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SLOT: L19+L20

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LAB EXPERIMENT 3

RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS

AIM:

Conducting random experiments with probability concepts.

QUESTION:

1. Select 20 numbers at random from the set 1 to 100
2. Sampling with replacement is suitable for throwing of a die.
3. roll 2 dice and find the product of the face values when rolling two dice
4. Combination for nCr (assign values for n and r)
5. Permutation (assign values for n and r)
6. To find the binomial co efficient of 8th to 10th terms
7. Pascal's triangle.
8. Tossing '3' coins with library 'prob'
9. Roll '4' dice with library 'prob'
10. To find expectation and variance for Discrete Random Variable. compute expectation and variance.

A discrete random variable X has the following probability distribution:

x	13	18	20	24	27
$P(x)$	0.22	0.25	0.20	0.17	0.16

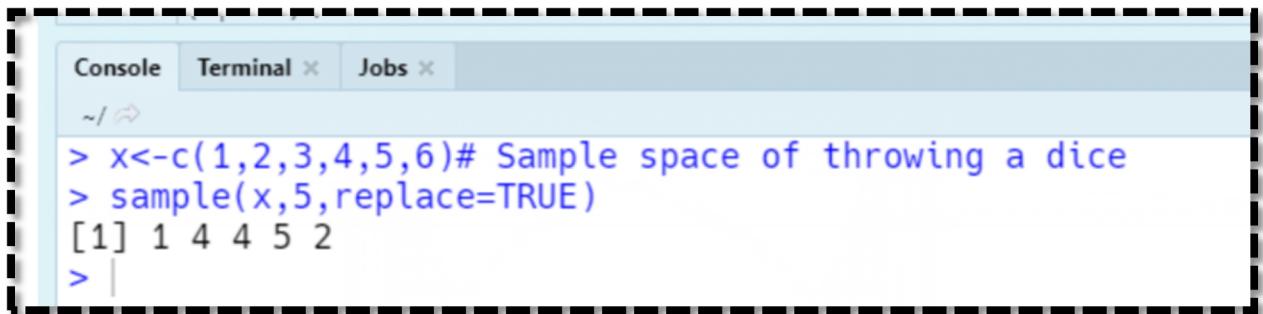
ANSWERS

1] 20 RANDOM VARIABLES FROM THE SET OF 1 TO 100.



```
Console Terminal × Jobs ×
~/
> sample(1:100,20)
[1] 1 64 33 86 96 72 48 97 54 10 8 79 77 66 58 16 46 82 43 5
> |
```

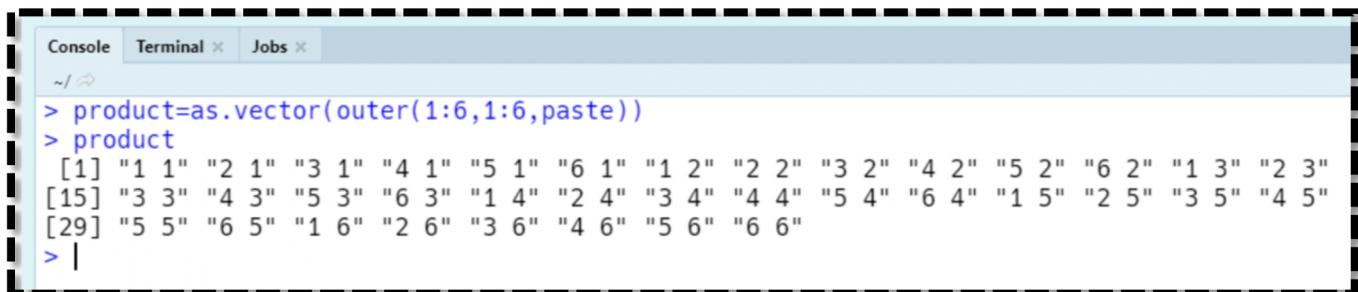
2]



```
Console Terminal × Jobs ×
~/
> x<-c(1,2,3,4,5,6)# Sample space of throwing a dice
> sample(x,5,replace=TRUE)
[1] 1 4 4 5 2
> |
```

3]

The Sample Space:



```
Console Terminal × Jobs ×
~/
> product=as.vector(outer(1:6,1:6,paste))
> product
[1] "1 1" "2 1" "3 1" "4 1" "5 1" "6 1" "1 2" "2 2" "3 2" "4 2" "5 2" "6 2" "1 3" "2 3"
[15] "3 3" "4 3" "5 3" "6 3" "1 4" "2 4" "3 4" "4 4" "5 4" "6 4" "1 5" "2 5" "3 5" "4 5"
[29] "5 5" "6 5" "1 6" "2 6" "3 6" "4 6" "5 6" "6 6"
> |
```

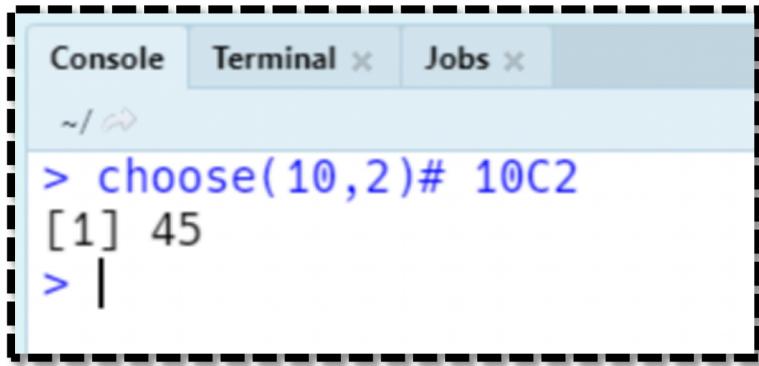
The Face Products:



A screenshot of an R console window. The title bar says "Console Terminal x Jobs x". The working directory is shown as "~ /". The command entered is "> product=as.vector(outer(1:6,1:6))". The output shows two rows of numbers: [1] 1 2 3 4 5 6 2 4 6 8 10 12 3 6 9 12 15 18 4 8 12 16 20 24 5 10 15 20 and [29] 25 30 6 12 18 24 30 36. A final ">" prompt is at the bottom.

4]

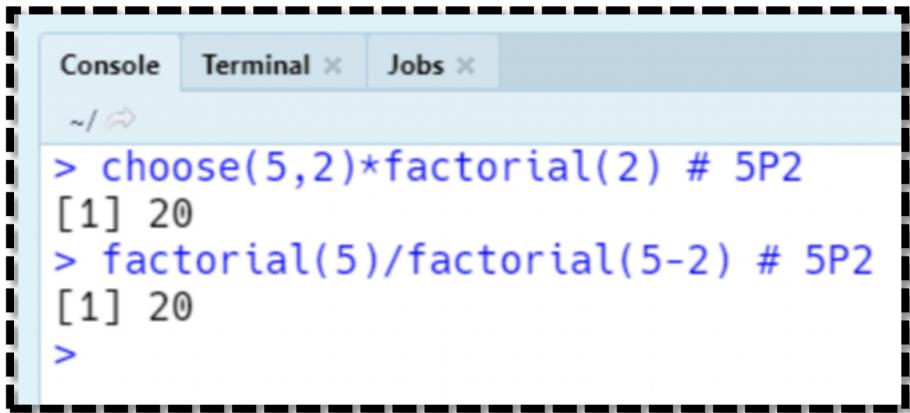
Combination:



A screenshot of an R console window. The title bar says "Console Terminal x Jobs x". The working directory is shown as "~ /". The command entered is "> choose(10,2) # 10C2". The output shows [1] 45. A final ">" prompt is at the bottom.

5]

Permutation:



A screenshot of an R console window. The title bar says "Console Terminal x Jobs x". The working directory is shown as "~ /". The first command entered is "> choose(5,2)*factorial(2) # 5P2", followed by [1] 20. The second command entered is "> factorial(5)/factorial(5-2) # 5P2", followed by [1] 20. Both commands end with a final ">" prompt.

6]

All the terms:



```
Console Terminal × Jobs ×  
~/  
> choose(10,0:10)  
[1] 1 10 45 120 210 252 210 120 45 10 1  
>
```

The 8th to 10th terms:

```
Console Terminal × Jobs ×  
~/  
> choose(10,7:9)  
[1] 120 45 10  
>
```

7]

Pascal's Triangle:

```
Console Terminal × Jobs ×  
~/  
> for (n in 0:6) print(choose(n,0:n))  
[1] 1  
[1] 1 1  
[1] 1 2 1  
[1] 1 3 3 1  
[1] 1 4 6 4 1  
[1] 1 5 10 10 5 1  
[1] 1 6 15 20 15 6 1  
>
```

8]

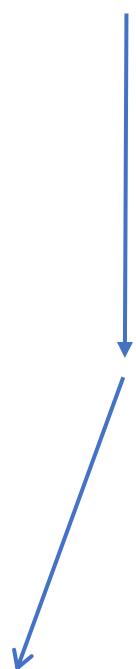
Tossing 3 Coins:

```
Console Terminal × Jobs ×
~/
> library(prob)
> tosscoin(3)
toss1 toss2 toss3
1     H     H     H
2     T     H     H
3     H     T     H
4     T     T     H
5     H     H     T
6     T     H     T
7     H     T     T
8     T     T     T
>
```

9]

Throwing 4 Die:

(As there are **268,738,560,000** Possibilities only few are shown below)



Console Terminal × Jobs ×

~/ ↵

> rolldie(4)

	X1	X2	X3	X4
1	1	1	1	1
2	2	1	1	1
3	3	1	1	1
4	4	1	1	1
5	5	1	1	1
6	6	1	1	1
7	1	2	1	1
8	2	2	1	1
9	3	2	1	1
10	4	2	1	1
11	5	2	1	1
12	6	2	1	1
13	1	3	1	1
14	2	3	1	1
15	3	3	1	1
16	4	3	1	1
17	5	3	1	1
18	6	3	1	1
19	1	4	1	1
20	2	4	1	1
21	3	4	1	1
22	4	4	1	1
23	5	4	1	1
24	6	4	1	1
25	1	5	1	1
26	2	5	1	1
27	3	5	1	1
28	4	5	1	1
29	5	5	1	1
30	6	5	1	1
31	1	6	1	1
32	2	6	1	1
33	3	6	1	1
34	4	6	1	1
35	5	6	1	1
36	6	6	1	1
37	1	1	2	1
38	2	1	2	1

10]

The mean, expectation, variance, and standard deviation.

```
Console Terminal × Jobs ×
~/
> x<-c(13,18,20,24,27)
> p<-c(0.22,0.25,0.20,0.17,0.16)
> m=sum(x*p)
> m
[1] 19.76
> expectation=sum(x^2*p)
> expectation
[1] 412.74
> variance=expectation-(m^2)
> variance
[1] 22.2824
> standdeviation=sqrt(variance)
> standdeviation
[1] 4.720424
>
```

11]

RANDOM VARIABLE DISTRIBUTION, PROBABILITY MASS DISTRIBUTION FOR THAT RANDOM VARIABLES, IT'S EXPECTATION, VARIANCE, AND CUMMULATIVE FREQUENCY.



```
Console Terminal × Jobs ×
~/
> x=c(1,2,3,4,5)
> p=c(0.1,0.2,0.1,0.3,0.3)
> x
[1] 1 2 3 4 5
> p
[1] 0.1 0.2 0.1 0.3 0.3
>
> pmf=sum(p)
> pmf
[1] 1
> m=sum(x*p)
> m
[1] 3.5
>
> e2=sum(x^2*p)
> e2
[1] 14.1
>
> v=e2-m^2
> v
[1] 1.85
>
> f=cumsum(p)#Cummulative Frequency
> f
[1] 0.1 0.3 0.4 0.7 1.0
> |
```

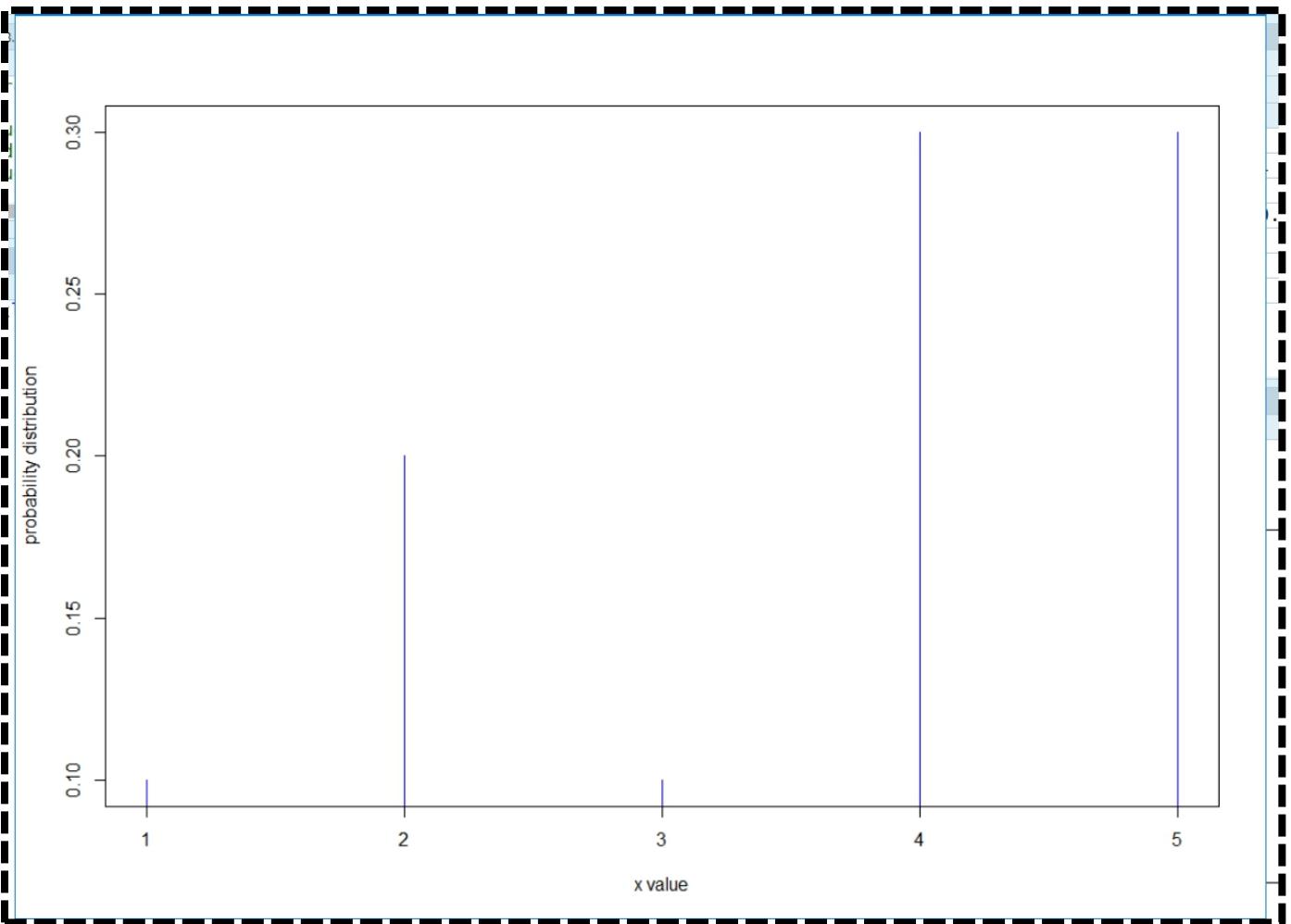
12]

VARIOUS REPRESENTATIONS OF RANDOM VARIABLES

COMMAND

```
~/
> plot(x,p,type='h',col='blue',xlab='x value',ylab = 'probability distribution') #type h is histogram
>
```

DIAGRAM:

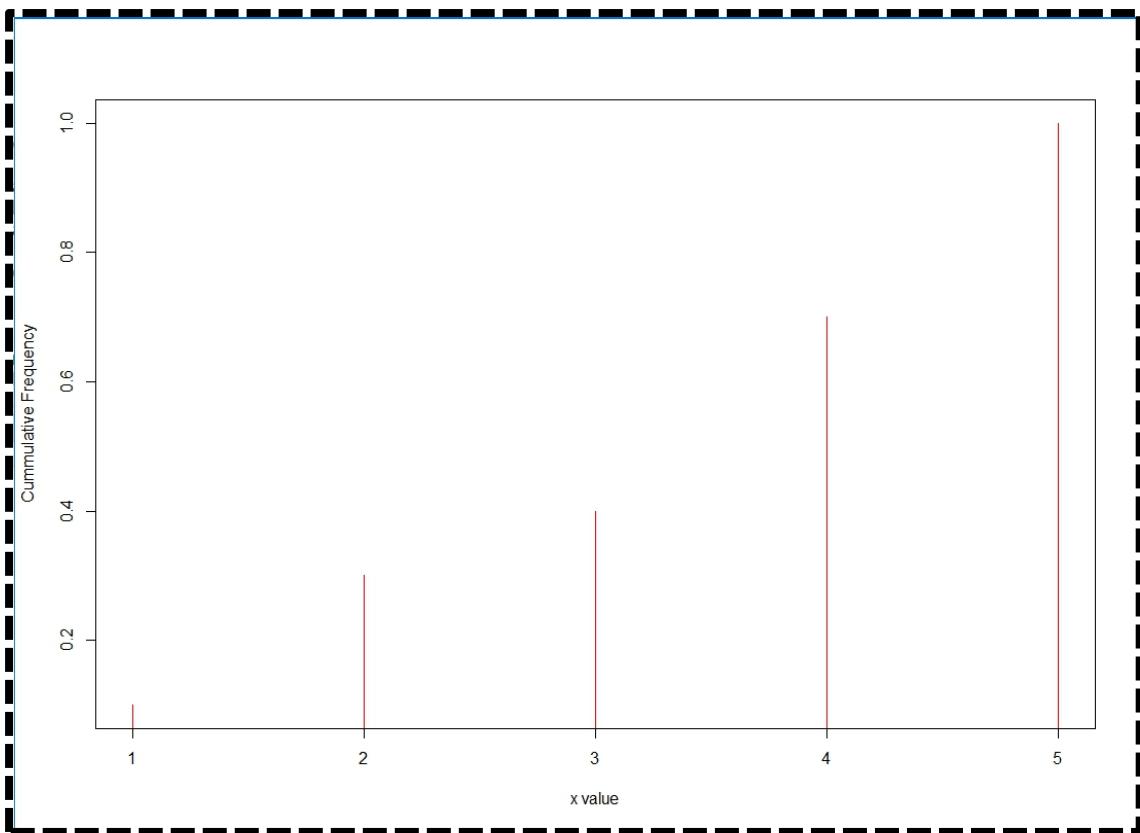


COMMAND

```
Console Terminal × Jobs × ~/ ↗> plot(x,f,type='h',col='red',xlab='x value',ylab = 'Cummulative Frequency')>
```

DIAGRAM





COMMAND

```
~/Documents> plot(x,f,type='s',col='blue',xlab='x value',ylab = 'Cumulative Frequency') #type s is step graph
>
```

DIAGRAM



