## Math 244 Exam II, Fall Name:

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November 04, 2010
Student \#:
Instructor: Dhar
Must show all work to receive full credit!!!
I pledge that I have not violated the NJIT code of honor $\qquad$

1. A portion of an electric circuit is displayed below. The switches operate independently of each other, and the probability that each relay closes when the switch is thrown is $80 \%$ for switches 1 to 4 and $90 \%$ for switches 5 and 6 . What is the probability that current will flow from $A$ to $B$ when the switch is thrown?
(14 pts) (Please see 3.35 , page 77 )

2. John flies frequently and likes to upgrade his seat to first class. He has determined that if he checks in for his flight at least 2 hours early, the probability that he will get the upgrade is 0.85 ; otherwise, the probability that he will get the upgrade is .35 . With his busy schedule, he checks in at least 2 hours before his flight only $45 \%$ of the time. What is the probability that for a randomly selected trip John will be able to upgrade to first class? (11 points) (Please see 3.43, page 81).
3. The median annual income for heads of households in a certain city is $\$ 60,000$. Three such heads of households are randomly selected for inclusion in an opinion poll. Compute the probability function of $X$ the number of heads of households with annual income above $\$ 60,000$ out of the sample of three. Clearly write down the cumulative distribution function (CDF) of $X$. What are the expected value and variance of $X$ ? (Please see problem 4.3, page 100) (18 pts)
4. The number of bacteria colonies of a certain type in a sample of polluted water has a Poisson distribution with mean of one colony per cubic centimeter. If five 1-cubic-centimeter samples of this water are independently selected, find the probability at least two samples will contain one or more bacteria colonies. (Please see problem 4.102, page 161) (15 pts)
5. Suppose that $5 \%$ of the engines manufactured on a certain assembly line are defective. If engines are randomly selected one at a time and tested, find the probability that (a) at least two defective engines are tested before two good (non defective) engines are found. (b) Given that the first two engines are defective, find the probability that at least one more defective engine is tested before the first good engine is found. (Please see problems number 4.67 and 4.68 , page 150). (16 pts)
6. Use the definition of probability generating function (p. g. f.) to derive the p. g. f. of Poisson random variable with parameter $\lambda$. (Please see problems number 4.133, page 175). (10 pts)
7. The weekly repair cost $X$, for a certain machine has a probability density function given by $f(x)=\left\{\begin{array}{ll}c x(1+x), & 0 \leq x \leq 1, \\ 0, & \text { otherwise },\end{array}\right.$ with measurements in $\$ 100$.
a. What is the probability that repair cost will exceed $\$ 80$ ?
b. Find mean and standard deviation of repair cost in dollars. (Please see page 199, 5.4 and page 208, 5.15) (16 points)
