School of Mathematics(SOM)

Thapar Institute of Engineering and Technology (TIET)

Probability and Statistics(UCS410) Exp. sheet 06 (Joint probability mass and density functions)

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(1) The joint probability density of two random variables X and Y is

$$f(x,y) = \begin{cases} 2(2x+3y)/5; & 0 \le x, y \le 1 \\ 0; & elsewhere \end{cases}$$

$\int\int f(x,y)dxdy = 1$

Then write a R-code to integral2 is in pracma package so first install.packages("pracma")

(i) check that it is a joint density function or not? (Use integral2()) first create function then using integral2 (function,xmin=0,xmax=1,ymin=0,ymax=1) and if it is 1 then it in joint density function else not

first write function2 that is function1(1,y) then using this integrate(func2,0,1)

(ii) find marginal distribution $g(x)$ at $x = 1$.

(iii) find the marginal distribution $h(y)$ at $y = 0$. do it in a similar way

(iv) find the expected value of $g(x,y) = xy$. write function such that xy*2(2x+3y)/5

(2) The joint probability mass function of two random variables X and Y is

$$f(x,y) = \{(x+y)/30;\ \ x = 0,1,2,3;\ \ y = 0,1,2\}$$

Then write a R-code to first create the function then create matrix like this matrix(c(func(0,0:2),func(1,0:2),func(2,0:2),func(3,0:2)),nrow=4,ncol=3)

(i) display the joint mass function in rectangular (matrix) form.

(ii) check that it is joint mass function or not? (use: Sum()) find the sum of matrix of joint mass function and if its 1 then yes else no

(iii) find the marginal distribution $g(x)$ for $x = 0,1,2,3$. (Use:apply()) use 1 for rowwise and 2 for columnwise apply(matrix,1,sum)

(iv) find the marginal distribution $h(y)$ for $y = 0,1,2$. (Use:apply()) apply(matrix,2,sum)

Conditional probability

$P(x|y) = \frac{P(x,y)}{P(y)}$

(v) find the conditional probability at $x = 0$ given $y = 1$. matrix[1,2]/apply(matrix,2,sum)[2]

(vi) find $E(x), E(y), E(xy), Var(x), Var(y), Cov(x,y)$ and its correlation coefficient.

to find E(x) first find marginal probability of x rowwise then multiply it with x and then add and to find Var(x) = E(x^2)-E(x)^2 where E(x^2) will be multiply x^2 with marginal probability and then adding and for cov(X,Y) = E(x*y)-E(x)*E(y)

and correlation = covariance/(sqrt(VarX*VarY))