Notes 10.4 – Random Variables and Probability Models – Day 2

I. Binomial Distributions Continued

A.) Expected Value for a Binomial Distribution with *n* trials with a probability of success *p* is given by

$$\mu = E\left(X\right) = np$$

B.) Standard Deviation for a Binomial Distribution with *n* trials with a probability of success *p* and a probability of failure *q* is given by

$$\sigma = \sqrt{npq}$$

C.) Ex. – You are have been given 100-question multiple choice test with each question having 4 possible choices. If you were to randomly choose each answer, what would be your expected score on the test if each question is worth one point?

$$\mu = 100\left(\frac{1}{4}\right) = 25\%$$

D.) Ex. – What would your standard deviation be?

$$\sigma = \sqrt{100\left(\frac{1}{4}\right)\left(\frac{3}{4}\right)} \approx 4.330$$

II. The Normal Model Revisited

A.) The Standard Normal Probability distribution for a population mean μ and standard deviation σ is given by

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$$

This basically centers the normal curve to have a mean of zero. The distance from the mean is measured in standard deviation units called *z*-scores. If random variable *X* has a mean μ and a standard deviation σ, then for a given value of *X* the *z*-score is

$$z = \frac{x-\mu}{\sigma}$$

B.) Ex. – The distribution of heights of American women is approximately Normal, with a mean of 63.8 inches and a standard deviation of 2.8 inches. Find the probabilities of each of the following:

1.) A randomly select woman is 5 ft. 10 in. tall

$$z = \frac{70 - 63.8}{2.8} \approx 2.2143$$

```
normalpdf(2.2143,0,1)
                .0343724201
```

2.) A randomly select woman is shorter than 5 ft. 10 in.

```
normalcdf(-1E99,2.2143,0,▸
                .9865959717
```

3.) A randomly select woman is taller than 5 ft. 10 in.

```
1-Ans
                .0134040283
```

4.) How tall are the shortest 5% of all adult American women?

```
invNorm(.05,0,1)
                -1.644853626
```

$$-1.6449 = \frac{x - 63.8}{2.8}$$

$$x = 59.19428 < 4'11.19428''$$