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CS2

(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

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

CODE ::

```
f<- function (x,y)
{
  (x+y)/30
}
m=matrix(c(f(0,0:2),f(1,0:2),f(2,0:2),f(3,0:2)),nrow=4,ncol=3,byrow=TRUE)
print(m)
```

OUTPUT::

```
> source("~/.active-rstudio-document")
           [,1]       [,2]       [,3]
[1,] 0.00000000 0.03333333 0.06666667
[2,] 0.03333333 0.06666667 0.10000000
[3,] 0.06666667 0.10000000 0.13333333
[4,] 0.10000000 0.13333333 0.16666667
```

(ii) check that it is joint mass function or not? (use: Sum())

CODE ::

```
if(sum(m)==1)
{
  print('f is a joint mass function')
}else
{
  print('f is not a mass function')
}
```

OUTPUT::

```
[1] "f is a joint mass function"
```

(iii) find the marginal distribution g(x) for x = 0, 1, 2, 3. (Use:apply())

CODE ::

```
gp<-apply(m,1,sum)
print(gp)
```

OUTPUT::

```
[1] 0.1 0.2 0.3 0.4
```

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

CODE ::

```
p<-apply(m,2,sum)
print(p)
```

OUTPUT::

```
[1] 0.2000000 0.3333333 0.4666667
```

(v) find the conditional probability at x = 0 given y = 1.

CODE ::

```
cond_prob <- m[1,2]/p[2]
print(cond_prob)
```

OUTPUT::

```
[1] 0.1
```

(vi) find E(x), E(y), E(xy), V ar(x), V ar(y), Cov(x, y) and its correlation coefficient.

CODE ::

```r
x<-c(0:3)
ex<-sum(x*gp)
print(ex)
ex2<-sum(x*x*gp)
#variance
varx<-ex2-(ex*ex)
print(varx)

y<-c(0:2)
ey<-sum(y*p)
print(ey)
ey2<-sum(y*y*p)
#variance
vary<-ey2-(ey*ey)
print(vary)

f1<-function(x,y)
{
  x*y*((x+y)/30)
}
m1<-matrix(c(f1(0,0:2),f1(1,0:2),f1(2,0:2),f1(3,0:2)),nrow=4,ncol=3,byrow=TRUE)
exy=sum(m1)
print(exy)


cov<-exy-(ex*ey)
```

OUTPUT::

```
[1] 1
[1] 1.266667
[1] 0.5955556
[1] 2.4
[1] -0.1333333
```

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

f(x,y) =

0;

2(2x+3y)/5;

0≤x,y≤1 elsewhere

Then write a R-code to

(i) check that it is a joint density function or not? (Use integral2())

CODE ::

```
f<-function(x,y){
  (4*x+6*y)/5
}

library("pracma")
x<-integral2(f,xmin=0, xmax=1, ymin=0, ymax=1)
i<- integral2(f,0,1,0,1)
if(i$Q)
{
  print('f is a joint density function')
}else
{
  print('f is not a joint demsity function ')
}
```

OUTPUT::

```
> source("~/.active-rstudio-document")
[1] "f is a joint density function"
```

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

CODE ::

```
f1<- function(y)
{

  (4+(6*y))/5
}
```

OUTPUT::

```
1.4 with absolute error < 1.6e-14
```

(iii) find the marginal distribution h(y) at y = 0.

Code ::

```
f3 <- function(x, y) {

  x * y * ((4 * x + 6 * y)/5)

}
```

OUTPUT::

```
0.4 with absolute error < 4.4e-15
```

(iv) find the expected value of g(x, y) = xy.

CODE ::

```
f3 <- function(x, y) {

  x * y * ((4 * x + 6 * y)/5)

}

exy = integral2(f3, xmin = 0, xmax = 1, ymin = 0, ymax = 1)$Q
print(exy)
```

OUTPUT::

```
[1] 0.3333333
```