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ELEC 3800 – project 3

Due: 10/14/21

1. A scatter plot was created for the first 1000 points of “x” and “y”.

**Code:**

```
N = 2000000;  
x = rand(N,1);  
n = randn(N,1);  
y = 3*x+n;  
figure(1)  
scatter(x(1:1000,1),y(1:1000,1))
```

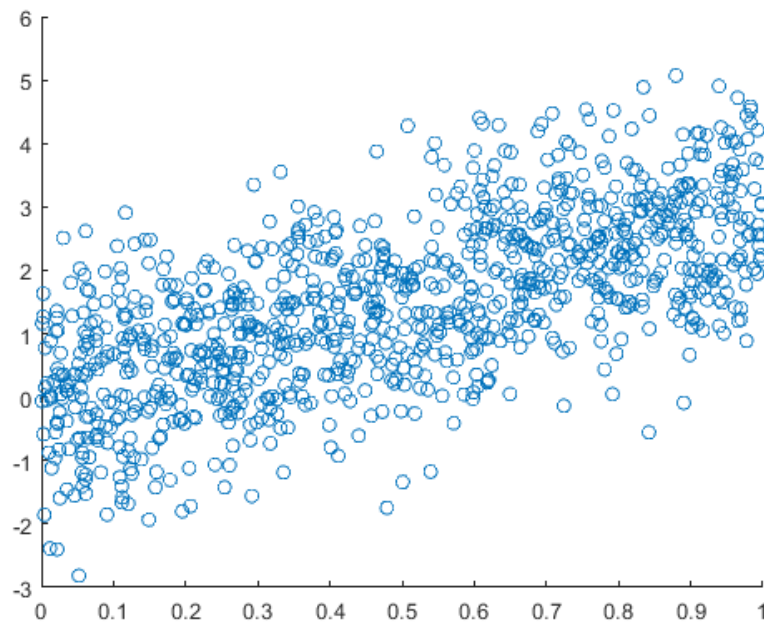


Figure 1: Scatter Plot

2. A 2D histogram was generated using hist3.

**Code:**

```
xc = [-0.2:0.025:1.2];  
yc = [-4.5:0.2:8];  
fxy = hist3([x y],{xc yc});  
figure(2)  
mesh(xc,yc,fxy')  
xlabel('x')  
ylabel('y')
```

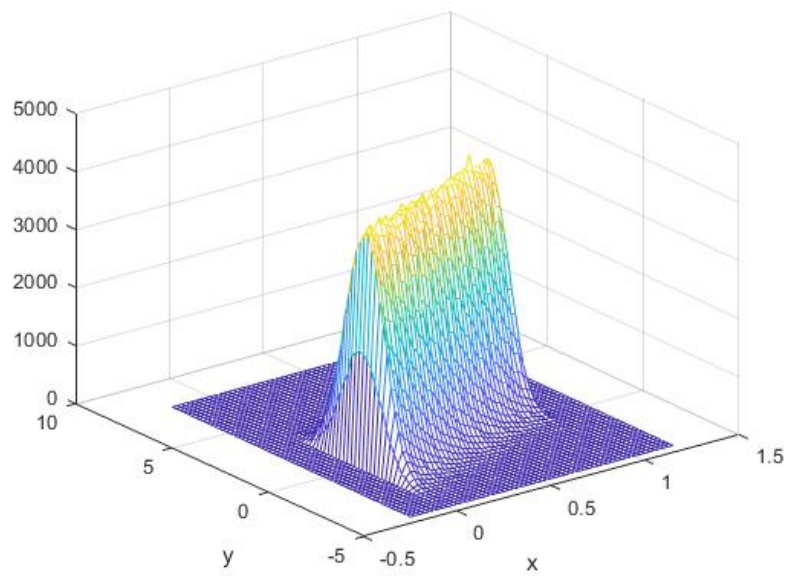


Figure 2: 2D Histogram

3. Based on the plot, what is the approximate most likely value of x if y = 1? y = 4? y = -2?

y-value	x-value
1	0.125
4	0.625
-2	0

4.  $E[XY]$  was estimated by using the formula below. The answer should be equivalent to  $5/3$ .

$$\frac{1}{N} \sum_{i=1}^N x_i y_i$$

**Code:**

```
summation = (1:N);
for i = (1:N)
    summation(i) = x(i)*y(i);
end
answer = sum(summation)/N

answer =

    1.6654
```

**Note:** This is approximately  $5/3$

5. The shape of the marginal density functions of “x” and “y” were estimated, multiplied, and plotted. This plot is straighter than that of part 2. It looks more like a typical Gaussian and makes estimating the x values to be more precise.

**Code:**

```
fx = hist(x,xc);  
fy = hist(y,yc);  
figure(3)  
mesh(xc,yc,fy'*fx)
```

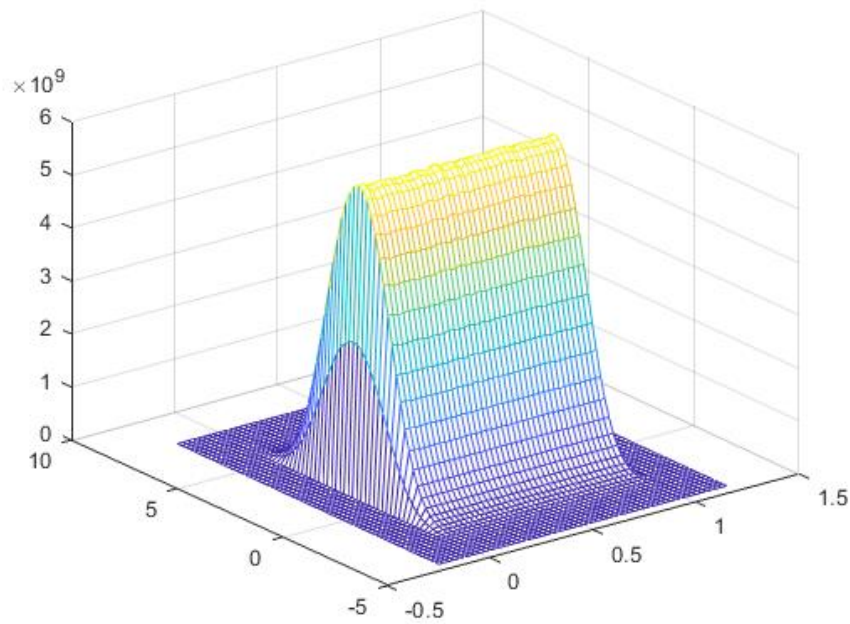


Figure 3: 2D Histogram Marginal Density Functions

X and Y are independent of each other. The y value remains the same regardless of the value of x. This contrasts with the graph from part 2 where the values are dependent on one another and vary with each value.