

1. Raindrops are falling at an average rate of 20 drops per square inch per minute. What would be a reasonable distribution to use for the number of raindrops hitting a particular region measuring 5 inches<sup>2</sup> in  $t$  minutes? Why? Using your chosen distribution, compute the probability that the region has no rain drops in a given 3 second time interval. A reasonable choice of distribution is P

Ans: As we have to find probability based on an interval we will use Poission Distribution

raindrop in 5 square inch /min= $20 \times 5 = 100$

raindrops in 5 square inch/ $t$  mins=  $100 \times t$

$\lambda = (\text{number of drops/min} \times 5 \text{ square inch area})/60 = (20 \times 5)/60 = 100/60$  number of drops /sec

No rain for 3 seconds=  $3/60 = 1/20$

$$P(\text{no rain for 3 seconds}) = \left[ \left( \frac{300}{60} \right)^0 \times e^{-(300/60)} \right] / 0! \\ = (1 \times e^{-5}) / 1 = e^{-5}$$

Let  $X$  be a random day of the week, coded so that Monday is 1, Tuesday is 2, etc. (so  $X$  takes values 1, 2,..., 7, with equal probabilities). Let  $Y$  be the next day after  $X$  (again represented as an integer between 1 and 7). Do  $X$  and  $Y$  have the same distribution? What is  $P(X)$

Ans:  $P(X) = 1/7$

$$Y = (X+1) \% 7$$

thus

X	1	2	3	4	5	6	7			
Y	2	3	4	5	6	7	1			

$$P(Y) = 1/7$$

Thus  $X, Y$  have same distribution

$$P(X) \text{ is } 1/7$$