**Statistics Assignment**

**Q-1 Harvard Law School courses often have assigned seating to facilitate the “Socratic method.” Suppose that there are 100 first year Harvard Law students, and each takes two courses: Torts and Contracts. Both are held in the same lecture hall (which has 100 seats), and the seating is uniformly random and independent for the two courses?**

1. **Find the probability that no one has the same seat for both courses (exactly; you should leave your answer as a sum.**

**Solution:**

Probability that no student seat on same seat in torts lecture = 1

Probability that a student gets same seat in contracts lecture = 1/100

Probability that a student does not get same seat in contracts lecture will be = 99/100

Since both events are independent probability that a student will not get seat in both class will be product of two = 1\*(99/100)’

Probability that no student gets same seat = (99/100) \*(99/100) \*……100 times

= (99/100) ^ 100

Also we can arrange k students on 100 seats in  ways

SO final probability will be

P(a)=∑( *\**(99/100) ^ (100-k)) for k=0 to 100

1. **Find a simple but accurate approximation to the probability that no one has the same seat for both courses**

**Solution:**

P(b)= [e^ (-1/100)] ^2

= [e^ (-1/50)]

1. **Find a simple but accurate approximation to the probability that at least two students have the same seat for both courses**

**Solution:**

P(c)=1-P (no students gets same seat)

=1-P(b)

=1- [e^ (-1/50)]

**Q-2 There are 100 passengers lined up to board an airplane with 100 seats (with each seat assigned to one of the passengers). The first passenger in line crazily decides to sit in a randomly chosen seat (with all seats equally likely). Each subsequent passenger takes his or her assigned seat if available, and otherwise sits in a random available seat. What is the probability that the last passenger in line gets to sit in his or her assigned seat?**

**Solution:**

Case 1- First passenger seats on his seat

So, everyone will seat on their respective seat

P (1) =1

Case 2- First passenger seats on last passenger seat

P (2) =0

Case 3- First passenger seats on seat other then first or last seat

P(n)=1/n for n>2

P (last passenger getting own seat) =P (1) +P (2) \*(1-P (1))

=1+(0\*(1-1))

=1

So, probability that last person gets his seat is 100%

**Q-3 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 inches2 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?**

**Solution:**

In this case we will consider Poisson distribution because it is commonly used to model events that occur randomly over time or space when the average rate of occurrence is known.

Here λ=20

Λ’= (λ / 60) \* 3

= (20 / 60) \* 3

= 1

P (X = 0) = e^(-λ') \* (λ') ^0 / 0!

P (X = 0) = e^ (-1) \* (1^0) / 0!

P (X = 0) = e^ (-1)

=0.3679

So, probability that no rain drops in given area in given time interval is 36.79%