LAB 6

Q1 .

Code :

```
# To verify joint density function
library('pracma')

f = function(x, y){
  2*(2*x + 3*y)/5
}

I = integral2(f, xmin=0, xmax=1, ymin=0, ymax=1)
I$Q

gx_1 = function(y){
  f(1, y)
}

gx1 = integral(gx_1, 0, 1)
gx1

hy_0 = function(x){
  f(x, 0)
}
hy0 = integral(gy_1, 0, 1)
hy0

exp = function(x, y){
  f(x,y) * x * y
}

exp_i = integral2(exp, 0, 1, 0, 1)
exp_i$Q
```

Output :

```
> I = integral2(f, xmin=0, xmax=1, ymin=0, ymax=1)
> I$Q
[1] 1
> # To verify joint density function
> library('pracma')
>
> f = function(x, y){
+   2*(2*x + 3*y)/5
+ }
>
> I = integral2(f, xmin=0, xmax=1, ymin=0, ymax=1)
> I$Q
[1] 1
>
> gx_1 = function(y){
+   f(1, y)
+ }
>
> gx1 = integral(gx_1, 0, 1)
> gx1
[1] 1.4
```

```
> exp_i = integral2(exp, 0, 1, 0, 1)
> exp_i$Q
[1] 0.3333333
```

Q2.

Code :

```r
# Q2
# To verify joint probability mass function
f = function(x, y){
  (x + y)/30
}
x = c(0:3)
y = c(0:2)

m1 = 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(m1)

# to check joint prob mass function
sum(m1)

#marginal of x
hx=apply(m1, 1, sum)
print(hx)

#marginal of y
hy=apply(m1,2,sum)
print(hy)

# conditional prob
m1[1,2]
hy[2]
p = m1[1,2]/hy[2]
print(p)
```

```r
# expectation and variance
Ex = sum(x*hx)
print(Ex)

Ey = sum(y*hy)
print(Ey)

Ex2 = sum(x*x*hx)
Ey2 = sum(y*y*hy)

varx = Ex2 - Ex*Ex
print(varx)

vary = Ey2 - Ey*Ey
print(vary)
```

```r
f1 = function(x,y){x*y*(x+y)/30}
m2 = matrix(c(f(0, 0:2), f(1, 0:2), f(2, 0:2), f(3, 0:2)), nrow=4, ncol=3, byrow=TRUE)
Exy = sum(m2)
print(Exy)

# covariance
cov = Exy - Ex*Ey
print(cov)
```

Output :

```
> m1 = 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(m1)
           [,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
>
> # to check joint prob mass function
> sum(m1)
[1] 1
>
> #marginal of x
> hx=apply(m1, 1, sum)
> print(hx)
[1] 0.1 0.2 0.3 0.4
>
> #marginal of y
> hy=apply(m1,2,sum)
> print(hy)
[1] 0.2000000 0.3333333 0.4666667
>
> # conditional prob
> m1[1,2]
[1] 0.03333333
> hy[2]
[1] 0.3333333
> p = m1[1,2]/hy[2]
> print(p)
[1] 0.1
>
```

```
> Ex = sum(x*hx)
> print(Ex)
[1] 2
>
> Ey = sum(y*hy)
> print(Ey)
[1] 1.266667
>
> Ex2 = sum(x*x*hx)
> Ey2 = sum(y*y*hy)
>
> varx = Ex2 - Ex*Ex
> print(varx)
[1] 1
>
> vary = Ey2 - Ey*Ey
> print(vary)
[1] 0.5955556
```

```
> vary = Ey2 - Ey*Ey
> print(vary)
[1] 0.5955556
> f1 = function(x,y){x*y*(x+y)/30}
> m2 = matrix(c(f(0, 0:2), f(1, 0:2), f(2, 0:2), f(3, 0:2)), nrow=4, ncol=3, byrow=TRUE)
> Exy = sum(m2)
> print(Exy)
[1] 1
>
> # covariance
> cov = Exy - Ex*Ey
> print(cov)
[1] -1.533333
>
```