ASSIGNMENT 6

Name: Mannat **Roll no.: 102017172** **Sub-group: 3CS7**

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

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

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 $g(x,y) = xy$.

```
> #----------------------------------------------------------
> #Ques-1
> f1<-function(x,y){
+   return((4*x+6*y)/5)
+ }
> #i)check that it is a joint density function or not?
> i<-integral2(f1,xmin=0,xmax=1,ymin=0,ymax=1)
> i
$Q
[1] 1

$error
[1] 6.938894e-17

> cat("It is a joint density function")
It is a joint density function
> #ii) find marginal distribution g(x) at x = 1.
>
> f12<-function(y){f1(1,y)}
> i2<-integrate(f12,0,1)
> cat("marginal distribution of g(x) at x=1")
marginal distribution of g(x) at x=1
> i2
1.4 with absolute error < 1.6e-14
> #iii)find the marginal distribution h(y) at y = 0.
>
> f13<-function(x){f1(x,0)}
> i3<-integrate(f13,0,1)
> cat("marginal distribution h(y) at y=0")
marginal distribution h(y) at y=0
> i3
0.4 with absolute error < 4.4e-15
> #iv)find the expected value of g(x, y) = xy.
>
> f14<-function(x,y){x*y*f1(x,y)}
> i4<-integral2(f14,xmin=0,xmax=1,ymin=0,ymax=1)
> cat("The expected value of g(x,y)=")
The expected value of g(x,y)=
> i4
$Q
[1] 0.3333333

$error
[1] 5.89806e-17

> |
```

(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.

(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())

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

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

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

```
> #-----------------------------------------------------
> #Ques-2
>
> f<-function(x,y){
+   return ((x+y)/30)
+ }
> x<-c(0,1,2,3)
> y<-c(0,1,2)
> c<-matrix(0,4,3)
> c
     [,1] [,2] [,3]
[1,]    0    0    0
[2,]    0    0    0
[3,]    0    0    0
[4,]    0    0    0
> #i)display the joint mass function in rectangular (matrix) form.
>
> for(i in 1:length(x)){
+   for(j in 1:length(y)){
+     c[i,j]=f(x[i],y[j])
+   }
+ }
> c
           [,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?
>
> if(sum(c)==1){
+   print("It is a Joint mass function")
+ }else{
+   print("It is not a joint mass function")
+ }
[1] "It is a Joint mass function"
> #iii) find the marginal distribution g(x) for x = 0, 1, 2, 3.
>
> h_y<-apply(c,2,sum)
> h_y
[1] 0.2000000 0.3333333 0.4666667
> #iv)find the marginal distribution h(y) for y = 0, 1, 2.
> g_x<-apply(c,1,sum)
> g_x
[1] 0.1 0.2 0.3 0.4
```

```
> #v)find the conditional probability at x = 0 given y = 1
>
> cp<-c[1,2]/h_y[2]
> cp
[1] 0.1
> #vi) find E(x), E(y), E(xy), Var(x), Var(y), Cov(x,y) and its correlation coefficient.
>
> ex<-sum(x*g_x)
> cat("E(x)=",ex)
E(x)= 2
> ey<-sum(y*h_y)
> cat("E(y)=",ey)
E(y)= 1.266667
> ex2<-sum(x*x*g_x)
> ey2<-sum(y*y*h_y)
> varx<-ex2-ex*ex
> cat("Variance(x)=",varx)
Variance(x)= 1
> vary<-ey2-ey*ey
> cat("Variance(y)=",vary)
Variance(y)= 0.5955556
> fxy<-function(x,y){
+   return(x*y*f(x,y))
+ }
> m<-matrix(c(fxy(0,0:2),fxy(1,0:2),fxy(2,0:2),fxy(3,0:2)),nrow=4,ncol=3,byrow=T)
> exy<-sum(m)
> cat("E(xy)=",exy)
E(xy)= 2.4
> covxy<-exy-ex*ey
> cat("Covariance(x,y)=",covxy)
Covariance(x,y)= -0.1333333
> corrcoeff<-covxy/sqrt(varx*vary)
> cat("Correlation Coefficient= ",corrcoeff)
Correlation Coefficient=  -0.1727737
>
```