1016-345-01
Probability and Statistics for Engineers

Problem Set 4

Assigned 2011 January 4
Due 2011 January 11

Show your work on all problems!

1 Devore Chapter 4, Problem 32

2 Devore Chapter 4, Problem 54

3 Devore Chapter 4, Problem 60

4 Devore Chapter 4, Problem 66

5 Computational Exercise (Extra Credit)

This problem will help you illustrate explicitly how a binomial distribution can be approximated by a normal distribution.

a. Consider a binomial random variable X with $n = 80$ and $p = 0.25$; plot its pmf $b(x; n, p)$.

b. Construct the corresponding normal random variable Y with $\mu = np = 20$ and variance $\sigma^2 = np(1-p) = 15$, and plot its pdf.

c. The pmf in part (a) and the pdf in part (b) should look similar, but a more direct comparison can be made using the cdfs. Plot, on the same set of axes,

(a) the cumulative distribution function $B(x; n, p)$;

(b) the approximate cdf $\Phi\left(\frac{x-np}{\sqrt{np(1-p)}}\right)$ without the continuity correction;

(c) the approximate cdf $\Phi\left(\frac{x+.5-np}{\sqrt{np(1-p)}}\right)$ with the continuity correction.

Hint: if you use matplotlib, the following function will be useful for calculating $\Phi(z)$:

```
import scipy
from scipy.special import erf

def Phi(z):
     return 0.5 * ( 1 + erf(z/np.sqrt(2)) )
```