

# STU22004 – Sample Questions 10

Q1. If  $m_x(t) = \left(\frac{1}{4} + \frac{3}{4}e^t\right)^{12}$ , find  $P(X > 10)$ .

Q2. If  $X_i$ s are 3 iid RVs with  $f(x) = 2x$ ,  $0 < x < 1$ , find  $P(\min(X_i) > 0.5)$ .

Q3. In a telecom transmission channel, there are some noise pulses which occur 3 times per minute with Poisson distribution. If we would like to send a message of 10 seconds using this channel, what is the probability that it does not be disturb by those noise pulses?

Q4. All screws used in a machine are manufactured by a single supplier, that could be either A or B with same chance. Probability that screws are faulty are  $q_A$  and  $q_B$  for suppliers A and B, respectively. We investigate 2 screws; if the first one is defective, what is the probability that the second one is defective as well?

Q5. You have 20 coins. You flip all and  $X$  of them are head; take them and flip the rest again. What is the probability that at the end of the second round, at the latest, all coins show heads?

Q6. If  $X$  and  $Y$  have the following joint distribution, find  $E[X | Y = 0]$ .

$Y \backslash X$	0	1
0	1/8	3/8
1	1/3	1/6

Q7. For  $f(x, y) = 8xy$ ,  $0 < x < 1$ ,  $0 < y < x$ , find  $Cov(X, Y)$ .

Q8. If  $X \sim U(0, 1)$  and  $Y|x \sim U(x, x + 1)$ , find  $P(X + Y < 1)$ .

Q9. If  $X \sim U(0, 1)$  and  $Y|x \sim B(n, x)$ , find  $E[Y]$  and  $Var[Y]$ .

Q10. If  $E[Y|x] = 7 - \frac{1}{4}x$  and  $E[X|y] = 10 - y$ , find  $Corr(X, Y)$ .

Q11. A system has two components, main and spare ones, both with Exponential lifetime with parameter  $\lambda$ . What is the expected value of percentage of the time that the system works with the spare component?

Q12. You roll two dice repeatedly until getting their sum equal 7. What is the probability that the required number of rolls is odd?

Q13. If  $X_i$ s are iid geometric RVs, find the probability distribution of  $Y = \min(X_i)$ .

Q14. A box contains 5 red and 10 black chips. We take 4 chips randomly and without replacement. If the number of taken red and black chips are shown by  $U$  and  $V$ , find  $Corr(X, Y)$ .

Q15. Mary flips 3 fair coins. What is the probability that she gets 3 heads for the second time in the 5<sup>th</sup> flip?