Statistics 110 – Assignment 5

Due: Wednesday, August 2, 2006

1. Rice 4.38

2. 4.68 (Hint: The question is asking about how many grandchildren an organism can have.)

3. 4.70

4. 4.74

5. 4.76 (You may assume that the moment generating function of a $Bern(p)$ RV is $M(t) = 1 - p + pe^t$.)

6. Let p be a random variable with density $f(p) = 2p$; $0 \leq p \leq 1$. Given p, let the conditional distribution of X be $Bin(2, p)$. Compute the moment generating function of X.

7. Rice 6.4

8. Rice 6.8

9. Let $\bar{X}$ be the average of a sample of size 25 independent normal random variables with mean 0 and variance 1. Determine c such that

$$P[|\bar{X}| \leq c] = 0.5$$

Now assume that the observations may not be normally distributed, but they still are independent with mean 0 and variance 1. Find an upper bound on the probability that

$$P[|\bar{X}| \leq c]$$

with c taken from the first part of the question.

10. Rice 6.10

11. Show that $E[S] \leq \sqrt{E[S^2]}$ by Jensen's inequality.

12. Let $X \sim Pois(20)$

    (a) Use the Markov inequality to obtain and upper bound on

    $$p = P[X \leq 26]$$

    (b) Use the one-sided Chebyshev inequality to obtain an upper bound on p.
    (c) Use the Chernoff bound to obtain an upper bound on p.

Suggested additional problems from Rice (don't hand in)

   4.60 4.64, 4.66, 4.67, 4.90, 4.91,