

ENEE324. Problem set 4

Date due March 2, 2016

Explanations are required, no credit for just the answer.

1. The number of particles passing through a detector is described by a random variable X that takes positive integer values. Find $P(X \leq EX)$ if (a) X is geometric with the parameter $p = 1/4$; (b) X is binomial with $n = 7$ trials and $p = 1/2$.

2. A die can roll 1, 2, or 3 with equal probabilities. Two such dice are rolled independently producing outcomes X_1 and X_2 . (a) Find the PMF of the random variable $X = X_1 - X_2$; find EX and $\text{Var}(X)$. (b) Find the PMF, EY and $\text{Var}(Y)$ of the random variable $Y = X^2$.

3. Traffic arrives at a toll plaza with some number of cashier booths/token readers and exits the plaza via 8 lanes. Suppose that four cars leave their cashier booths and each is routed to its exit traffic lane. Assume that the outgoing lanes are chosen independently, and each car is sent to each of the 8 lanes with equal probability.

(a) Describe the sample space of the experiment (using the number of cars in the outgoing lanes).

(b) Find the probability of the event

$$\{a_i \text{ cars are sent to lane } i, \text{ where } i = 1, \dots, 8 \text{ and where } a_1 + a_2 + \dots + a_8 = 4.\}$$

(c) Let X be the RV equal to the number of cars in lane 1. Find the PMF of X .

4. The experiment consists in rolling successively a fair 6-sided die. Let X be the number of rolls until each of the six possible outcomes appears at least once. Find the PMF of X .

5. Select 4 people randomly and let X be the number of different birthdays among them. Find EX .

6. (Poisson distribution). Suppose that 2.5% of the students in the EE program are golf fans. In a class with 80 randomly chosen students, what is the probability that there are at least 2 golf fans?