

Math 302 Assignment 4

This assignment is due IN CLASS on Wed. October 12.

NO LATES THIS WEEK SO SOLUTIONS CAN BE POSTED ON THE WEB WEDNESDAY EVENING.

1. A salesperson has found that the probability of a sale on a single contact is approximately 0.03 and the sales for different contacts are independent events. If the salesperson contacts 100 prospects, find the probability of getting at least 2 sales

- (i) by using the binomial distribution
- (ii) by using the Poisson approximation.

2. If 1% of a certain population is colour-blind, how large a sample must be taken from this population to ensure that the sample will contain at least one colour-blind person with probability .95 or more.

3. Assume X is a geometric r.v. with parameter p .

- (a) Show that for any non-negative integers, m, n ,

$$P(X > m + n | X > m) = P(X > n).$$

- (b) Calculate $E(r^X)$ for $0 \leq r < (1 - p)^{-1}$.

(c) Calculate the k th moment of r^X and give the values of $r \geq 0$ for which each moment is finite. What is $\text{Var}(r^X)$?

4. Let X be a discrete r.v.

- (a) If $E(X) = 0$, show that for any constant $c \neq 0$, $E((X - c)^2) > E(X^2)$.

- (b) If X has mean value μ and variance σ^2 , then show that

$$E((X - c)^2) > E((X - \mu)^2) \text{ for all } c \neq \mu.$$

This shows that a random variable's mean, μ , minimizes the mean square distance from a constant c to the random variable over all constants.

5. Two r.v.'s Z and W are *uncorrelated* if $E(ZW) = E(Z)E(W)$. Let X and Y be independent Bernoulli r.v.'s with parameter $\frac{1}{2}$. Prove that $X + Y$ and $|X - Y|$ are uncorrelated r.v.'s but are not independent r.v.'s.

Here are some practice problems not to be handed in, but try them before the first midterm.

p. 174-179 # 4.21, 4.22, 4.27, 4.28, 4.37, 4.38, 4.51, 4.55, 4.83