Mathematics for Data Science (Graduate Course)

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Assignment # 1

Q1. In a certain assembly plant, three machines B_1, B_2, and B_3 make 30%, 45%, and 25% respectively of the products. It is known from past experience that 2%, 3% and 2% of the products made by each machine, respectively are defective. Now, suppose that a finished product is randomly selected. What is the probability that it is defective? And what is the probability that it was made by machine B_3?

Q2. The probability that a man will be alive in 25 years is 3/5, and the probability that his wife will be alive in 25 years is 2/3. Find the probability that (i) both will be alive in 25 years. (ii) only man will be alive in 25 years. (iii) only the wife will be alive. (iv) at least one will be alive in 25 years and (v) neither will be alive in 25 years.

Q3. A Random variable X is of Continuous type with p.d.f.

$$f(x) = 2x \qquad 0 < x < 1$$

$$= 0 \qquad elsewhere$$

Find   (i) $P(X = 0.5)$,   (ii) $P(X \leq 0.5)$,   (iii) $P(X > 0.25)$,   (iv) $P(0.25 \leq X \leq 0.5)$

- Also find the distribution function.

Q4). The incidence of occupational disease in an industry is such that the workmen have a 20% chance of suffering from it. What is the probability that out of 6 workmen (i) not more than 2 will catch the disease and (ii) 4 or more will catch the disease?

Q5. In the following circuit assume the components fail independently.

(a). What is the probability that the entire system works

(b). Given that the system works, what is the probability that component A is not working?

(c). if it is known that the system does not work what is the probability that component A also does not work?