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

**Code:**

N = 1000000;

x = rand(N,1);

n = randn(N,1);

y = 5\*x+n;

figure(1)

scatter(x(1:1000,1),y(1:1000,1))

A close up of a map

Description automatically generated

Figure 1: Scatter Plot

1. A 2D histogram was generated using hist3.

**Code**:

xc = [-0.2:0.025:1.2];

yc = [-6.5:0.2:10];

fxy = hist3([x y],{xc yc});

figure(2)

mesh(xc,yc,fxy')

xlabel('x')

ylabel('y')

A close up of a cage

Description automatically generated

Figure 2: 2D Histogram

1. 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 |

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

**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

1. 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)

A screen shot of a social media post

Description automatically generated

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.