Homework #1 - ANSWERS
Economics 113
Introduction to Econometrics
Professor Spearot
Due Friday, October 3rd, 2008 – Beginning of class

1. Drummers are unpredictable. Sometimes they play fast, and sometimes they play slow. During a recent 5 day mini-tour, Professor Spearot played the same song at the following tempos:

Day	Tempo (Beats per minute)
1	100
2	110
3	100
4	120
5	80

Calculate the mean, median, mode, variance, standard deviation, and range of Professor Spearot's tempos during this epic five-day tour.

Mean=(1/5)*(100+110+100+120+80)=**<u>102</u>**
Median=100
Mode=100
Range=120-80=40
Variance=1/4*((100-102)^2+(110-102)^2+(100-102)^2+(120-102)^2+(80-102)^2)
=1/4*((-2)^2+(8)^2+(-2)^2+(18)^2+(-22)^2)
=1/4*(4+64+4+324+484)
=1/4*(880)=**<u>220</u>**
St. dev =Variance^(1/2)
=<u>14.83</u>

2. Professor Spearot's bandmates blame his tempo issues on the number of Red Bull cans consumed prior to the show. Data on this behavior is detailed in the following table:

Day	Red Bull (Cans)
1	1
2	2
3	2
4	5
5	0

What is the covariance and correlation between tempos and red bull consumption?

Mean(R)=(1+2+2+5+0)/5=2

Cov(R,T)=(1/4)*((1-2)*(100-102)+ (2-2)*(110-102)+ (2-2)*(100-102)+ (5-2)*(120-102)+ (0-2)*(80-102))
=(1/4)*((1-2)*(100-102) + (5-2)*(120-102)+ (0-2)*(80-102))

=(1/4)*(-1*(-2) + 3*18-2*(-22))
=(1/4)*(2+54+44)
=(1/4)*(100)
=**<u>25</u>**

Variance(R)= (1/4)*((1-2)^2+ (2-2) ^2+ (2-2) ^2+ (5-2) ^2+ (0-2) ^2)
= (1/4)*((1-2)^2 + (5-2) ^2+ (0-2) ^2)
=1/4*(1+9+4)
=1/4*(14)=3.5
Stdev(R) = Variance(R)^(1/2)
= 1.870829

Corr(R,T)=Cov(R,T)/(StDev(R)* StDev(T))
=25/(1.870829*14.83)
=**<u>0.901</u>**

3. Suppose that Professor Spearot wants to measure Tempo in beats per second rather than beats per minute. Given that there are 60 seconds in one minute, re-derive the mean and standard deviation of Tempo. What happens to the correlation between Red Bull consumption and Tempo?

This involves scaling the Tempo variable by (1/60). Thus, when there are 100 beats per minute, there are 100/60 beats per second.

Mean(Beats per second)=(1/60)* Mean(Beats per minute)=102/60=**<u>1.7</u>**

Standard deviation changes in the same manner:

SD(Beats per second)=(1/60)* SD(Beats per minute)= 14.83/60=**<u>0.247</u>**

Correlation doesn't change since correlation is insensitive to scale (unitless).

4. Suppose that I decide that I want to measure variation using the "coefficient of variation", which is defined as the standard deviation of random variable divided by its mean. Please prove that random variables *X* and *Z*=*aX* have the exact same coefficient of variation. That is, show that scaling does not affect the coefficient of variation.

Using the fact that $\hat{\mu}_z = a\hat{\mu}_x$ and $\hat{\sigma}_z = a\hat{\sigma}_x$ it follows that :

$$\frac{\hat{\sigma}_z}{\hat{\mu}_z} = \frac{a\hat{\sigma}_x}{a\hat{\mu}_x} = \frac{\hat{\sigma}_x}{\hat{\mu}_x}$$