

Quiz 7

True/False - No explanation needed. (2pts)

1. For any two random variables X and Y , $E(X + Y) = E(X) + E(Y)$ holds if and only if X and Y are independent. **True/False**

sol. The equation $E(X + Y) = E(X) + E(Y)$ holds for *any* X and Y .

2. If n is large and p is relatively small, the Poisson distribution with intensity $\lambda = np$ can be used to approximate the binomial distribution X_n . **True/False**

Problems - Need justification. No justification means **zero!**

1. You decide to play the lottery over and over until you win some prize. Each time you play the lottery, the probability that you win a prize is 0.01. Let X be the number of times that you play the lottery and do not win any prize. Identify the name of the distribution of X and find $P(X = 10)$. (5pts)

sol. X follows *geometric distribution*. In this case, the probability for winning a prize $p = 0.01$ and $P(X = k) = 0.01^k \cdot 0.99$. Hence

$$P(X = 10) = 0.01^{10} \cdot 0.99.$$

2. The midterm exam 3 of Math 10B course consists of 10 true/false questions, each worth 2 points. For each question, If you give a wrong answer, you will get -1 point. Also, if you don't answer and leave it as a blank, then you will get 0 point. The probability that Ramanujan answers a true/false question correctly is 0.6, the probability that he leave it as a blank is 0.2, and the probability that she answers a question wrong is 0.2. What is his expected score on the midterm? (5pts)

sol. Let X_i be a random variable that represents the point we get from i -th problem ($1 \leq i \leq 10$). Then we want to compute $E(X)$ for $X = X_1 + X_2 + \dots + X_{10}$. All of these X_1, X_2, \dots, X_{10} are identical, so $E(X) = E(X_1) + \dots + E(X_{10}) = 10E(X_1)$. Hence we get

$$E(X) = 10E(X_1) = 10(0.6 \cdot 2 + 0.2 \cdot 0 + 0.2 \cdot (-1)) = 10.$$