In [1]:

```python
import numpy as np
```

In [2]:

```python
# INTERSECTIONS AND UNION RULE
```

```
P[A ∪ B] = P[A] + P[B] - P[A ∩ B]     # Always True
```

In [ ]:

```python

```

In [ ]:

```python

```

In [3]:

```python
# CONDITIONAL PROBABILITY
```

```
P[A|B] = P[A ∩ B]/P[B]           # Always True
```

In [ ]:

```python

```

In [4]:

```python
# A and B are independent events if
```

```
P[A|B] = P[A]
P[B|A] = P[B]
```

```
P[A ∩ B] = P[A] * P[B] if A and B are independent
P[A ∩ B ∩ C] = P[A] * P[B] * P[C]    if  A , B , C are indepenedent events

```

In [ ]:

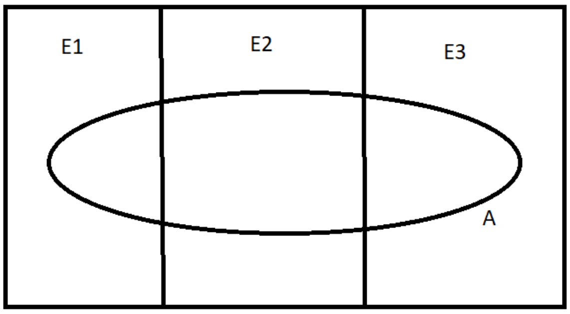
```python

```

In [ ]:

```python

```

In [5]:

```python
# BAYES THEOREM
```



```
if E1 E2 E3  are mutually exhaustive events     E1 ∪ E2 ∪ E3 = S
E1 ∩ E2 = {}
E2 ∩ E3 = {}
E3 ∩ E1 = {}   And Mututally Exclusive events

P[E1|A] = p[A|E1] * p[E1] /                                 # Always True
            P[A]

P[A] = P[A|E1]*P[E1] + P[A|E2]*P[E2] + P[A|E3]*P[E3]

P[E1|A] = (P[A|E1] * P[E1]) /
        (P[A|E1]*P[E1] + P[A|E2]*P[E2] + P[A|E3]*P[E3])
             # True only for Mutually Exclusive and Exhaustive evenets

```

In [ ]:

In [ ]:

```
∩
```

```
∪
```

In [ ]:

In [ ]:

In [ ]:

A random variable describes the outcomes of a statistical experiment in words. The values of a random variable can vary with each repetition of an experiment.

Random Variable:

A random variable is a variable that takes numerical values as a result of a random experiment or measurement ; associates a numerical value with each possible outcome.

RVs must have numerical values

```
Random Variable is denoted by a X.

```

```
for die roll : x = 1,2,3,4,5,6

A discrete random variable is a vriable that may take on either a finite number of values or an infinite sequence of values such as 0,1,2,3,... .
```

In [ ]:

```
Discrete probabiliy distribution :

    class overall satisfaction: given by 108 students :
            1 = very dissatisfied
            2 = very satisfied

    x        count     count/total =P(x)
    1        5             0.046
    2        10            0.093
    3        11            0.102
    4        44            0.407
    5        38            0.351
         total : 108    total p = 1


  P(x = 4,5) : P(student is satisfied and very satistifed):
  = 0.407 + 0.351
  = 0.758


```

Type *Markdown* and LaTeX: α^2

In [ ]:

```
```

In [ ]:

```
```

In [ ]:

```
```

In [ ]:

```
```

Expected Value

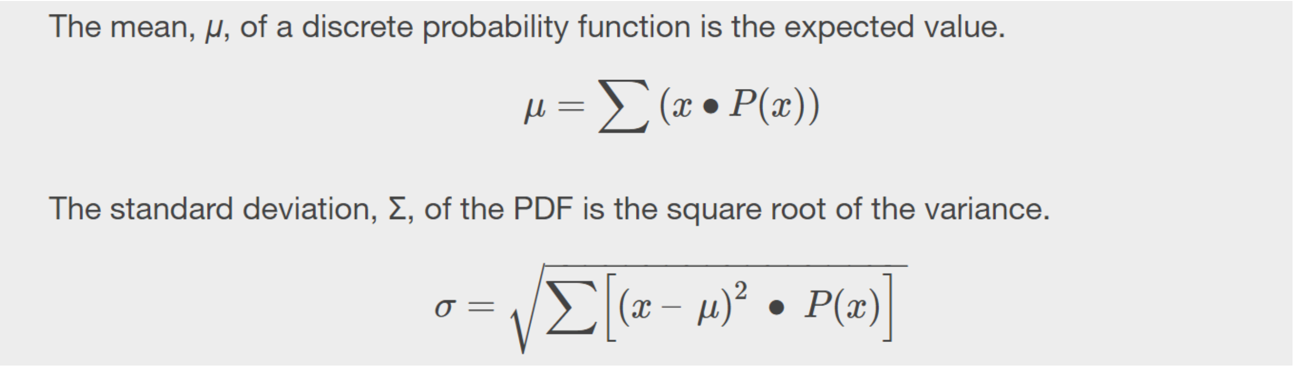
```
The expected value is simply the mean of a random variable ;
the average expeced outcome .
Iit doent not have to be a value that discrete random variable can assume.
```

```
E(X) = Σ(x*P(x))

```

```
The Law of Large Numbers states that, as the number of trials in a probability experiment increases, the difference between the theoretical probability of an event and the relative frequency approaches zero (the theoretical probability and the relative frequency get closer and closer together).
```

```
When evaluating the long-term results of statistical experiments, we often want to know the “average” outcome.
```

```
This “long-term average” is known as the mean or expected value of the experiment and is denoted by the Greek letter μ. In other words, after conducting many trials of an experiment, you would expect this average value.
```

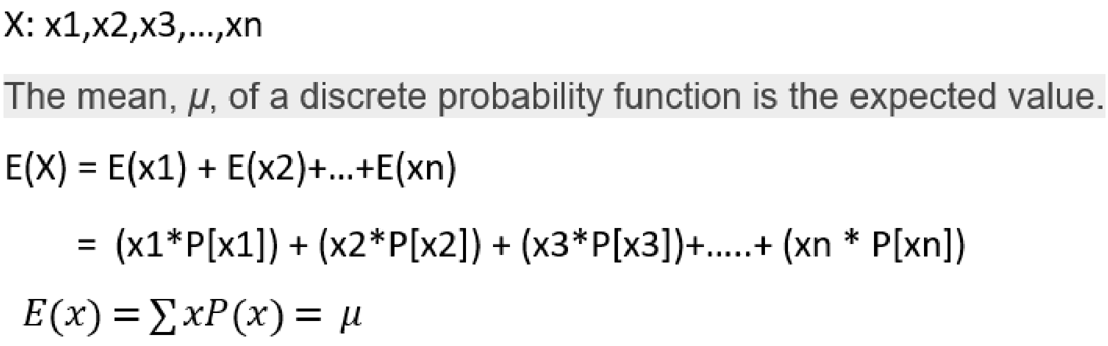


The mean, μ, of a discrete probability function is the expected value.

$$\mu = \sum (x \bullet P(x))$$

The standard deviation, Σ, of the PDF is the square root of the variance.

$$\sigma = \sqrt{\sum \left[(x - \mu)^2 \ \bullet \ P(x) \right]}$$



X: x1,x2,x3,...,xn

The mean, μ, of a discrete probability function is the expected value.

E(X) = E(x1) + E(x2)+...+E(xn)

= (x1*P[x1]) + (x2*P[x2]) + (x3*P[x3])+.....+ (xn * P[xn])

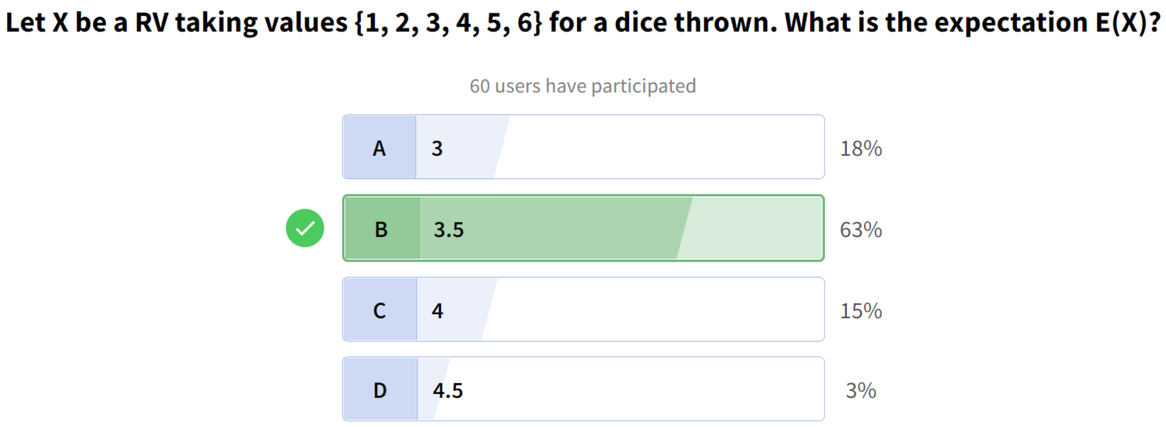
$$E(x) = \sum xP(x) = \mu$$

the variance.

$$
\begin{aligned}
&Var(x) = E(x-\mu)^2 \\
&= E\left(x^2 - 2x\mu + \ \mu^2\right) \\
&= E\left(x^2\right) - 2\mu\left(E(x)\right) + E\left(\mu^2\right) \\
&= E\left(x^2\right) - 2\mu\mu + E\left(\mu^2\right) \\
&= E\left(x^2\right) - 2\mu^2 + \ \mu^2 \\
&= E\left(x^2\right) - \ \mu^2 \\
&= E\left(x^2\right) - \left(E(x)\right)^2
\end{aligned}
$$

In [ ]:

```

```



Let X be a RV taking values {1, 2, 3, 4, 5, 6} for a dice thrown. What is the expectation E(X)?

60 users have participated

A	3	18%
✓ B	3.5	63%
C	4	15%
D	4.5	3%

In [7]:

```
(1*(1/6))+(2*(1/6))+(3*(1/6))+(4*(1/6))+(5*(1/6))+(6*(1/6))
# E(X) = Σ(x*P(x))
```

Out[7]: 3.5

In [ ]:

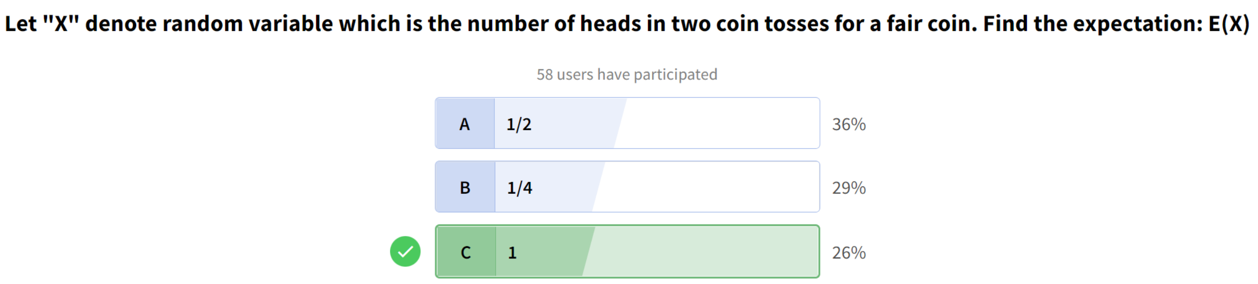
```

```

```
    class overall satisfaction: given by 108 students :
            1 = very dissatisfied
            2 = very satisfied

    x         count     count/total =P(x)    x*P(x)
    1         5             0.046             0.046
    2         10            0.093             0.186
    3         11            0.102             0.306
    4         44            0.407             1.628
    5         38            0.351             1.755
         total : 108     total p = 1       Σ(x*P(x)) = 3.70
                                       average|expected rating : 3.70

```

Type *Markdown* and LaTeX: α^2

In [ ]:

```

```



Let "X" denote random variable which is the number of heads in two coin tosses for a fair coin. Find the expectation: E(X)

58 users have participated

A	1/2	36%
B	1/4	29%
✓ C	1	26%

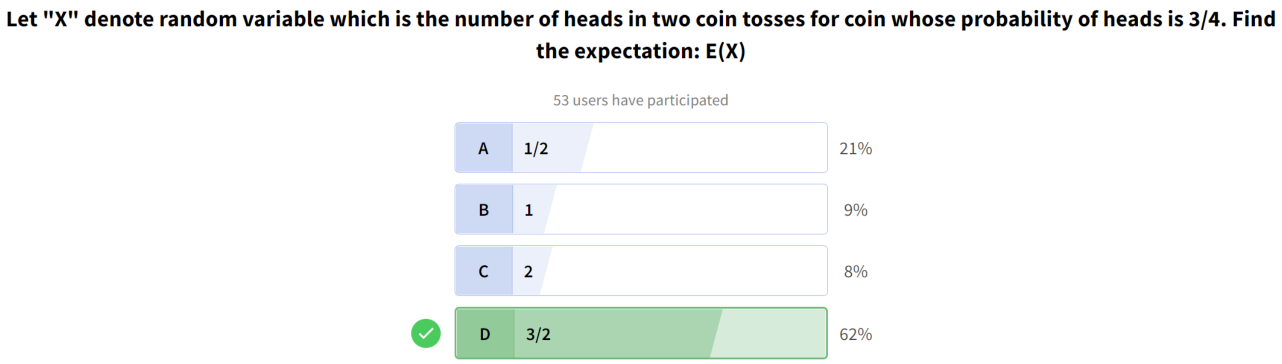
```
two coin toss :

    X : no of heads
        {
            HH   2
            HT   1
            TH   1
            TT   0
        }

    RV

    x      P(x)
    0 : 1  1/4
    1 : 2  2/4
    2 : 1  1/4

     E(X) = Σ(x*P(x))
```

In [8]:

```
(0*(1/4))+(1*(2/4))+(2*(1/4))
```

Out[8]:

```
1.0
```



Let "X" denote random variable which is the number of heads in two coin tosses for coin whose probability of heads is 3/4. Find the expectation: E(X)

53 users have participated

A	1/2	21%
B	1	9%
C	2	8%
✓ D	3/2	62%

In [ ]:

```

```

```
    x      P(x)
    0 : 1  1/4   * 1/4
    1 : 2  1/4 * 3/4 * 2
    2 : 1  3/4 * 3/4

     E(X) = Σ(x*P(x))
     E(X) = (0 * P[x=0]) + (1 * P[x=1]) + (2 * P[x=2])

        (0 * ((1/4)^2)) + (1 * (2*(1/4)*(3/4))) + (2 * ((3/4)^2))

```

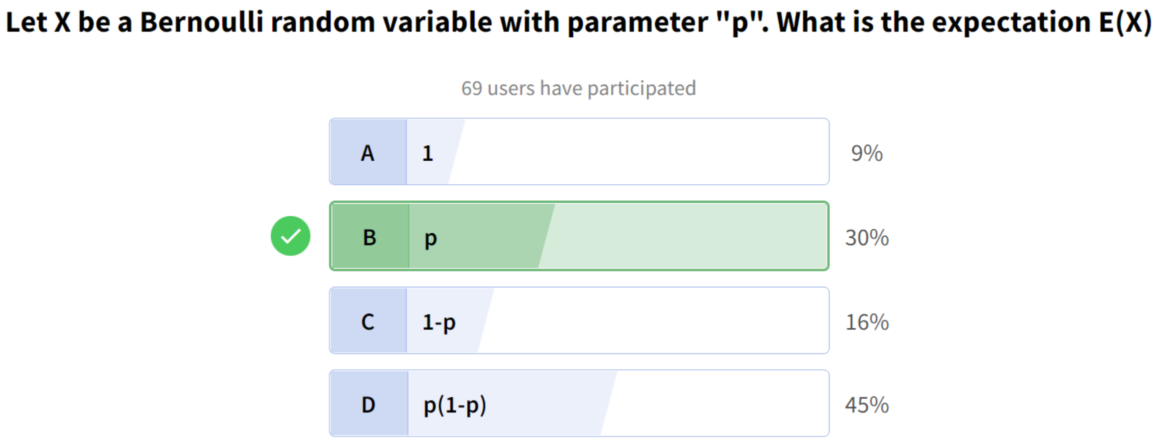
In [9]:

```
(0 * ((1/4)**2)) + (1 * 2*(1/4)*(3/4)) + (2 * ((3/4)**2))
```

Out[9]:

```
1.5
```

In [10]:
```
3/2
```
Out[10]:
```
1.5
```



Let X be a Bernoulli random variable with parameter "p". What is the expectation E(X)

69 users have participated

	A	1	9%
✓	B	p	30%
	C	1-p	16%
	D	p(1-p)	45%

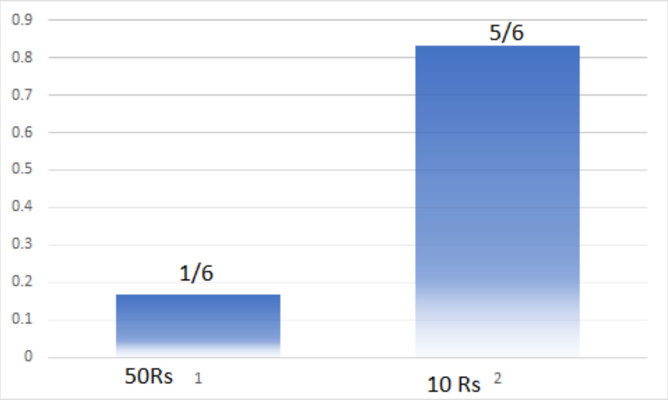
In [ ]:
```

```

Expected value :

weighted average

Example :

```

We toss 1000 times :

How much money do we expect to get :



# roll a dice: {1,2,3,4,5,6}
# everytime 6 comes up , u get 50rs
# else : 10 rs

RV :
    10 : {1,2,3,4,5}      5/6
    50 : {6}              1/6


```



In [11]:
```
1000*((5/6*10)+(1/6*50))
```

Out[11]:
```
16666.666666666664
```

In [ ]:
```

```

```
for example : if we get 320 times {6} out of 1000
                         and 680 times {1,2,3,4,5,}

     ( (320 * 50Rs) + (680 * 10Rs))/1000
        k1             k2

    total expected amount(average) to get :K = (k1 + k2)

  expected amount per toss  = ((k1*50) + (k2*10))/k
                            = ((k1*50) + (k2*10))/ k1 + k2

                          (1/6 * 50)   + (5/6 * 10)       this is per toss
                         ((1/6 * 50)   + (5/6 * 10))  * 1000 toss



```

```
Expected value (Mean of a random vvariable )

E(X) = Σ(x*P(x))
     = 50*(1/6)  + 10*(5/6)
     = 16.666 Rs

for 1000 times  16666.67 Rs

```

In [12]:
```
(50*(1/6)  + 10*(5/6))*1000
```

Out[12]:
```
16666.666666666664
```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

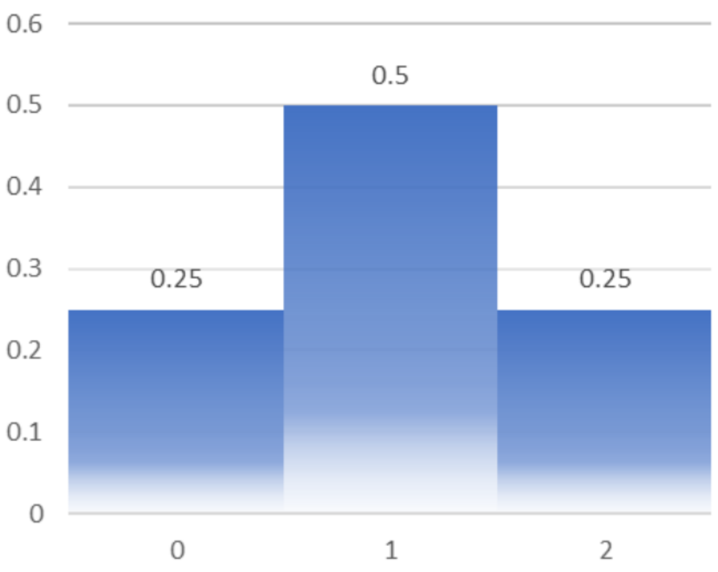
In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

```
Coin toss twice:

    Sample Space : S = {HH,HT,TH,TT}

X : no of heads in 2 tosses:

        HH 2
        HT 1
        TH 1
        TT 0

0 happened  1 times   probability P[TT] = 1/4
1 happened  2 times   probability P[HT,TH] = 2/4
2 happened  1 times   probability P[HH] = 1/4
```

```
#### Probability Mass Function
A probability mass function is a function that gives the probability that a discrete random variable is exactly equal to some value.
```



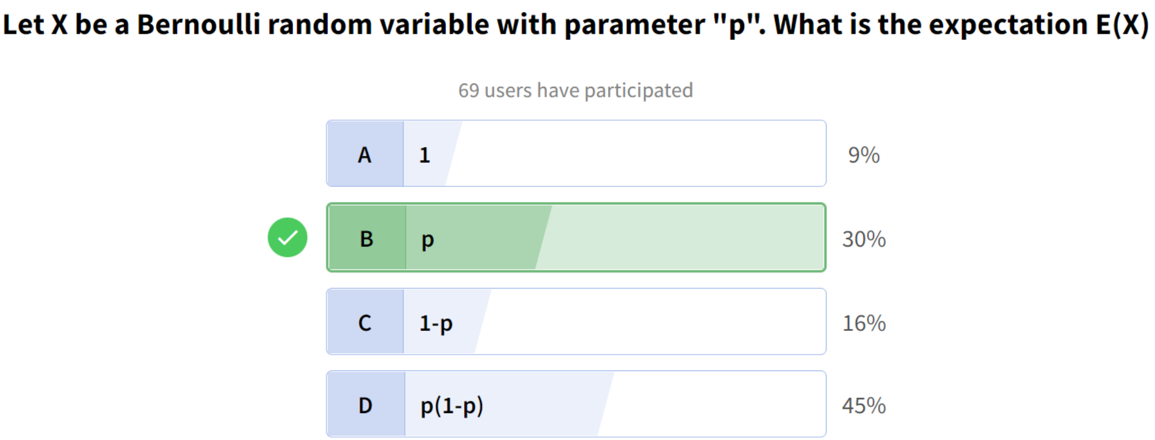
```
discrete RV
1. Constituting a seperate thing.
2. cosisting of unconnected distinct parts
3. Mathematics defined for a finite or countable set of values, not continuous .

```

```
that means , Random Variables must be Mutually Exclusive and Exhaustive
they cannot be overlaped

```

Bernoulli Random Variable :

```
The Bernoulli distribution, is the discrete probability distribution of a random variable which takes the value 1 with probability p and the value 0 with probability q=(1-p).
```

```
X = 0,1
P[1]  = p
P[0]  = 1-p

example :
in dice:

S = {1,2,3,4,5,6}  # all possible outcomes

if we define burnoulli RV

X = {
     0 , (odd events)       P[0] 1/2
     1 , (even events)      P[1] 1/2
    }

if
Y = {
    0, {1,2}         2/6   p
    1, {3,4,5,6}     4/6   1-p
    }

```



Let X be a Bernoulli random variable with parameter "p". What is the expectation E(X)

69 users have participated

A	1	9%
✓ B	p	30%
C	1-p	16%
D	p(1-p)	45%

In [ ]:

```

```

In [13]:

```python
import math
```

Basic Counting Principle

```
## Basic Counting Principle

4 boxes are thre , and 10 balls !
How many ways we can put different balls into those 4 boxes . one in each box :



    _  _  _  _

    for first box, we have 10 choices of balls
        2nd box            9
        3rd bax            8
        4th box            7

    total ways : 10 * 9 * 8 *7    ("Permutations ")

      =  10 * 9 * 8 * 7 * ( 6 * 5 * 4 * 3 * 2 * 1)
        /   ( 6 * 5 * 4 * 3 * 2 * 1)

      = 10! / 6!
      = 10! / (10 - 4)!

 Permutation : General formula :

  nPr =     n!/
          (n-r)!


```

In [14]:

```python
10 * 9 * 8 *7
```

Out[14]:

```
5040
```

In [15]:

```python
math.perm(10,4)
```

Out[15]:

```
5040
```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

```
if we are tossing one coin 10 times :

 {HHHH...H , HHH...T , HHHHH...TH, .....}

    SUCH,
    total number of outcomes : 2**10 = 1024

  How many of 2^10 outcomes have  4 heads :

    we are intereseted in 4 Heads out of 1024 outcomes :
        choose 4 locations to place head

        10 * 9 * 8 * 7 (permutations)

        now lets say , there's one outcome 1,5,6,7 .
                                but there also will be 7,6,5,1.
                                (permutations)
             that is why:

    to get the combinations we have to divide the choices which are repeated in different order

        = 10 * 9 * 8 * 7 /
            4!

        = 10*9*8*7*6*5*4*3*2*1 /
               4! * (6*5*4*3*2*1)

        = 10! /
          4!*6!

        = 10!/
          4!(10-4!)


Combinations : nCr =    n!
                     / r!(n-r)!
```

In [16]:

```
math.comb(10,4)
```

Out[16]:

```
210
```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

Binomial Random Variable :

```
Two pparameters  :
    > n : process consists of sequence of n trials
    > only two exclusive outcomes are : success and failure :

                P[sucess] = p
                P[failure] = 1-p

   all trials are independent, outcome of previous trials do not influence further trials.
```

In [ ]:

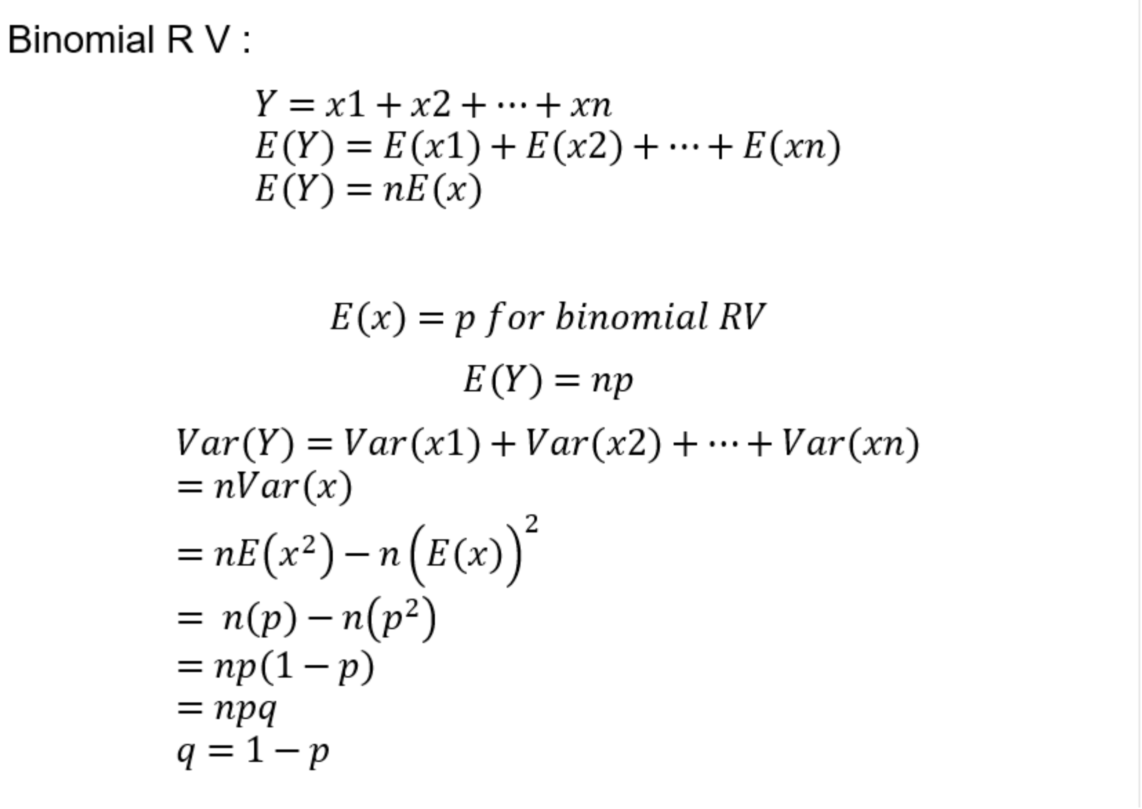
```
```

There are three characteristics of a binomial experiment.

- There are a fixed number of trials. Think of trials as repetitions of an experiment.
- The letter n denotes the number of trials.
- There are only two possible outcomes, called "success" and "failure," for each trial.
- The letter p denotes the probability of a success on one trial, and q denotes the probability of a failure on one trial. p + q = 1.
- The n trials are independent and are repeated using identical conditions. Because the n trials are independent, the outcome of one trial does not help in predicting the outcome of another trial.
- Another way of saying this is that for each individual trial, the probability, p, of a success and probability, q, of a failure remain the same.

> The outcomes of a binomial experiment fit a binomial probability distribution.
>
> - The random variable X = the number of successes obtained in the n independent trials.

> The mean, μ, and variance, σ2, for the binomial probability distribution are μ = np and σ2 = npq.



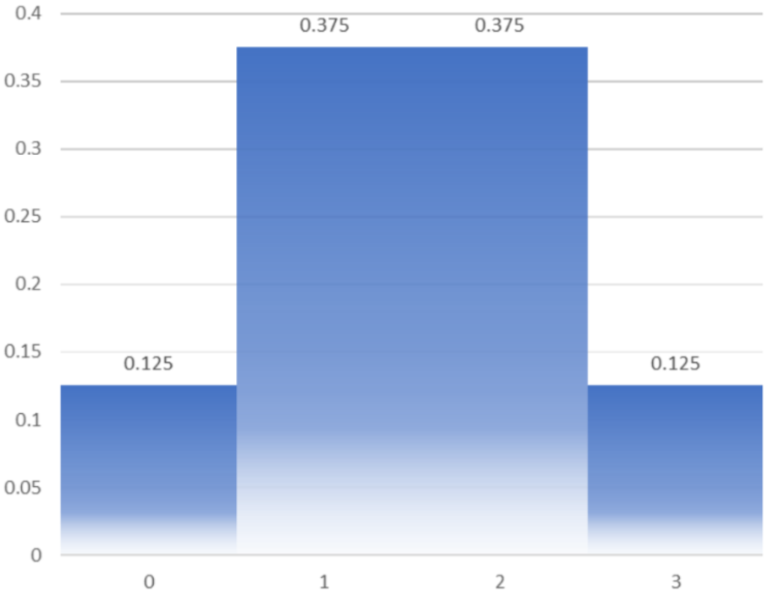
Binomial R V :

$$Y = x1 + x2 + \cdots + xn$$
$$E(Y) = E(x1) + E(x2) + \cdots + E(xn)$$
$$E(Y) = nE(x)$$

$$E(x) = p\ for\ binomial\ RV$$
$$E(Y) = np$$

$$Var(Y) = Var(x1) + Var(x2) + \cdots + Var(xn)$$
$$= nVar(x)$$
$$= nE(x^2) - n\left(E(x)\right)^2$$
$$= \ n(p) - n(p^2)$$
$$= np(1-p)$$
$$= npq$$
$$q = 1 - p$$

```
for 3 trial coin toss :

n = 3

Probability of heads is p

S = {    # of heads     P[x]
    HHH : 3
    HHT : 2
    HTH : 2
    HTT : 1                              P[TTT] = (1-p)^3
    THH : 2                              P[HHH] = (p)^3
    THT : 1                              P[HHT] = p^2 * (1-p)^1
    TTH : 1                              P[TTH] = (1-p)^2 * p
    TTT : 0
    }


  so , the random variable will take values: X = {0,1,2,3}

  x  P[x]
  0  1/8     0  : 1 times  P[x = 0]  = 1 * (1-p)^3
  1  3/8     1  : 3 times  P[x = 1]  = 3 * p * ((1-p)^2)
  2  3/8     2  : 3 times  P[x = 2]  = 3 * (p^2) * (1-p)
  3  1/8     3  : 1 times  P[x = 3]  = 1 * p^3



   P[x = 1]   {HTT,THT,TTH}
               A    B   C     A or B or C

   P[A U B U C] = P[A] + P[B] + P[C]
                = p(1-p)^2 + p(1-p)^2 + p(1-p)^2
                = 3 * p(1-p)^2


    P[x = 2]   {HHT,HTH,THH}
                 A    B   C     A or B or C

   P[A U B U C] = P[A] + P[B] + P[C]
                = p^2 * (1-p)^1 + p^2 * (1-p)^1 + p^2 * (1-p)^1
                = 3 * p^2 * (1-p)^1

    P[x = 3]    {HHH}  (H and H and H)

             P[H] = p

             P[HHH] = p^3

    P[x = 0]
                TTT      (T and T and T)
                (1-p)^3
```



```
 x  P[x]
 0  1/8
 1  3/8
 2  3/8
 3  1/8
```

In [17]:

```
100/6
```

Out[17]:

```
16.666666666666668
```

In [ ]:

In [ ]:

In [ ]:

```
x : no of heads in n trials(n tosses)
p : probability of heads

P[x = k]            = nCk            * (p^k) *    (1-p)^n-k
probability of      total number     probability  probability of
number of heads(k)  of outcomes      of k heads   (n-k) tails
in n trials         with k heads
```

In [ ]:

In [ ]:

Q :

a very poor manufacturer is making a product with a 20% defect rate.
If we select 5 randomly chosen items at the end of assembly line ,
what is the probability of having 1 defective item in our sample ?

```
Q :
a very poor manufacturer is making a product with a 20% defect rate.
If we select 5 randomly chosen items at the end of assembly line ,
what is the probability of having 1 defective item in our sample ?

n = 5 randomly chosen items
k = 1
```

```


P[x = k]            = nCk     *       (p^k)   *     (1-p)^n-k
P[1 defective       = c(5,1)  *     (0.20)^1 *   (1-0.20)^(5-1)
product in
sample of 5]
                    = 0.4096
```

In [18]:

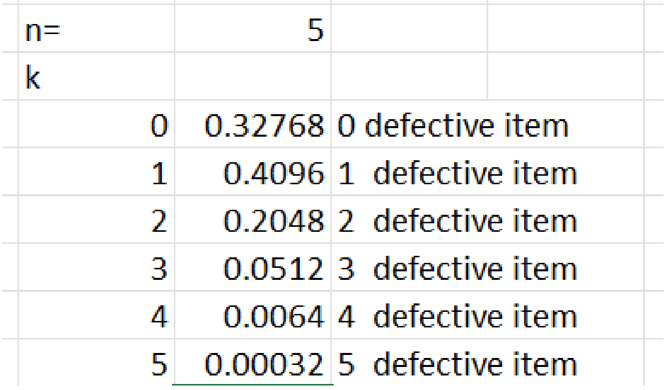
```
import math
```

In [19]:

```
math.comb(5,1)  *     ((0.20)**1) * ((1-0.20)**(5-1))
```

Out[19]:

```
0.4096000000000001
```



n=	5	
k		
0	0.32768	0 defective item
1	0.4096	1 defective item
2	0.2048	2 defective item
3	0.0512	3 defective item
4	0.0064	4 defective item
5	0.00032	5 defective item

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

Q:

As a sales manager you analyze the sales records for all the sales persons under your guidance :

Joan has a sucess rate of 75% and averages 10 sales calls per day. Joan has a sucess rate of 45% and averages 16 sales calls per day.

```
 what is the probability that each sales person makes 6 sales on any given day !
```

```
For Joan:

P[x = k]            = nCk     *       (p^k)   *     (1-p)^n-k
P[6 sucess        = c(10,6)  *     (0.75)^6 *   (1-0.75)^(10-6)
calls out of
Joan's total
10 calls]
                    =  0.146 = 14.6 %
```

In [20]:

```
math.comb(10,6)  *     ((0.75)**6) * ((1-0.75)**(10-6))
```

Out[20]:

```
0.1459980010986328
```

```
For Margo:

P[x = k]             = nCk     *       (p^k)  *    (1-p)^n-k
P[6 sucess         = c(16,6)  *     (0.45)^6 *  (1-0.45)^(16-6)
calls out of
Joan's total
16 calls]
                     =  0.168 = 16.8 %
```

In [21]:

```
math.comb(16,6)  *     ((0.45)**6) * ((1-0.45)**(16-6))
```

Out[21]:

```
0.16843255710751262
```

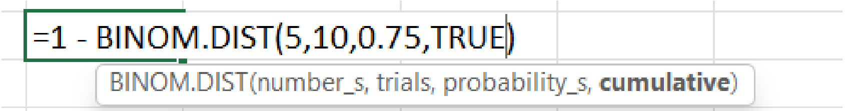
Binomial Mean(Expected Value)

```
binomial mean = n*p
```

```
for
Joan = n * p = 10*0.75
     =7.5                       # sales for Joan / day

for
Margo = n * p = 16*0.45
     =7.2                       # sales for Margo / day


binomial standard deviation : square_root(n*p*(1-p))
```

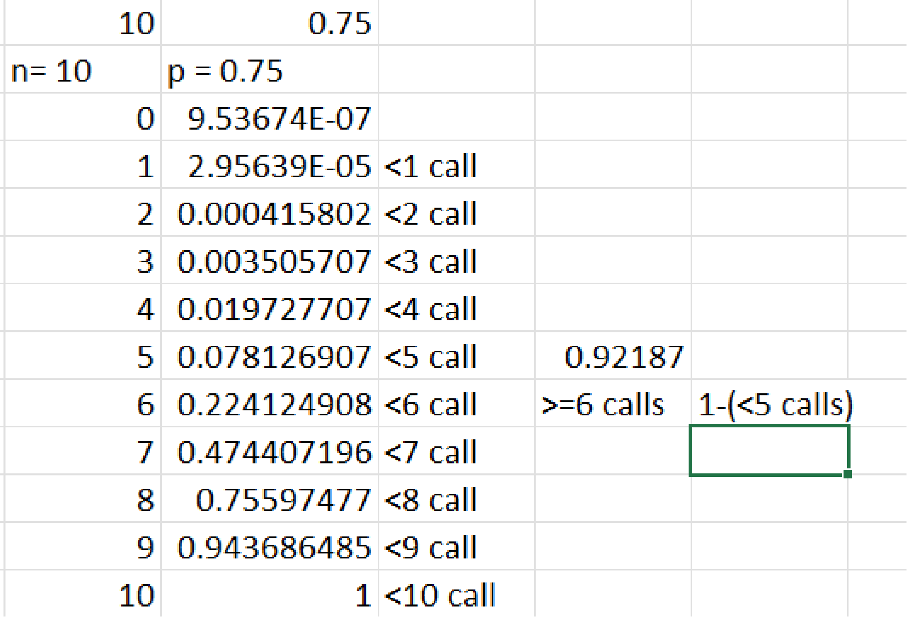
What is the probability that each sales person makes atleast 6 sales

binomial cummulative probability cdf:



=1 - BINOM.DIST(5,10,0.75,TRUE)

BINOM.DIST(number_s, trials, probability_s, **cumulative**)



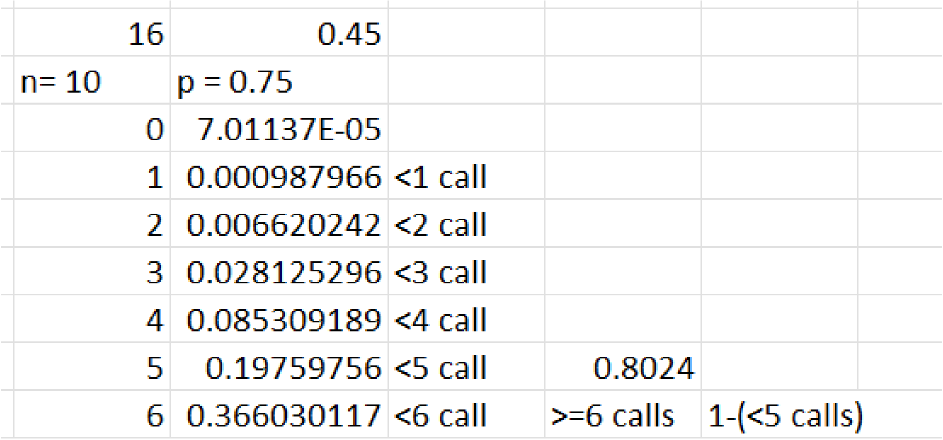
10	0.75			
n= 10	p = 0.75			
0	9.53674E-07			
1	2.95639E-05	<1 call		
2	0.000415802	<2 call		
3	0.003505707	<3 call		
4	0.019727707	<4 call		
5	0.078126907	<5 call	0.92187	
6	0.224124908	<6 call	>=6 calls	1-(<5 calls)
7	0.474407196	<7 call		
8	0.75597477	<8 call		
9	0.943686485	<9 call		
10	1	<10 call		

In [22]:

```
1-0.07812  # for joan
```

Out[22]:

```
0.92188
```



16	0.45			
n= 10	p = 0.75			
0	7.01137E-05			
1	0.000987966	<1 call		
2	0.006620242	<2 call		
3	0.028125296	<3 call		
4	0.085309189	<4 call		
5	0.19759756	<5 call	0.8024	
6	0.366030117	<6 call	>=6 calls	1-(<5 calls)

In [23]:

```
1-0.1976  # for Margo
```

Out[23]:

```
0.8024
```

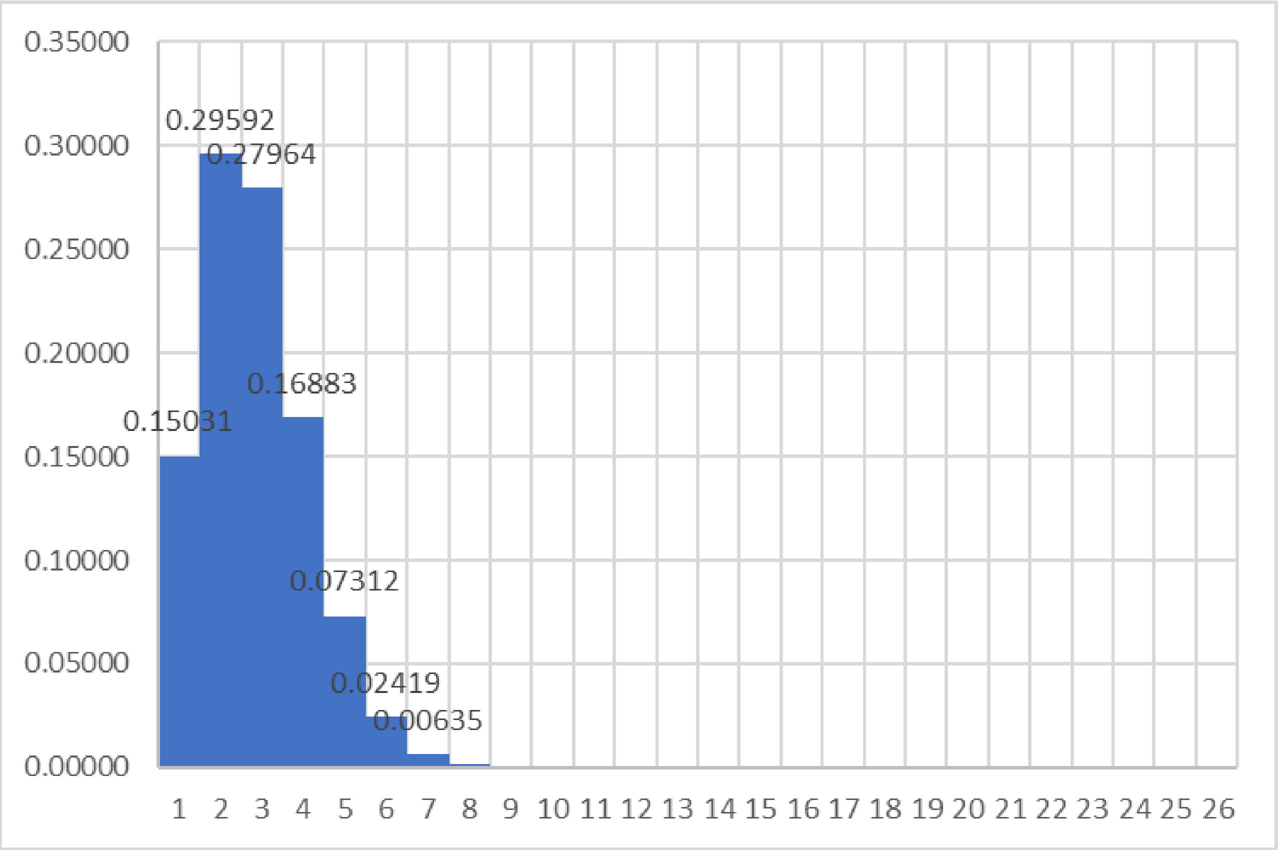
In [ ]:

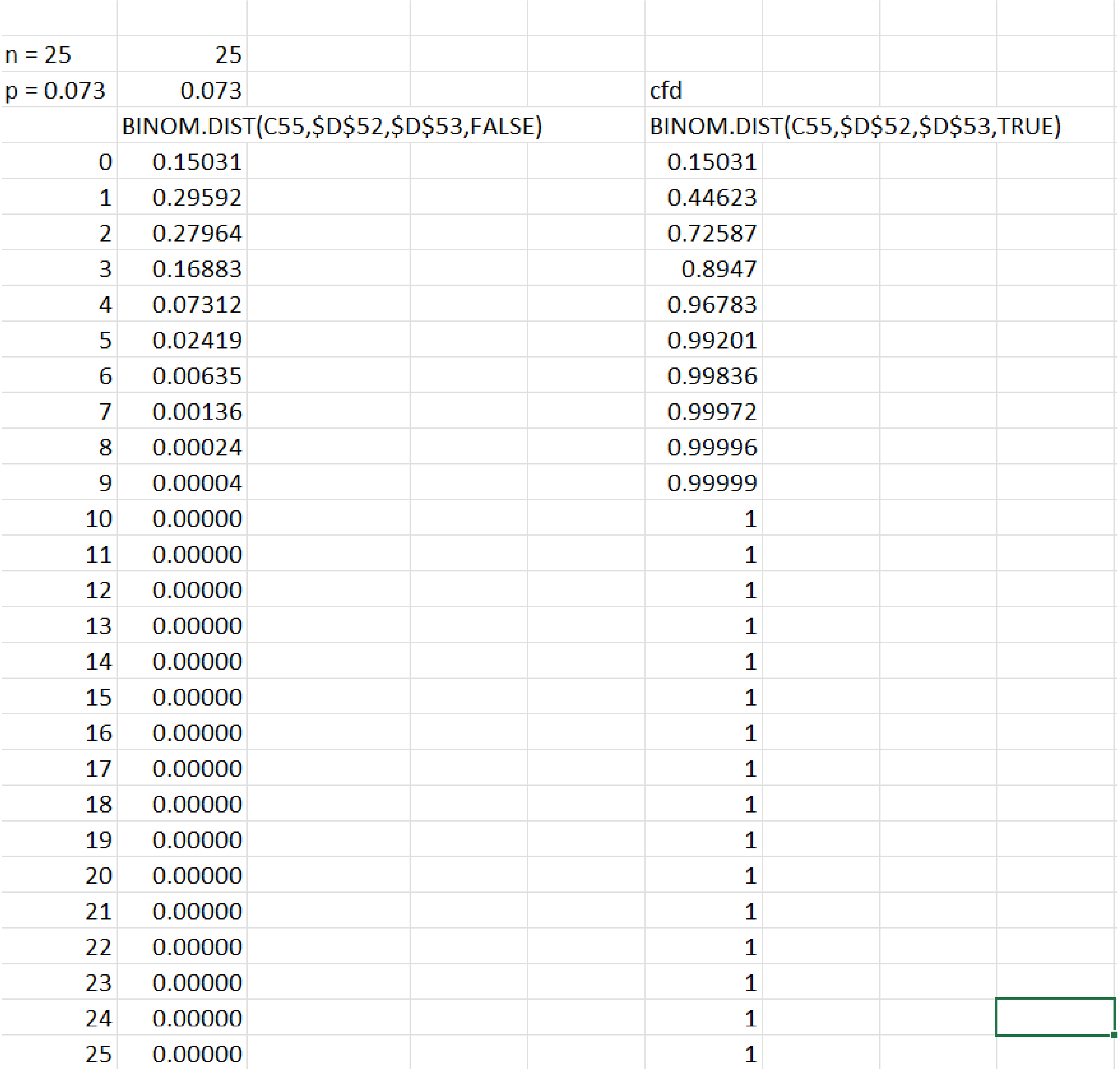
Q:

According to recent data collected by netmarketshare.com

7.3% of internet users are using MacOS_X. Based on a random sample of 25 internet users for a class project, we are interested in :

1. A graph of binomial distribution
2. binomial distribution mean and std
3. P[exactly 3 users are using Mac_OS_x]
4. P[more than 5 users using]
5. P[no one uses using Macos]
6. P[2 to 5 users using Mac]





n = 25	25	
p = 0.073	0.073	cfd
	BINOM.DIST(C55,D52,D53,FALSE)	BINOM.DIST(C55,D52,D53,TRUE)
0	0.15031	0.15031
1	0.29592	0.44623
2	0.27964	0.72587
3	0.16883	0.8947
4	0.07312	0.96783
5	0.02419	0.99201
6	0.00635	0.99836
7	0.00136	0.99972
8	0.00024	0.99996
9	0.00004	0.99999
10	0.00000	1
11	0.00000	1
12	0.00000	1
13	0.00000	1
14	0.00000	1
15	0.00000	1
16	0.00000	1
17	0.00000	1
18	0.00000	1
19	0.00000	1
20	0.00000	1
21	0.00000	1
22	0.00000	1
23	0.00000	1
24	0.00000	1
25	0.00000	1

```
Q2 :

mean = n*p   and std = sq(np(1-p))
```

In [24]:
```
(25*0.073),(math.sqrt(25*0.073*(1-0.073)))
```

Out[24]:
```
(1.825, 1.3006825131445414)
```

```
Q3: from above table : from excel :
            Exact probability at 3 users using Mac : 0.16883

```

```
Q4 : more than 5 users using MAc :
        1-(<=5 users )
        =1-0.99201
        = 0.0079
```

In [25]:
```
1-0.99201
```

Out[25]:
```
0.007990000000000053
```

```
Q5 : no one using mac :
        0.150

```

```
Q6:
2 to 5 users :

0.99201-0.446
= 0.5460
```

In [26]:
```
0.99201-0.446
```

Out[26]:
```
0.5460099999999999
```

In [ ]:
```

```

In [ ]:
```

```

Q :

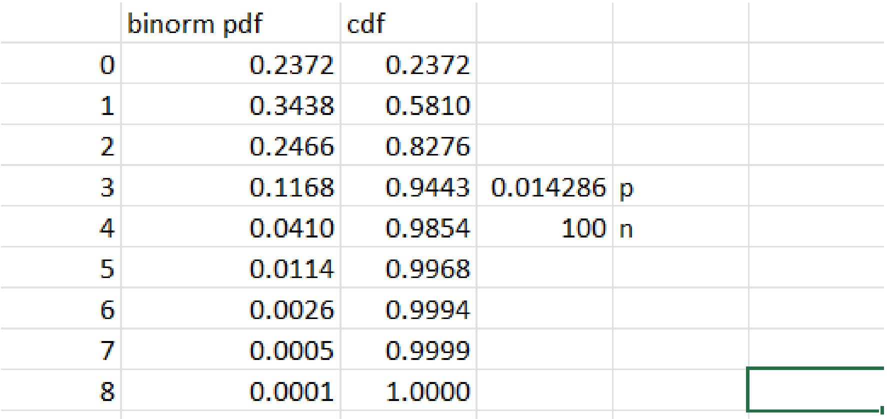
- In the 2013 Jerry's Artarama art supplies catalog, there are 560 pages.
- Eight of the pages feature signature artists.
- Suppose we randomly sample 100 pages.
- Let X = the number of pages that feature signature artists.

1. What values does x take on?
2. What is the probability distribution? Find the following probabilities:

> - the probability that two pages feature signature artists.
> - the probability that at most six pages feature signature artists
> - the probability that more than three pages feature signature artists.

- Using the formulas, calculate the (i) mean and (ii) standard deviation.

```
X = 0,1,2,3,4,5,6,7,8

X in Binomial Distribution : n = 100
                  Probability of feature signature : 8/560

```



	binorm pdf	cdf		
0	0.2372	0.2372		
1	0.3438	0.5810		
2	0.2466	0.8276		
3	0.1168	0.9443	0.014286	p
4	0.0410	0.9854	100	n
5	0.0114	0.9968		
6	0.0026	0.9994		
7	0.0005	0.9999		
8	0.0001	1.0000		

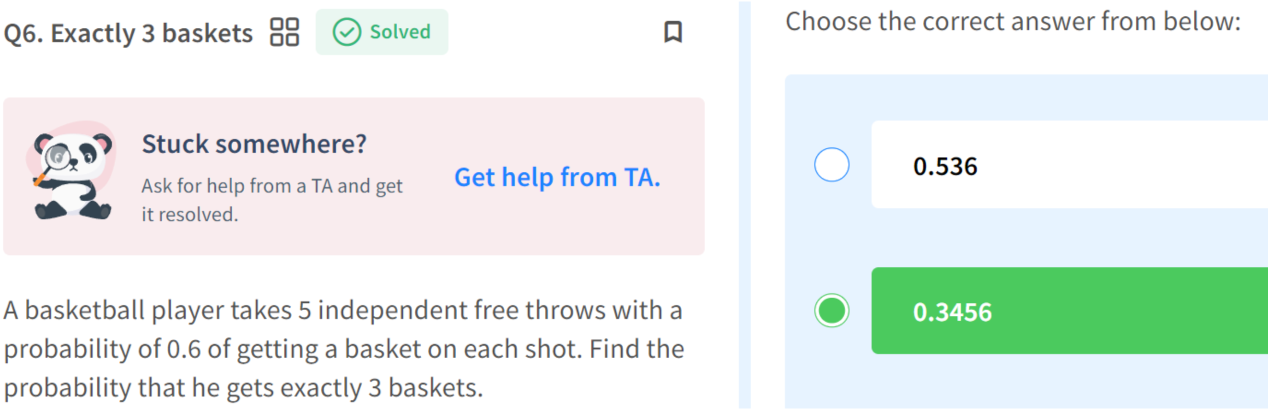
```
P[x = 2] = 0.2466
P[x<=6] = 0.9994
P[x>3] = 1-P[x<=3]
       = 1-0.9443
       = 0.0557
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:



Q6. Exactly 3 baskets Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

A basketball player takes 5 independent free throws with a probability of 0.6 of getting a basket on each shot. Find the probability that he gets exactly 3 baskets.

Choose the correct answer from below:

○ 0.536

● 0.3456

In [27]:
```
math.comb(5,3)
```
Out[27]:
```
10
```

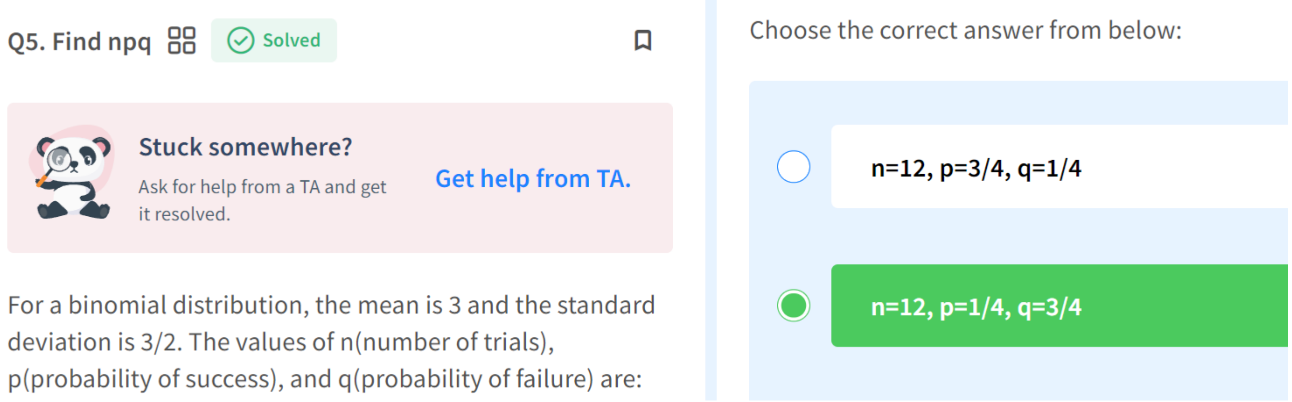
In [28]:
```
0.6**3
```
Out[28]:
```
0.21599999999999997
```

In [29]:
```
(1-0.6)**2
```
Out[29]:
```
0.16000000000000003
```

In [30]:
```
10*0.21599999999999997*0.16000000000000003

```
Out[30]:
```
0.3456
```

In [ ]:

```

```



Q5. Find npq ✓ Solved

Stuck somewhere?
Ask for help from a TA and get it resolved.
Get help from TA.

For a binomial distribution, the mean is 3 and the standard deviation is 3/2. The values of n(number of trials), p(probability of success), and q(probability of failure) are:

Choose the correct answer from below:

○ n=12, p=3/4, q=1/4

● n=12, p=1/4, q=3/4

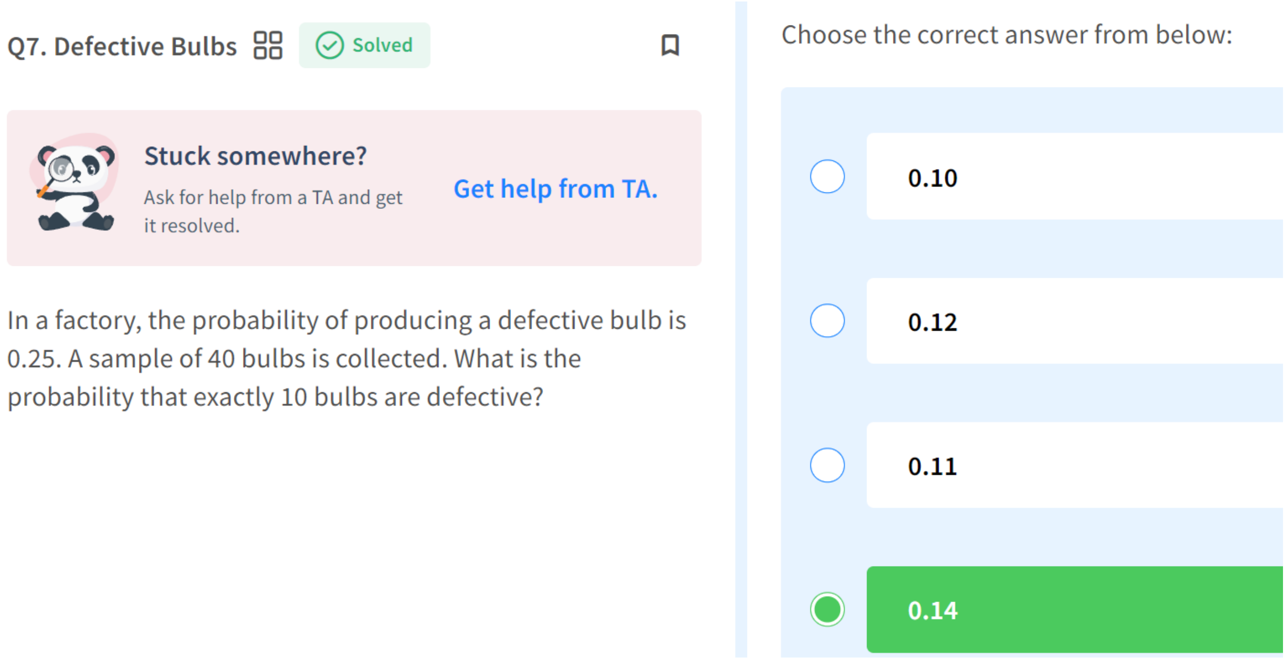
```
mean  = 3 = np
std = 3/2

std = sq(npq)
3/2 = sq(3 * q)
q = 3/4
p = 1-q = 1/4
n = mean/p = 3 / (1/4) = 12
```

In [ ]:

```

```

In [ ]:

```

```



Q7. Defective Bulbs ✓ Solved

Stuck somewhere?
Ask for help from a TA and get it resolved.
Get help from TA.

In a factory, the probability of producing a defective bulb is 0.25. A sample of 40 bulbs is collected. What is the probability that exactly 10 bulbs are defective?

Choose the correct answer from below:

○ 0.10

○ 0.12

○ 0.11

● 0.14

In [31]:

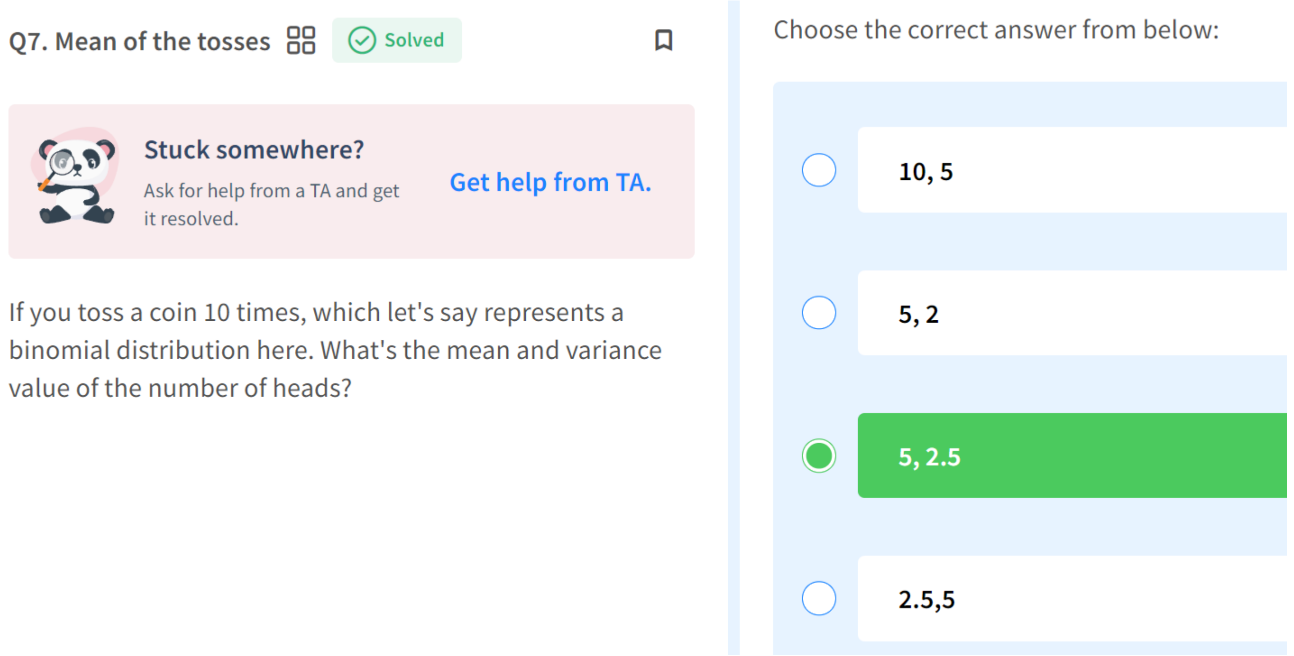
```
(math.comb(40,10)) * (0.25**10) * ((1-0.25)**(40-10))
```

Out[31]:

```
0.14436434635625678
```

In [ ]:

```

```



Q7. Mean of the tosses

Stuck somewhere?

Ask for help from a TA and get it resolved.

If you toss a coin 10 times, which let's say represents a binomial distribution here. What's the mean and variance value of the number of heads?

Choose the correct answer from below:

○ 10, 5

○ 5, 2

● 5, 2.5

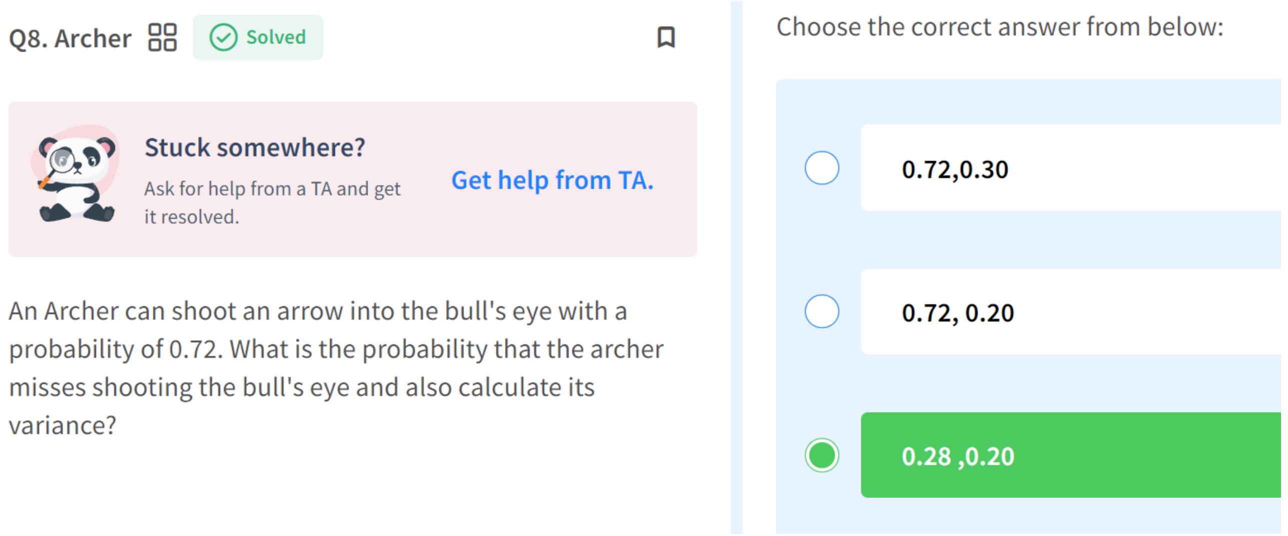
○ 2.5,5

```
n * p = (10 * (1/2))
n*p*q = variance = 10*(1/2)*(1/2)
```

```
In [32]: (10 * (1/2)),(10*(1/2)*(1/2))
```

```
Out[32]: (5.0, 2.5)
```

```
In [ ]:
```



Q8. Archer

Stuck somewhere?

Ask for help from a TA and get it resolved.

An Archer can shoot an arrow into the bull's eye with a probability of 0.72. What is the probability that the archer misses shooting the bull's eye and also calculate its variance?

Choose the correct answer from below:

○ 0.72,0.30

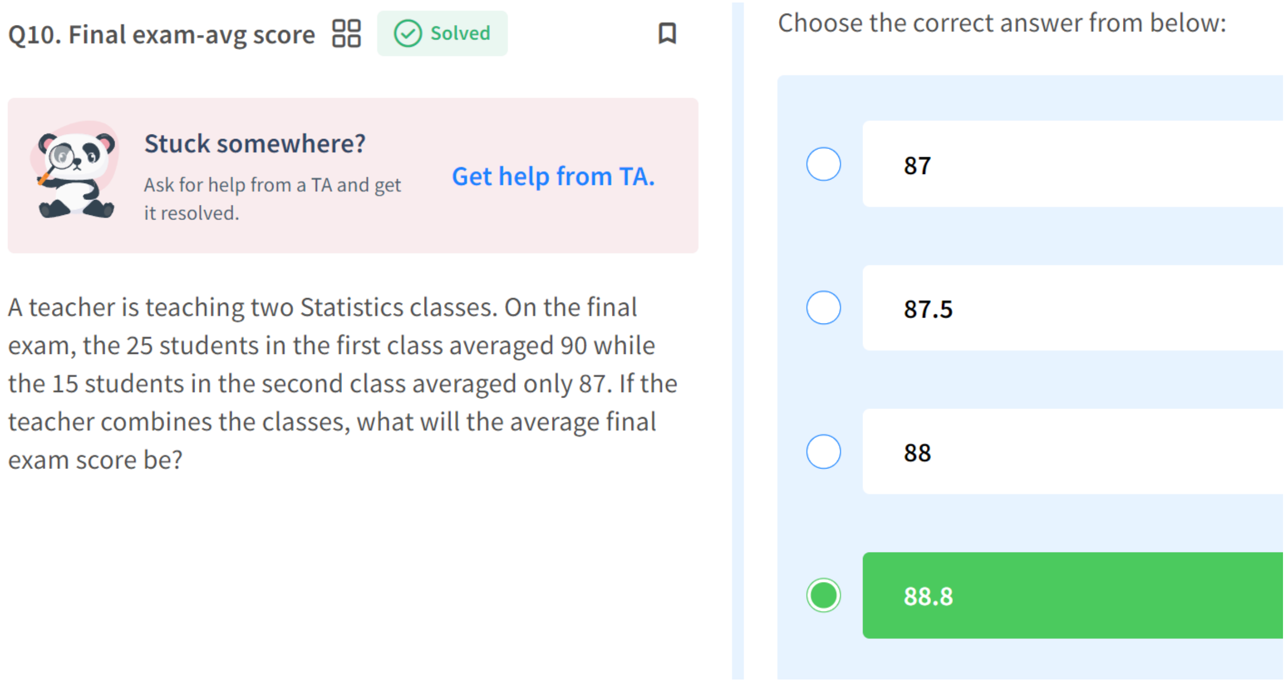
○ 0.72, 0.20

● 0.28 ,0.20

```
In [33]: (1-0.72),(0.72*(1-0.72))
```

```
Out[33]: (0.28, 0.2016)
```

```
In [ ]:
```



Q10. Final exam-avg score Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

A teacher is teaching two Statistics classes. On the final exam, the 25 students in the first class averaged 90 while the 15 students in the second class averaged only 87. If the teacher combines the classes, what will the average final exam score be?

Choose the correct answer from below:

○ 87

○ 87.5

○ 88

● 88.8

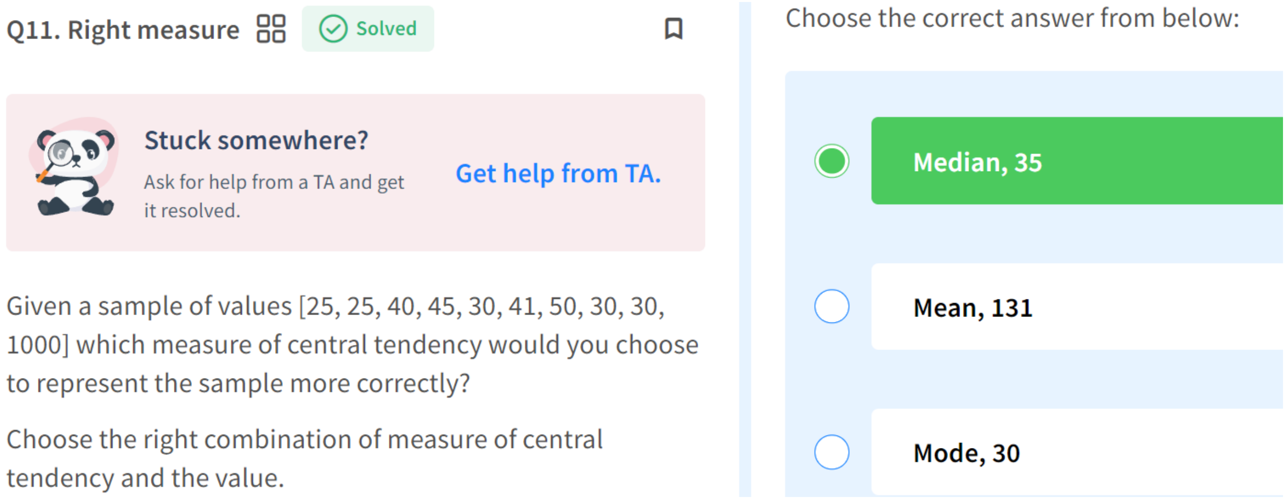
```
students    grades
25           90        25*90 = 2250
15           87        15*87 = 1305
total Students : 40       total : 3555

    expected final average :  3555/40 = 88.8


```

In [ ]:

```
3555/40
```

In [ ]:

```

```



Q11. Right measure Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Given a sample of values [25, 25, 40, 45, 30, 41, 50, 30, 30, 1000] which measure of central tendency would you choose to represent the sample more correctly?

Choose the right combination of measure of central tendency and the value.

Choose the correct answer from below:

● Median, 35

○ Mean, 131

○ Mode, 30

In [ ]:

```
x =  np.array([25, 25, 40, 45, 30, 41, 50, 30, 30, 1000])
```

In [ ]:

```
np.median(x)
```

In [ ]:

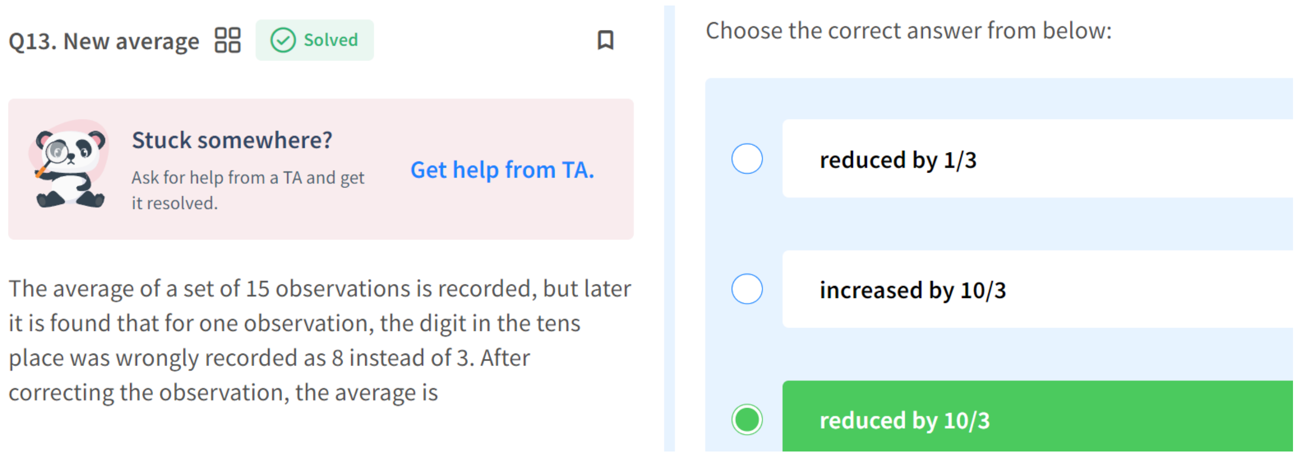
```

```

In [ ]:

```

```

In [ ]:

```

```



Q13. New average ✓ Solved

Stuck somewhere?
Ask for help from a TA and get it resolved.
Get help from TA.

The average of a set of 15 observations is recorded, but later it is found that for one observation, the digit in the tens place was wrongly recorded as 8 instead of 3. After correcting the observation, the average is

Choose the correct answer from below:

○ reduced by 1/3

○ increased by 10/3

● reduced by 10/3

```
In [ ]: np.mean(np.array([100,180,20,100,100,100,100,100,100,100,100,100,100,100,100]))
```

```
In [ ]: 100
```

```
In [ ]: np.mean(np.array([100,130,20,100,100,100,100,100,100,100,100,100,100,100,100]))
```

```
In [ ]: 96.66/100
```

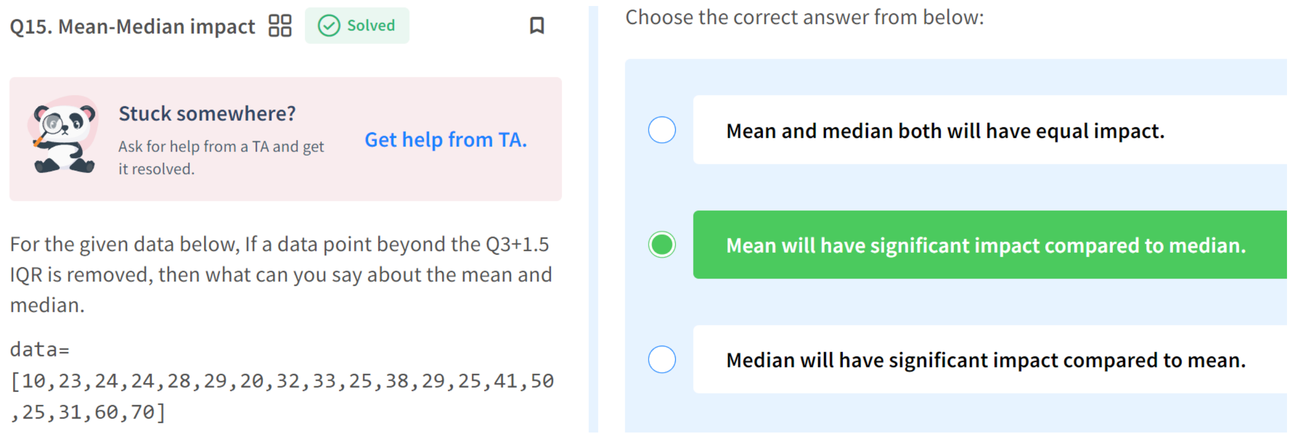
```
In [ ]: (96/2)/2
```

```
In [ ]: 10/3
```

```
In [ ]: 96.666+3.333
```

```
In [ ]:
```

```
In [ ]:
```



Q15. Mean-Median impact ✓ Solved

Stuck somewhere?
Ask for help from a TA and get it resolved.
Get help from TA.

For the given data below, If a data point beyond the Q3+1.5 IQR is removed, then what can you say about the mean and median.

```
data=
[10,23,24,24,28,29,20,32,33,25,38,29,25,41,50
,25,31,60,70]
```

Choose the correct answer from below:

○ Mean and median both will have equal impact.

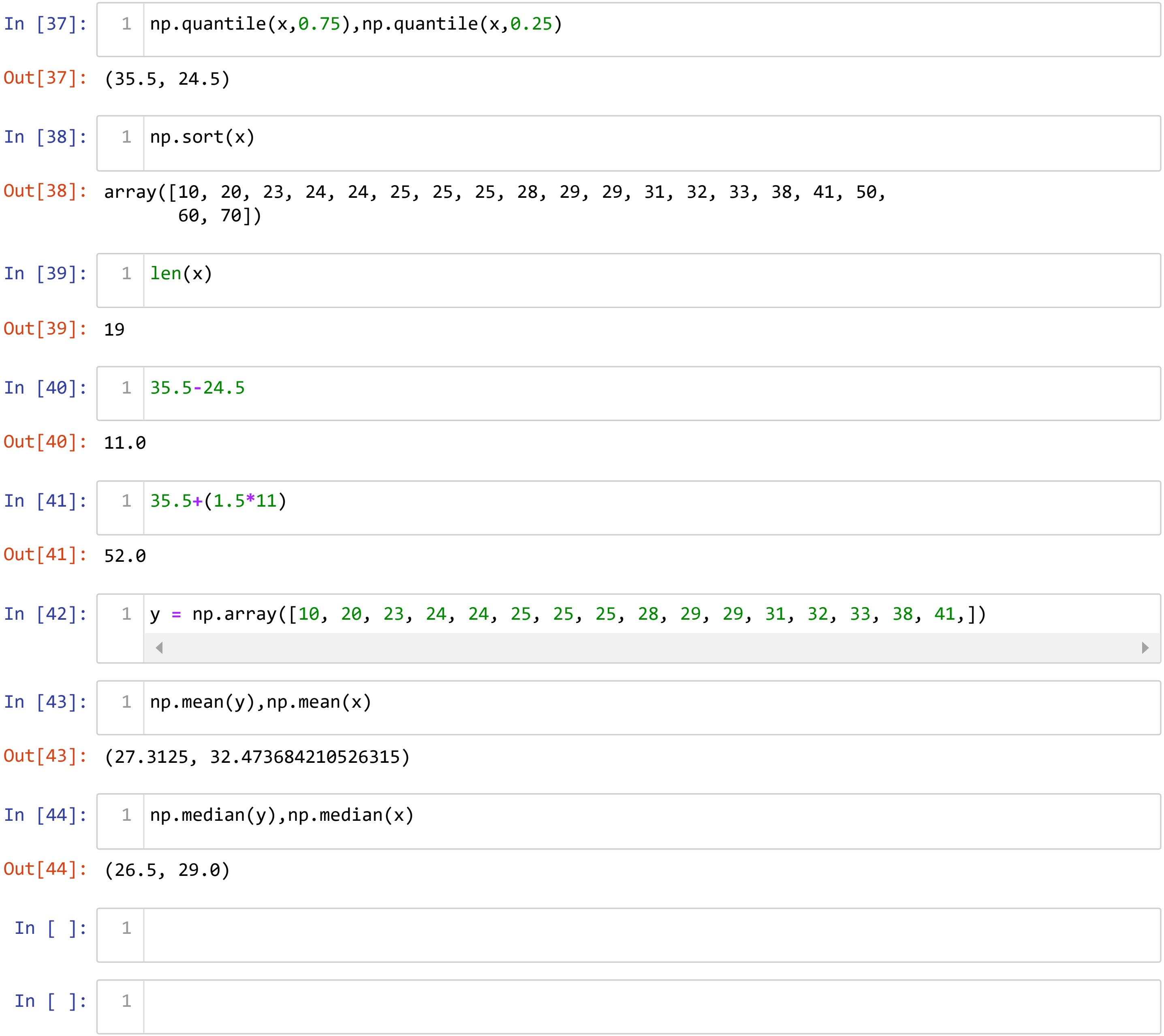
● Mean will have significant impact compared to median.

○ Median will have significant impact compared to mean.

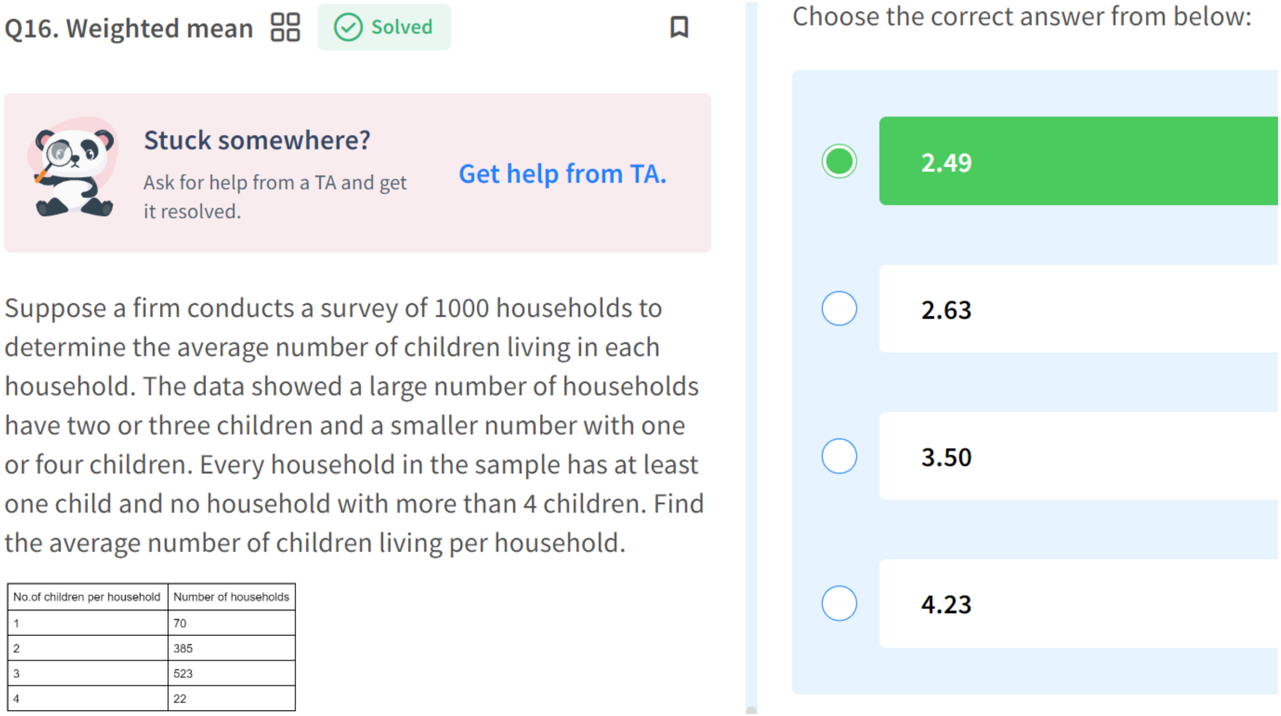
```
In [35]: x = np.array([10,23,24,24,28,29,20,32,33,25,38,29,25,41,50,25,31,60,70])
```

```
In [36]: x
```

```
Out[36]: array([10, 23, 24, 24, 28, 29, 20, 32, 33, 25, 38, 29, 25, 41, 50, 25, 31,
                60, 70])
```



```
In [37]: np.quantile(x,0.75),np.quantile(x,0.25)

Out[37]: (35.5, 24.5)

In [38]: np.sort(x)

Out[38]: array([10, 20, 23, 24, 24, 25, 25, 25, 28, 29, 29, 31, 32, 33, 38, 41, 50,
                60, 70])

In [39]: len(x)

Out[39]: 19

In [40]: 35.5-24.5

Out[40]: 11.0

In [41]: 35.5+(1.5*11)

Out[41]: 52.0

In [42]: y = np.array([10, 20, 23, 24, 24, 25, 25, 25, 28, 29, 29, 31, 32, 33, 38, 41,])

In [43]: np.mean(y),np.mean(x)

Out[43]: (27.3125, 32.473684210526315)

In [44]: np.median(y),np.median(x)

Out[44]: (26.5, 29.0)

In [ ]:

In [ ]:
```



Q16. Weighted mean

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Suppose a firm conducts a survey of 1000 households to determine the average number of children living in each household. The data showed a large number of households have two or three children and a smaller number with one or four children. Every household in the sample has at least one child and no household with more than 4 children. Find the average number of children living per household.

No.of children per household	Number of households
1	70
2	385
3	523
4	22

Choose the correct answer from below:

● 2.49

○ 2.63

○ 3.50

○ 4.23

```
In [45]:  70+385+523+22

Out[45]:  1000
```

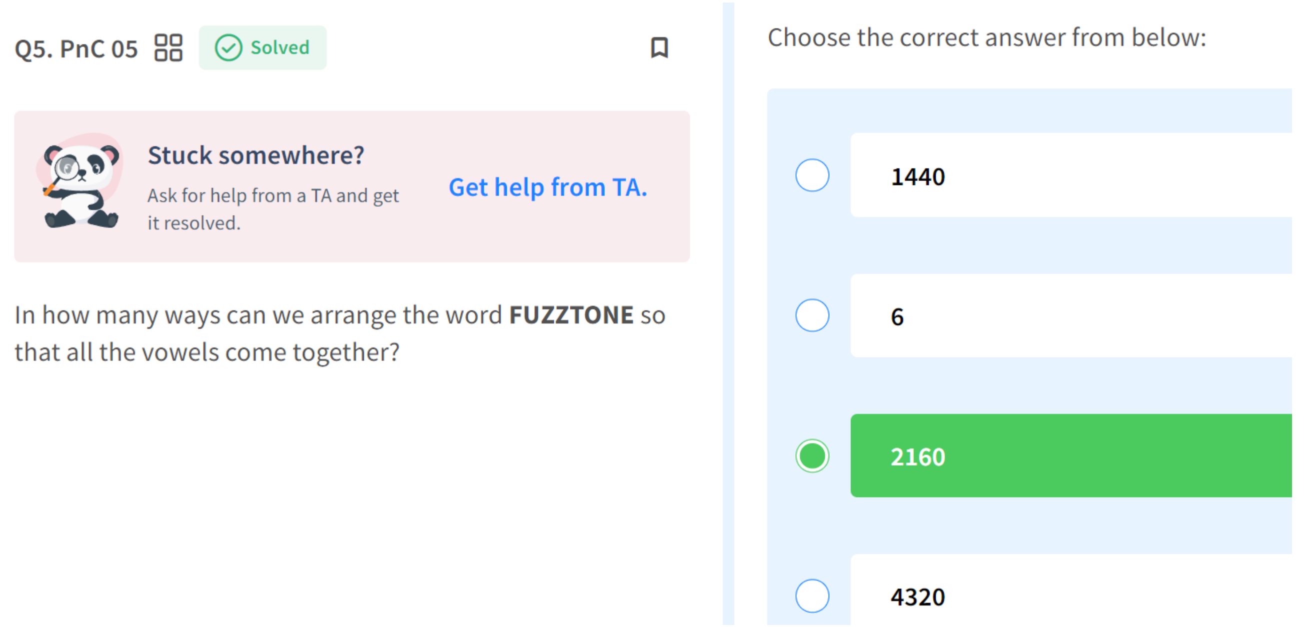
```
In [ ]:
```

```
In [46]:  (1*(70/1000))+(2*(385/1000))+(3*(523/1000))+(4*(22/1000))

Out[46]:  2.497
```

```
In [ ]:
```

```
In [48]:  # If a normal distribution with μ = 200 have P(X > 225) = 0.1587, then P(X < 175) equal to:
```

```
In [ ]:
```



Q5. PnC 05 Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

In how many ways can we arrange the word **FUZZTONE** so that all the vowels come together?

Choose the correct answer from below:

○ 1440

○ 6

● 2160

○ 4320

```

                FUZZTONE
                FZZTN(UOE)
(n-r)!
n!

There are 3 vowels (U,E,O) which can be arranged in 3! ways.
Let the vowels be in one group.
Now, we have (8-3=)5 characters + 1 group = 6
This can be arranged in 6! ways.
But the alphabet Z is twice so we need to divide by 2!.
This give us

6!/2!

Total ways to arrange the letters = 3!× 6!/2!
                                     =2160
 Hence, the value of FUZZTONE after applying permutation is 2160.
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```