M362K (56310), Sample Midterm 1 Solutions

Note: For those problems taken directly from the book, solutions are available on pp. 498-500.

5.

a) Since $\mu = np = 1$, the Poisson approximation implies that $P(X=1) \approx e^{-1}$ and $P(X=2) \approx e^{-1}/2$. Therefore, $P(X=1)/P(X=2) \approx 2$ (in this case, the approximation gives the exact answer).

b) $P(X=1|X=1 \text{ or } 2) = P(X=1)/P(X=1 \text{ or } 2) \approx e^{-1}/(e^{-1}+e^{-1}/2) = 2/3$ (again, this agrees with the exact answer).

6.

c) Now suppose that there actually are 3 red tickets in the box. Suppose we sample tickets from the box 3 times without replacement. Let $R = \#$ of red tickets drawn and $G = \#$ of green tickets drawn. What is the joint distribution of the random variables R and G?

$P(r,g)$	$r=0$	1	2	3	$P(G=g)$
$g=0$	0	0	0	1/10	1/10
1	0	0	6/10	0	6/10
2	0	3/10	0	0	3/10
3	0	0	0	0	0
$P(R=r)$	0	3/10	6/10	1/10	

d) R and G are *not* independent. For example,

$$P(R=1, G=0) = 0 \neq 3/100 = P(R=1)P(G=0).$$