Math 10 - Spring 2013
Homework 3
Due April 15, 2013

Everybody believes in the normal approximation, the experimenters because they think it is a mathematical theorem, the mathematicians because they think it is an experimental fact.—Gabriel Lippman

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Turn in: Exercises 3.2, 3.7, 3.10, 3.20, 3.24, 3.25, 3.28, 3.31 and 3.46 from the end of chapter 3 in the texbook and problems 10 and 11 below.

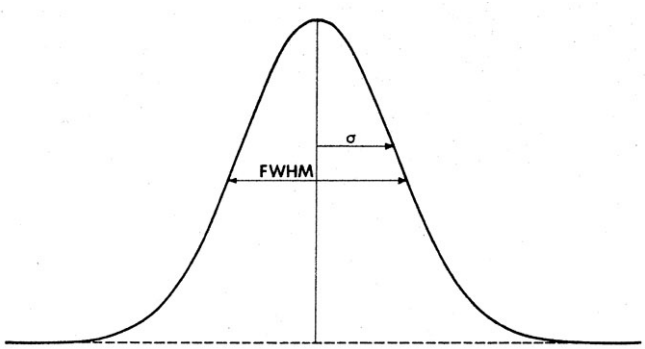
10. The width of a normal distribution is usually characterized by the parameter σ, the standard deviation. An alternative parameter with a simple geometric interpretation is the full width at half maximum, or FWHM. This parameter is the distance between the two points x where $N(\mu, \sigma)$ is half of its maximum value, as in the figure below. Using the equation for the normal distribution with $\mu = 0$,

$$N(0, \sigma, x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-x^2}{2\sigma^2}}$$

Show that

$$\text{FWHM} = 2\sigma\sqrt{2\ln 2} = 2.35\sigma.$$

Note: Sometimes the half width at half maximum, or HWHM, which is half of the FWHM is also used. So HWHM $= 1.17\sigma$, or very roughly HWHM $\approx \sigma$.



11. The normal approximation to the binomial distribution is excellent for large n, and surprisingly good for n small, especially if p is close to $1/2$. To illustrate this, compute the probability of observing 2 or 3 successes in 4 trials if $p = 1/2$ both exactly and using the normal approximation. Remember the tip on the bottom of page 143!