RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS

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Aim:

1. Conducting random experiments with probability concepts
2. Computing and Plotting Binomial and Poisson Distributions

Code:

```
# Generating 5 random variables in-between 1 to 50

sample(1:50,5)
```

```
[1] 32  6 10 23 50
```

```
# Generating 5 random variables in-between 1 to 50 with repetition

for (i in c(1:5)) {

  print(sample(1:6,10,replace = TRUE))

}
```

```
[1] 6 5 2 5 6 6 5 5 1 6
[1] 3 6 2 1 3 2 2 6 2 6
[1] 2 6 4 1 4 5 3 4 3 6
[1] 2 6 4 3 2 6 4 6 3 4
[1] 6 6 3 3 4 5 1 3 5 6
```

```
# Roll 2 Dice (Sample Space of rolling Two Dice)

dice= as.vector(outer(1:6,1:6,paste))

dice
```

```
[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" "3 3" "4 3" "5 3" "6 3" "1 4" "2 4"
[21] "3 4" "4 4" "5 4" "6 4" "1 5" "2 5" "3 5" "4 5" "5 5" "6 5" "1 6" "2
6" "3 6" "4 6" "5 6" "6 6"
```

```
dice= as.vector(outer(1:6,1:6)) ## Product of face values when rolling two dice

dice

[1]  1  2  3  4  5  6  2  4  6  8 10 12  3  6  9 12 15 18  4  8 12 16 20 2
4  5 10 15 20 25 30  6 12 18 24 30 36


# Probabilities for the outcomes (chance of success) by using the 'prob' argument to sample

##Replace = F won't work

print(sample(c("Success", "Fail"),10, replace = T,prob = c(0.9,0.1)))

[1] "Success" "Success" "Success" "Success" "Success" "Fail"    "Success"
"Success" "Success" "Success"

sample(c("Success","Fail"),10,replace=T) ## no restriction on output

[1] "Fail"    "Success" "Success" "Fail"    "Fail"    "Fail"    "Success"
"Success" "Fail"    "Success"


# Combination of nCr

choose(7,2)

[1] 21


# Probability

p = factorial(10)/factorial(5)

[1] 30240


#To find the binomial co-efficient using choose command

choose(10,0:10) # for n=10 and x ranges from 0 to 10

[1]   1  10  45 120 210 252 210 120  45  10   1


for (n in 0:10) 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
[1]  1  7 21 35 35 21  7  1
[1]  1  8 28 56 70 56 28  8  1
[1]   1   9  36  84 126 126  84  36   9   1
[1]   1  10  45 120 210 252 210 120  45  10   1


# Tossing 'n' coins
```

n =3

library(prob)

tosscoin(n)

```
  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
```

#[OR]

prob::tosscoin((n))

```
  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
```

tosscoin(n,makespace = TRUE)

```
  toss1 toss2 toss3 probs
1     H     H     H 0.125
2     T     H     H 0.125
3     H     T     H 0.125
4     T     T     H 0.125
5     H     H     T 0.125
6     T     H     T 0.125
7     H     T     T 0.125
8     T     T     T 0.125
```

rolldie(2)

```
   X1 X2
1   1  1
2   2  1
3   3  1
4   4  1
5   5  1
6   6  1
7   1  2
8   2  2
9   3  2
10  4  2
11  5  2
12  6  2
13  1  3
```

```
14   2   3
15   3   3
16   4   3
17   5   3
18   6   3
19   1   4
20   2   4
21   3   4
22   4   4
23   5   4
24   6   4
25   1   5
26   2   5
27   3   5
28   4   5
29   5   5
30   6   5
31   1   6
32   2   6
33   3   6
34   4   6
35   5   6
36   6   6
```

m=2

rolldie((n.nsides=m))

```
    X1 X2
1    1  1
2    2  1
3    3  1
4    4  1
5    5  1
6    6  1
7    1  2
8    2  2
9    3  2
10   4  2
11   5  2
12   6  2
13   1  3
14   2  3
15   3  3
16   4  3
17   5  3
18   6  3
19   1  4
20   2  4
21   3  4
22   4  4
23   5  4
24   6  4
25   1  5
26   2  5
27   3  5
28   4  5
29   5  5
30   6  5
31   1  6
```

```
32  2  6
33  3  6
34  4  6
35  5  6
36  6  6
```

To find expectation and variance for Discrete random Variables

```
x=c(0:3)

p=c(1/8,3/8,3/8,1/8)

mean=sum(x*p)

mean

[1] 1.5

variance = sum((x^2*p))-(mean^2)

variance

[1] 0.75
```