

1016-351-01

Probability

Problem Set 5

Assigned 2011 October 11
Due 2011 October 18

Show your work on all problems! If you use a computer to assist with numerical computations, turn in your source code as well.

1 Devore Chapter 4, Problem 8

2 Devore Chapter 4, Problem 20

3 Devore Chapter 4, Problem 32

Note that problem 4.32 is different in the seventh and eighth editions of Devore. Be sure to do the problem from the eighth edition.

4 Devore Chapter 4, Problem 54

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,
 - (i) the cumulative distribution function $B(x; n, p)$;
 - (ii) the approximate cdf $\Phi\left(\frac{x-np}{\sqrt{np(1-p)}}\right)$ without the continuity correction;
 - (iii) 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 $\Phi(z)$:

```
from scipy.special import ndtr as Phi
```