes through point (0, 3) and is perpendicular to line 1

$$m = \frac{rise}{run} = \frac{chg \quad in \quad y}{chg \quad in \quad x} \qquad b = \overline{y} - m\overline{x}$$

So, the slope for line 1

$$m_1 = \frac{y_1 - y_2}{x_1 - x_2} = \frac{5-2}{-3-1} = -\frac{3}{4}$$ (notice: keep the order of points in order!)

$$b_1 = 3.5 - (-0.75) * (-1) = 2.75 \quad \text{where } \overline{y} = \left(\frac{5+2}{2}\right) = 3.5 \quad \overline{x} = \left(\frac{-3+1}{2}\right) = -1$$

Thus the equation for line 1 will be

$$y = \frac{11}{4} + \left(-\frac{3}{4}\right)x$$

Given that line 2 is perpendicular to line 1, so the slope for line 2, m_2, will be equated to

$$m_2 = -\frac{1}{m_1} = -\frac{1}{-3/4} = \frac{4}{3}$$

and the point line 2 passes will be the y intercept, b_2, since x = 0,

Thus the equation for line 2, which is perpendicular to line 1, will be

$$y = 3 + \left(\frac{4}{3}\right)x$$