Problem Statement 1:

A test is conducted which is consisting of 20 MCQs (multiple choices questions) with

every MCQ having its four options out of which only one is correct. Determine the

probability that a person undertaking that test has answered exactly 5 questions wrong.

In [3]:
```
# Importing libraries
from scipy.stats import binom
# No. of Trails = No.of multiple choice questions
n = 20

# Number of questions answered wrong  = 5
success = 5

# Probability of getting a question right  = 1 - (No. of correct answers per questi
on/Total number of possible answers per question)
p = 1 - (1/4)
print(p)
```

```
0.75
```

In [4]:
```
# PMF is the function that we can use to get the probability of exact values
print("The probability that a person undertaking the test answered exactly 5 questi
ons wrong is : {:0.10f}".format(binom.pmf(success, n, p)))
```

```
The probability that a person undertaking the test answered exactly 5 questions
wrong is : 0.0000034265
```

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Step 1: Determine the Formula: Binomial Distribution: Bernoulli trials where n = 1 n = number of trials attempted, k = number of successes in ‘n’ trials n - k = number of failures s = probability of success in a trial (1 - s) = probability of failure

P (‘k’ successes in ‘n’ trials) = C(n,k)*(s^k)*((1−s)^(n−k)) where, C (n, k) = n!/(k!(n−k)!)

Step 2: Formula substitution:

n = 20 n - k = 5 k = 20 - 5 = 15

s = (1/4), where probability of success or the right answer 1 - s = 1 - (1/4) = (3/4), where probability of failure or the wrong answer

Therefore the binomial distribution is P (exactly 5 out of 20 answers incorrect) = C (20,5) *((1/4)^15)* ((3/4)^5)

= P (5 out of 20) = (20*19*18*17*16)/(5*4*3*2*1) *(1/4)^15* (3/4)^5

= 3.4 * 10^(-6) = 0.0000034

Problem Statement 2:

A die marked A to E is rolled 50 times. Find the probability of getting a “D” exactly 5 times.

In [6]:
```
# Importing libraries
from scipy.stats import binom

# No. of Trails =  No. of times the die is rolled i.e. 50
n=50

# The die has to roll a “D” exactly 5 times
success = 5

# Probability of getting "D" when rolled once is =  1/5
p = 1/5
print("p: ", p)
p:  0.2

# PMF is the function that we can use to get the probability of exact values
print("The probability of getting a “D” exactly 5 times is : {:0.10f}".format(binom
.pmf(success,n,p)))
```

```
p:  0.2
The probability of getting a “D” exactly 5 times is : 0.0295312043
```

Here, n = 50, k = 5, n - k = 4/5.

The probability of success = probability of getting a “D”= s = 1/5

Hence, the probability of failure = probability of not getting a “D” = 1 - s = 4/5.

In [ ]:
```

```

Problem Statement 3:

Two balls are drawn at random in succession without replacement from an urn containing 4 red balls and 6 black balls. Find the probabilities of all the possible outcomes.

In [7]:
```
# Importing libraries# Impor
from scipy.stats import binom

# Initializing values
r = 4 # No. of red balls
b = 6 # No. of black balls
t = r + b # Total number of balls
```

In [8]:
```
#There are only four possible combinations when the two balls are drawn at random:
# (red, red),(red,black),(black, red), (black, black)

# Probability of (red, red)
prob_rr = ((r/t)*((r-1)/(t-1)))
print("Probability of (red, red): ", prob_rr)

# Probability of (red, black)
prob_rb = ((r/t)*((b)/(t-1)))
print("Probability of (red,black): ", prob_rb)

# Probability of (black, red)
prob_br = ((b/t)*((r)/(t-1)))
print("Probability of (black, red): ", prob_br)

# Probability of (black, black)
prob_bb =  ((b/t)*((b-1)/(t-1)))
print("Probability of (black, black): ", prob_bb)
```

```
Probability of (red, red):  0.13333333333333333
Probability of (red,black):  0.26666666666666666
Probability of (black, red):  0.26666666666666666
Probability of (black, black):  0.3333333333333333
```

In [9]:
```
# The probabilty of all possible outcomes
prob_all = ((r/t)*((r-1)/(t-1)))  +  ((r/t)*((b)/(t-1)))  +  ((b/t)*((r)/(t-1)))
+  ((b/t)*((b-1)/(t-1)))
# OR
# prob_all = prob_rr + prob_rb + prob_br + prob_bb
prob_all
```

Out[9]: 1.0

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First determine the probabilities of the events.

Table of Probability of events	
Events	**Probability**
RR	(4/10)(3/9) = 2/15
RB	(4/10)(6/9) = 4/15
BR	(6/10)(4/9) = 4/15
BB	(6/10)(5/9) = 1/3

The probability of 0 black balls (RR)is 2/15

The probability of 1 black ball is (RB or BR) is 4/15+4/15 = 8/15

The probability of 2 black balls (BB) is 1/3

If Z is the random variable representing the number black balls. The probability distribution will be :

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BB	(6/10)(5/9) = 1/3

Notice that the sum of the probabilities = 2/15+8/15+1/3 = 1

```
In [ ]:
```