LAB ASSIGNMENT – 6

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Q1 : (1)The joint probability density of two random variables X and Y is f(x, y) = 2(2x + 3y)/5; 0 ≤ x, y ≤ 1

0; elsewhere

Then write a R-code to

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

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

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

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

CODE:

```
# 1
f<-function(x,y){
  (2*(2*x+3*y))/5
}

# (i)
install.packages('pracma')
library('pracma')
integral2(f,0,1,0,1)

# (ii)
f<-function(y){
  (2*(2+3*y))/5
}
integrate(f,0,1)

# (iii)
f<-function(x){
  (2*(2*x))/5
}
integrate(f,0,1)

# (iv)
f<-function(x,y){
  (x*y)*((2*(2*x+3*y))/5)
}
integral2(f,0,1,0,1)
```

OUTPUT:

```
> # 1
> f<-function(x,y){
+   (2*(2*x+3*y))/5
+ }
> integral2(f,0,1,0,1)
$Q
[1] 1

$error
[1] 6.938894e-17

> # (ii)
> f<-function(y){
+   (2*(2+3*y))/5
+ }
> integrate(f,0,1)
1.4 with absolute error < 1.6e-14
> # (iii)
> f<-function(x){
+   (2*(2*x))/5
+ }
> integrate(f,0,1)
0.4 with absolute error < 4.4e-15
> # (iv)
> f<-function(x,y){
+   (x*y)*((2*(2*x+3*y))/5)
+ }
> integral2(f,0,1,0,1)
$Q
[1] 0.3333333

$error
[1] 5.89806e-17
```

Q2 : The joint probability mass function of two random variables X and Y isf(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.
(ii) check that it is joint mass function or not? (use: Sum())
(iii) find the marginal distribution g(x) for x = 0, 1, 2, 3. (Use:apply())

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

(i) find the conditional probability at x = 0 given y = 1.
(ii) find E(x), E(y), E(xy), V ar(x), V ar(y), Cov(x, y) and its correlation coefficient.

CODE:

```r
# 2
p<-function(x,y){
  (x+y)/30
}

# (i)
joint_mass<-matrix(c(p(0,0:2),p(1,0:2),p(2,0:2),p(3,0:2)),nrow = 4,ncol = 3,byrow =
joint_mass

# (ii)
sum(joint_mass)

# (iii)
gx<-apply(joint_mass,1,sum)
gx

# (iv)
hy<-apply(joint_mass,2,sum)
hy

# (v)
p(0,1)/sum(joint_mass[,2])

# (vi)
# E(x)
x<-c(0,1,2,3)
sum(x*gx)
# E(y)
y<-c(0,1,2)
sum(y*hy)
# E(x,y)
p<-function(x,y){
  (x*y)*((x+y)/30)
}
joint_mass1<-matrix(c(p(0,0:2),p(1,0:2),p(2,0:2),p(3,0:2)),nrow = 4,ncol = 3,byrow
sum(joint_mass1)
# Var(x)
varx<-sum(x*x*gx)-(sum(x*gx)^2)
varx
# Var(y)
vary<-sum(y*y*hy)-(sum(y*hy)^2)
vary
# Cov(x,y)
cov<-sum(joint_mass1)-(sum(x*gx)*sum(y*hy))
cov
# Correlation Coefficient
corr<-cov/(sqrt(varx)*sqrt(vary))
corr
```

OUTPUT:

```
> # 2
> p<-function(x,y){
+   (x+y)/30
+ }
> # (i)
> joint_mass<-matrix(c(p(0,0:2),p(1,0:2),p(2,0:2),p(3,0:2)),nrow = 4,ncol = 3,byrow = TRU
E)
> joint_mass
           [,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)
> sum(joint_mass)
[1] 1
> # (iii)
> gx<-apply(joint_mass,1,sum)
> gx
[1] 0.1 0.2 0.3 0.4
> # (iv)
> hy<-apply(joint_mass,2,sum)
> hy
[1] 0.2000000 0.3333333 0.4666667
> # (v)
> p(0,1)/sum(joint_mass[,2])
[1] 0.1
> # (vi)
> # E(x)
> x<-c(0,1,2,3)
> sum(x*gx)
[1] 2
> # E(y)
> y<-c(0,1,2)
> sum(y*hy)
[1] 1.266667
```

```
> # E(x,y)
> p<-function(x,y){
+   (x*y)*((x+y)/30)
+ }
> joint_mass1<-matrix(c(p(0,0:2),p(1,0:2),p(2,0:2),p(3,0:2)),nrow = 4,ncol = 3,byrow = TR
UE)
> sum(joint_mass1)
[1] 2.4
> # Var(x)
> varx<-sum(x*x*gx)-(sum(x*gx)^2)
> varx
[1] 1
> # Var(y)
> vary<-sum(y*y*hy)-(sum(y*hy)^2)
> vary
[1] 0.5955556
> # Cov(x,y)
> cov<-sum(joint_mass1)-(sum(x*gx)*sum(y*hy))
> cov
[1] -0.1333333
> # Correlation Coefficient
> corr<-cov/(sqrt(varx)*sqrt(vary))
> corr
[1] -0.1727737
```