Math 530

Autumn 2006

**Exam 2 Review**

**(1.)** Suppose that the lifetime $X$ of a particular kind of atom has an exponential distribution with a half-life of 10 years.

**(a.)** Find the probability that an atom of this type survives at least 23 years.

**(b.)** Find the time at which $P(X > t) = 0.10$

**(2.)** Suppose that $X$ and $Y$ are independent random variables such that $X$ has Poisson distribution with parameter $\mu$ and $Y$ has geometric distribution over $\{0, 1, \ldots, \}$ with parameter $p$. (ie. $P(Y = k) = (1-p)^k p$ )

**(a.)** Find $P(X = Y)$ in terms of $\mu$ and $p$.

**(b.)** Evaluate $P(X = Y)$ in (a.) if $\mu = 2$ and $p = \frac{1}{2}$.

**(3.)** Suppose that 100 random digits from $\{0, 1, \ldots, 9\}$ are generated. Let $X_i$ be the value of the $i$th digit, $S = X_1 + X_2 + \cdots + X_{100}$ and $Z$ be the number of zeros which occur. Find:

**(a.)** $P(Z = 1)$

**(b.)** $E(Z)$

**(c.)** $E(S)$

**(d.)** An upper bound on $P(Z \geq 15)$ using Markov's inequality.

**(e.)** A normal approximation to $P(Z \geq 15)$

**(4.)** Suppose that a $X$ is a random variable with range $\{-1, 0, 1\}$ such that $P(X = -1) = P(X = 0) = \frac{1}{4}$ and $P(X = 1) = \frac{1}{2}$. Let $S$ be the sum of 25 independent random variables with the same distribution as $X$. Find

**(a.)** $E(S)$,

**(b.)** $SD(S)$,

**(c.)** An normal approximation to $P(S > 0)$.

**(5.)** Let $X$ and $Y$ have geometric distributions with parameters $p_1$ and $p_2$ respectively. Find $P(X = Y)$.

**(6.)** Suppose that a 6-sided die is rolled 3 times. Let $X$ be the sum of the first and second rolls and let $Y$ be the sum of the first and third rolls.

**(a.)** Construct a joint distribution table for $X$ and $Y$.

**(b.)** Find $P(X = 6)$

**(c.)** Find the distribution of $\min(X, Y)$.