Assignment-4: PS(MA2102)

1. A newsboy purchases papers at 2/- and sell them at 3/-. However, he is not allowed to return unsold papers if his daily demand is a binomial random variable with n=10, p=$\frac{1}{3}$, approximately how many papers should he purchase so as to maximize his expected profit.

   (Write a program to solve it)
2. In a precision bombing attack, there is a 50% chance that bomb will strike the target, two direct hits are required to destroy the target completely. How many bombs must be dropped to give at least 99% chance of completely destroying the target.
3. A purchaser of transistors buys them in lots of size 10. The policy is to inspect 3 components randomly from a lot, to accept a lot if all 3 are non-defective. If 30% lots have 4 defective components and 70% have 1 defective component. What proportion of lots does the purchaser reject?
4. The expected number of typographical errors on a page of certain magazine is 0.2. What is the probability that the next page you read contains (a) 0 and (b) 2 or more typographical errors?
5. The monthly worldwide average number of airplane crashes of commercial airlines is 3.5. What is the probability that there will be,
   a. At least 2 such accidents in the next month
   b. At most 1 accident in the next month

   Hint: airplane crashes happen under Poisson process over time
6. The suicide rate in a certain state is 1 per 100000 inhabitants per month. Find the probability that in the city of 400000 inhabitants within this state, there will be 8 or more suicides in a given month?
7. A box contains 4 white and 4 black balls. We randomly choose 4 balls. If 2 of them are white and 2 are black, we stop. If not, we replace the balls in the box and again randomly select 4 balls. This continue until exactly 2 of the 4 chosen are white. What is the probability that we shall make exactly n selections?
8. A pipe-smoking mathematician carries at all times 2 match boxes, 1 in his left-hand pocket 1 in his right-hand pocket. Each time he needs a match he is equally likely to take it from either pocket. Consider the moment when the mathematician first discovers that one of his matchboxes is empty. If it is assumed that initially left-hand matchbox contained 50 matches, and right-hand matchbox contained 40 matches. What is the probability that are exactly 10 matches in the other box?
9. Trains headed for destination A arrive at the train station at 15-min intervals starting at 7A.M., whereas trains headed for destination B arrive at 15-min intervals starting at 7:05 A.M.
   i. If certain passenger arrives at the station at a time uniformly distributed between 7 and 8 A.M. and then gets on the first train that arrives, what proportion of time does he or she go to destination A.
   ii. What if the passenger arrives at a time uniformly distributed between 7.10 and 8.10 A.M?

10. The time (in hours) required to repair a machine is an exponentially distributed random variable with parameter $\lambda = \frac{1}{2}$. What is
    i. The probability that a repair time exceeds 2 hours
    ii. The conditional probability that a repair takes at least 10 hours, given that its duration exceeds 9 hours?

11. A randomly chosen IQ test taker obtains a score that is approximately normal random variable with mean 100 and standard deviation 15. What is the probability that the test score of such a person is (a) above 125; (b) between 90 and 110?
12. The annual rainfall in Cleveland, Ohio I approximately normal random variable with mean 40.2 inches and standard deviation 8.4 inches. What is the probability that
    i. Next year's rain fall will exceed 44 inches
    ii. The yearly rain falls in exactly three of the next seven years will exceed 44 inches? Assume that if A_i, is the event that the rainfall exceeds 44 inches in year i(from now), then the events $A_{i,}\ i \geq 1$, are independent.
13. Suppose the life(in hours) of an electronic tube manufactured by a certain process is normally distributed with mean 160 hrs and standard deviation σ .
    i. what is the maximum allowable values of σ, if the life X of tube is to have a probability 0.80 of being between 120 and 200 hrs.
    ii. If $\sigma = 30$, and tube is working after 140 hours , what is the probability that it will function for additional 30 hours
14. The life span of a certain component need in a CPU is assumed to follow gamma distribution with average life 24 and the mode(most likes life) 22 (measured in 1000 days). Determine the variance of life span.
15. The lead time for orders of diodes from a certain manufacturer is known to have a gamma distribution with a mean 20 days and standard deviation of 10 days. Determine the probability of receiving an order within 15 days of placement date.
16. Let X be a continuous random variable with $S_X = (0, \infty)$ such that $P(X > r + s\,/X > r) = P(X > s)$, for any positive real numbers r, s. Then X must follow Exponential distribution.
17. Compute the hazard rate function of X when X is uniformly distributed over $(0, a)$.
18. The number of years that a machine functions is a random variable whose hazard rate function is given by

$$\lambda(t) = \begin{cases} 0.2\,, & 0 < t < 2 \\ 0.2 + 0.3(t-2), & 2 \leq t < 5 \\ 1.1, & t > 5 \end{cases}$$

    i. What is the probability that the machine will still be working six years after being purchased?
    ii. If it is still working six years after purchased, what is the conditional probability that it will fail within the succeeding two years?

*******THE END*******