



Coimbatore – 35

DEPARTMENT OF MATHEMATICS UNIT - I PROBABILITY AND RANDOM VARIABLES

PROPERTIES

MATHEMATICAL EXPECTATIONS :

Let 'x'be a standom variable with probability density function for, or probability mars function p(x) then the mathematical expectation of 'x' is denoted by E(x) and is given by E(x) = E report, for a discrete random Variable = Saturda, for a continuous random Vor The variance of a random variable 'x' is denoted by var (x) and is defined by $Var(x) = E(x^2) - (E(x))^2$ = Enzpen) - [Expens], for a discrete RV. = Jazfendn-[Jafenda], for a cts. RV.





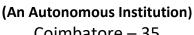
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PROPERTIES : If 'x' and 'y' are random variable and a, b are constants, then (i) E(a) = a(ii) E(ax) = aE(x)(iii) E(ax+b) = a E(x)+b(iv) If $Y \leq x$, then $E(y) \leq E(x)$ (v) If x & y are independent then E(xy) = E(x) E(y) (Vi) $E(x^2) \ge (E(x))^2$ (vii) Var $(x) \ge 0$ (viii) Var(a) = 0(ix) Var $(ax) = a^2 var(x)$ (x) $Var(x \pm a) = Var(x)$ (xi) Var $(ax+b) = a^2 \operatorname{Var}(x)$ $(xii) \operatorname{Var}(ax+by) = a^2 \operatorname{Var}(x) + b^2 \operatorname{Var}(y)$







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PROBLEMS :

(1) When a die is theown, 'x' denotes the number that twens up. Find Elx), Elx2) and var(x). Soln: Let 'x' denotes the number that twens up in die. (ie) 'x' takes values 1, 2, 3, 4, 5, 6. 2:123456 pran: 46 16 16 16 16 16 16 New E(x) = < x p(x) = 1×16+2×16+3×16+4×16+5×46+6×46 a side all and prestruction = 21/2 = 1/2 ered arriver and her bury $E(x^2) = \sum x^2 p(x)$ = $(1)^{2} \times Y_{6} + (2)^{2} \times \frac{1}{6} + (3)^{2} \times \frac{1}{6} + (4)^{2} \times \frac{1}{6} + (5)^{2} \times \frac{1}{6} + (6)^{2} \times \frac{1}{6}$ = 91/6 are stranged $Var(x) = E(x^2) - (E(x))^2$ = 91/2 - (21/2)2 $= \frac{546 - 441}{36} = \frac{105}{36}$ $=\frac{35}{10}$

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Find
$$E(x_2)$$
 and $E(2x+3)$ for the following probability
distribution:
 $x: -2 -1 = 0 + 2 = 3$
 $p(x): y_6 + y_6 = 0 = 2/3 + y_6 + y_6$
Soln:
Now $E(x^2) = \leq x^2 p(x)$
 $= (-2)^2 x y_6 + (-1)^2 x y_6 + 0 + (1)^2 x y_6 + (2)^2 x y_6 + (3)^2 x y_6 + ($

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Let x be a standom variable with E(x)=1 and E(x(x-1))=4. Find var(x) and var(2-3x) <u>Soln:</u> E(x)=1; E(x(x-1))=4 (given) Now E(x(x-1))=4 $E(x^2-x)=4$ $E(x^2)-E(x)=4$ $E(x^2)-1=4$ $\Rightarrow E(x^2)=5$. Var(x) = $E(x^2)-(E(x))^2=5-1=4$ Now Var(2-3x) = $(-3)^2$ var(x) = 9x(4)=36