MATH 301

PROBABILITY

AND

STATISTICS

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Mini Project 1

Q1:

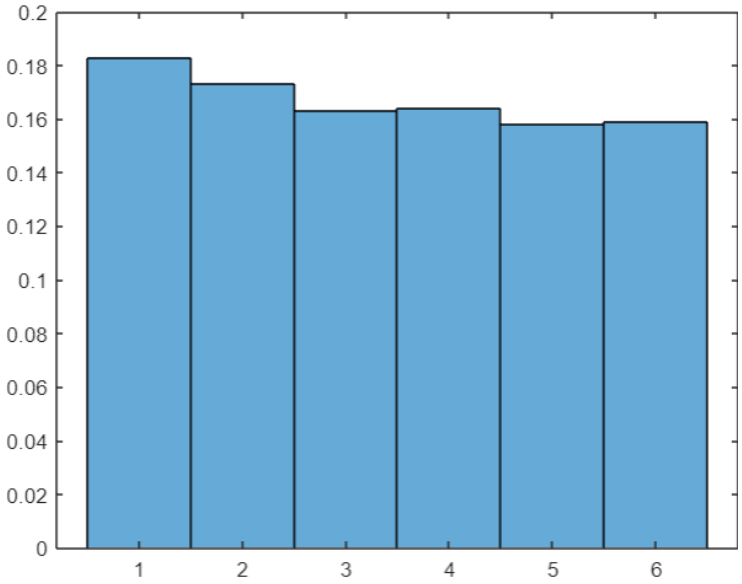
```
array=randi(6,1,1000);
histogram(array);
yticklabels(yticks*0.001);
fprintf("EV: %f SD: %f V: %f",mean(array) , std(array),var(array));
```

Explanation:

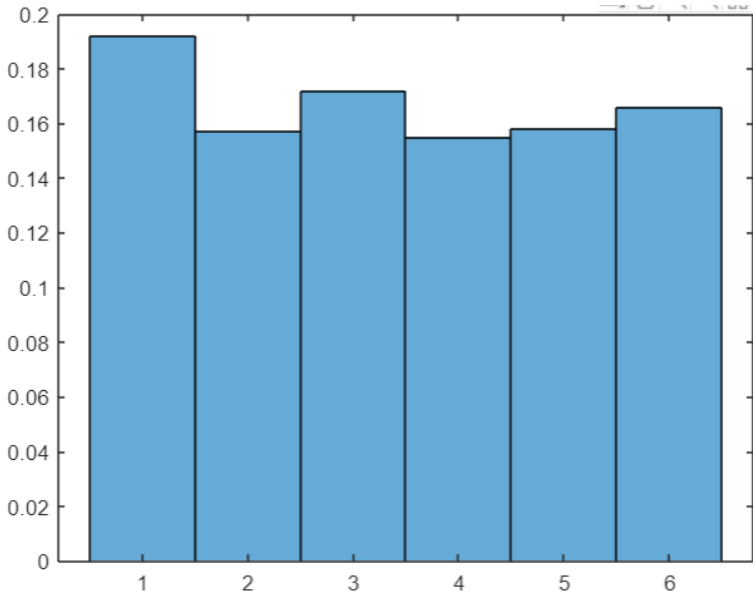
In the first parenthesis of first row, I wrote 6,1,1000. 6 means how many face a dice have, 1 means how many time we toss the dices and 1000 means how many dice are we use. With the second row, I gave a command to make a graph. In the third row, I divide the y column with 1000 to see PMF histogram. In the last row, I print the result as the expected value (EV), standard deviation (SD), and the variance (V) of the random variables.

Examples:

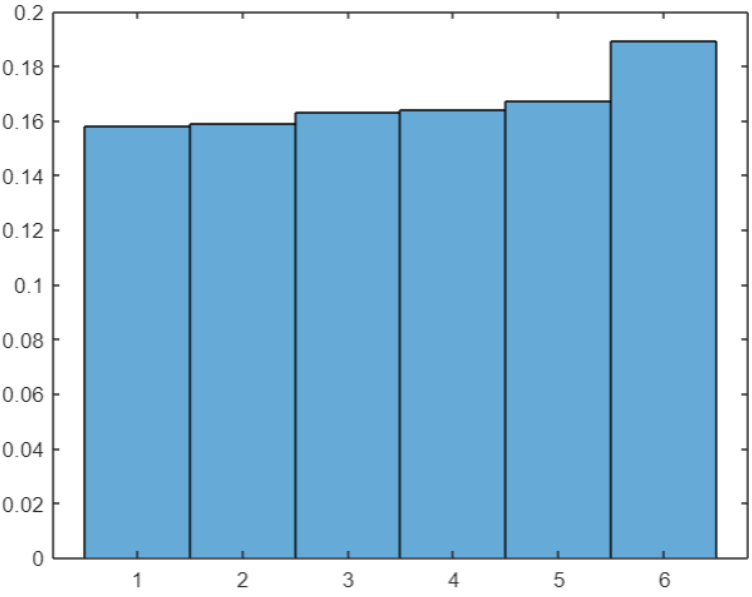
Test1: 3.418000 SD: 1.720534 V: 2.960236



Test2: EV: 3.428000 SD: 1.739495 V: 3.025842



Test3: EV: 3.590000 SD: 1.725943 V: 2.978879



When I execute the code 3 times, I got the results above. As we can see, the results are always close to each other. Expected value is very close to 3.5 as we talked in the lecture.

Q2:

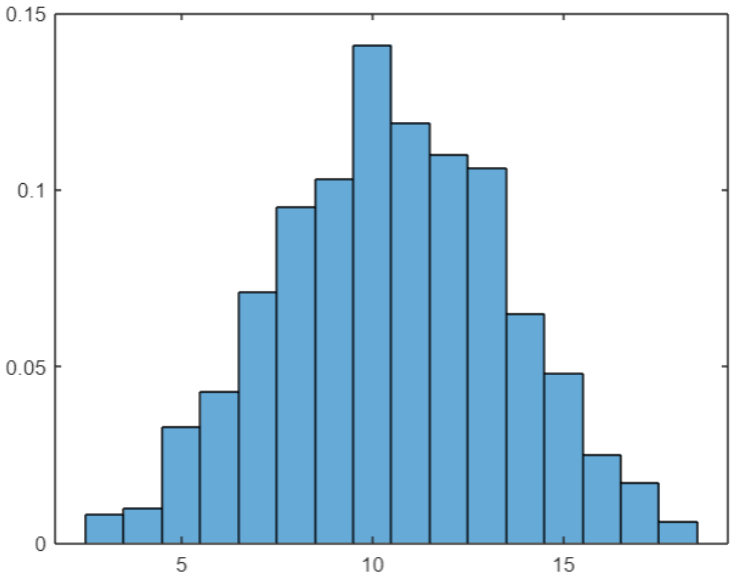
```
array=randi(6,3,1000);
sum=sum(array);
histogram(sum);
yticklabels(yticks*0.001);
fprintf("EV: %f SD: %f V: %f",mean(sum) , std(sum),var(sum));
```

Explanation:

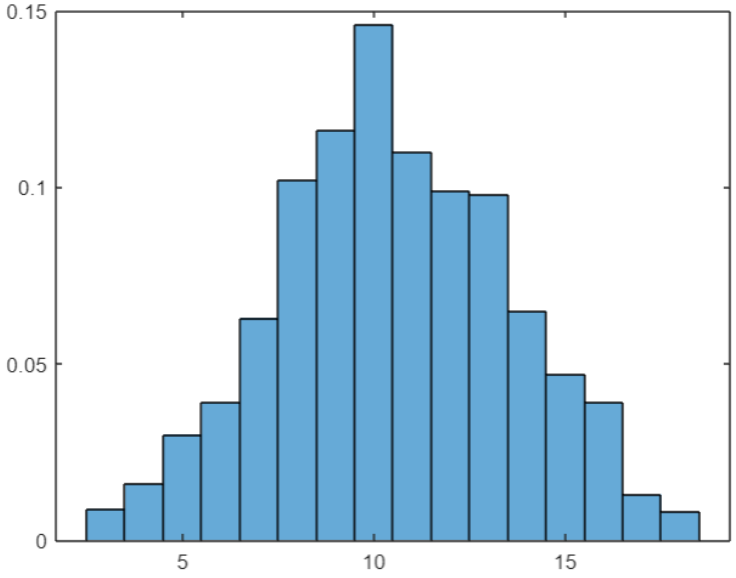
In the first parenthesis of first row, I wrote 6,3,1000. 6 means how many face a dice have, 3 means how many dices we have and 1000 means how many times we toss the dices. In the second row, I sum the 3 dices. In the third row, I made a histogram for the summation of the dices. For the 4th row, I divide the result to see probability. For the last row I printed the result as the expected value (EV), standard deviation (SD), and the variance (V) of the random variables.

Examples:

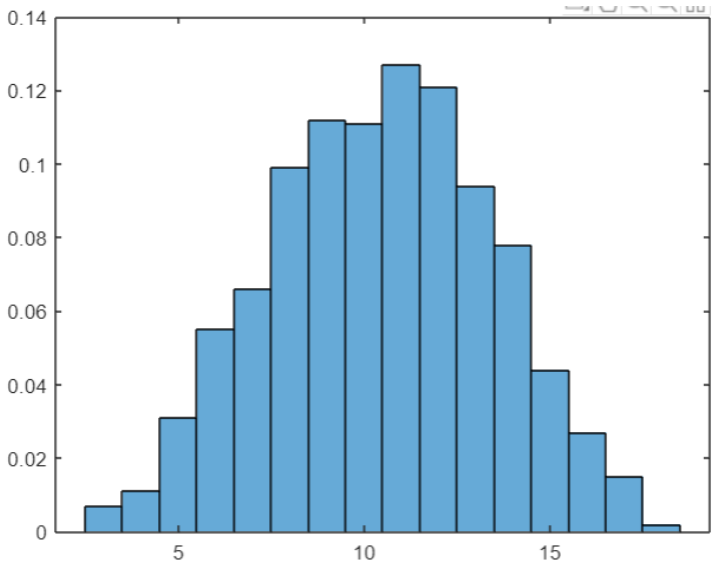
Test1: EV: 10.515000 SD: 3.000129 V: 9.000776



Test2: EV: 10.512000 SD: 3.063534 V: 9.385241



Test3: EV: 10.468000 SD: 2.987625 V: 8.925902



Q3:

```
N=input("How many times you want to flip?");
P=input("What is the probability of getting head?");
if P==0.5
Array = randi([0 1], 1, N);
end
if P==0.2
Array = randi([0 4], 1, N);
end
x=0;
for i=1:1:N
    if Array(i)==1
        x=x+1;
else
    Array(i)=0;
    end
end
fprintf("%d    EV: %f    V: %f ", x , mean(Array) ,var(Array));
Array
```

Explanation:

First 2 rows are for getting inputs from users. The user can enter how many times they want to flip and probability of getting head. Then I made 2 different possibilities for coin. 0.5 is for fair coin and 0.2 is for unfair coin. The if conditions are for outputs of tosses. For fair coin there are 2 different possibilities which are 0 and 1. For unfair coin there are 5 different possibilities which are 0,1,2,3,4. I said 1 is head. For loop is for a counter for our attempts. When I get 1, the counter increase 1. And for printing the result, I print the result as the expected value (EV), standard deviation (SD), and the variance (V) of the random variables. Last row is for seeing array values that we obtain.

I made the example with 10 tosses. For the 0.2 probability of getting head and for the 0.5 probability of getting head shown below. As we can see, when the probability is 0.2, the result for expected value is very close to 0.2. when we made the probability as 0.5, the expected value is close to 0.5 because of the fair coin.

Examples:

Test1:

How many times you want to flip?
10
What is the probability of getting head?
0.5
7   EV: 0.700000   V: 0.233333

Test2:

How many times you want to flip?
10
What is the probability of getting head?
0.2
2   EV: 0.200000   V: 0.177778

Test3:

How many times you want to flip?
100
What is the probability of getting head?
0.5
40   EV: 0.400000   V: 0.242424

Test4:

How many times you want to flip?
100
What is the probability of getting head?
0.2
13   EV: 0.130000   V: 0.114242

Probability	Toss Number	Expected Value	Variance
0.5	10	0.700	0.2333
0.5	100	0.400	0.2424
0.2	10	0.200	0.1777
0.2	100	0.130	0.1142

Q4:

```
clc;
clear;
p=input("What is the probability of getting head?")

  if p==0.2;
    for x=1:100
    for y=1:500
        toss = randi([0 4], 1, 1);
    if toss==1
         break;
    end
    end
       Array(x)=y;
    end
    Array
  end

   if p==0.5;
    for x=1:100
    for y=1:500
        toss = randi([0 1], 1, 1);
    if toss==1
         break;
    end
    end
       Array(x)=y;
    end
Array
end
fprintf("EV: %f V: %f ", mean(Array), var(Array));
```

Explanation;

First 2 row code clear the console and existing results. We are getting an input about probability of getting head from user with the 3rd row. And then we have 2 different possibilities such as 0.2 and 0.5. I made a table with the different inputs to make example clear.

When we made the 100 or 1000 tosses with 0.5 probability, we generally have the head in 2nd toss. So the expected value is very close to 2. When we change the probability with 0.2, we generally got the head in our 5th tosses. Because of this, the expected value is close 5.

Probability	Toss Number	Expected Value	Variance
0.2	100	4.650	20.1287
0.2	1000	4.998	18.0480
0.5	100	1.900	1.8686
0.5	1000	2.073	2.4761