

## Problems

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**Q 1.** The chances that a Doctor A will diagnose a disease X correctly is 0.6. The chance that a patient will die by his treatment after correct diagnosis is 0.4 and the chances of the death by wrong diagnosis is 0.7. A patient of a doctor A who had disease X died. What is the chance that his disease was diagnosed correctly.

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**Q 2.** Three urns contain 6 red 4 black ; 4 red 6 black ; 5 red 5 black balls respectively. One of the urns is selected at random and a ball is drawn from it . If the ball drawn is red , find the probability that it is drawn from the first urn?

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**Q 3.** A binary communication channel carries data as one of two types of signals denoted by 0 and 1. Due to noise a transmitted 0 is received as 1 with prob 0.6 and 1 is received as 0 with prob 0.09. Prob of transmitting 0 is 0.45. If a signal is sent determine (i) Prob that 1 is recived (ii) prob that 0 was transmitted given that 0 was recived (iii) prob that 101 is received as 011.

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**Q 4.** Suppose that an electric device has a life length X which is considered as random variable with pdf  $f(x) = e^{-x}; x > 0$  .Suppose that the cost of manufacturing one such item is 2. The manufacturer sells the item for 5 but guarantees a total refund if  $X = 0.9$ . What is the manufacturer expected profit per item?

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**Q 5.** A coin is tossed till first head appears. Let X denote the number of tosses. Find  $E(X)$ .

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**Q 6.** The joint pdf of 2 dimensional random variable  $(X, Y)$  is given by

$$f(x, y) = \begin{cases} x^3 + \frac{xy}{3}, & \text{if } 0 < x < 1, 0 < y < 2 \\ 0, & \text{else where} \end{cases}$$

Compute (i)  $P(Y < 1/2)/(X < 1/2)$  (ii)  $P(Y < X)$

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**Q 7.** Suppose that a 2 dimensional random variable  $(X, Y)$  is uniformly distributed over a semicircle  $x^2 + y^2 = 1$  above the xy-plane then compute the following

(i) marginal probability distributions of X and Y.

(ii)  $E(X), E(Y), E(XY)$

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**Q 8.** Find the mean and variance of a random variable of a one dimensional continuous random variable with p.d.f. given by

$$f(x) = \begin{cases} \frac{x}{a^2} e^{-x^2/2a^2}, & \text{if } x \geq 0 \\ 0, & \text{else where} \end{cases}$$

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**Q 9.** If the random variable K is uniformly distributed over the interval  $(0, 5)$ , then what is the probability that the roots of the equation  $4x^2 + 4xk + k + 2 = 0$  are real.

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**Q 10.** Let  $(X, Y)$  be a continuous two dimensional r.v. with joint p.d.f

$$f(x, y) = \begin{cases} 8xy, & \text{if } 0 < x < y < 1 \\ 0, & \text{else where} \end{cases}$$

Then compute (i)  $E(7XY^2 + 5X)$  (ii)  $COV(X, Y)$

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