Q:

- Three professors at George Washington University did an experiment to determine if economists are more selfish than other people. They dropped 64 stamped, addressed envelopes with dollars 10 cash in different classrooms on the George Washington campus. 44% were returned overall. From the economics classes 56% of the envelopes were returned. From the business, psychology, and history classes 31% were returned.
- Let: R = money returned; E = economics classes; O = other classes

1. Write a probability statement for the overall percent of money returned.
2. Write a probability statement for the percent of money returned out of the economics classes.
3. Write a probability statement for the percent of money returned out of the other classes.
4. Is money being returned independent of the class? Justify your answer numerically and explain it.
5. Based upon this study, do you think that economists are more selfish than other people? Explain why or why not. Include numbers to justify your answer.

```
P[R] = 0.44
P[R|E] = 0.56
P[R|O] = 0.31
Dependent : E[R|O] != P[R]
P[R|E] > P[R] , so economists are nt selfish infact it is opposite.
```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
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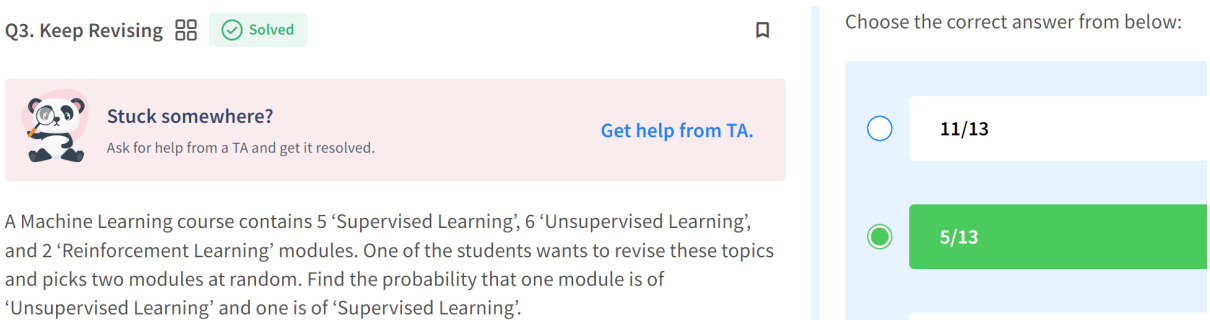
```

Probability Statistic 1

In [ ]:
```

```



In [1]:
```
import math
```

In [2]:
```
math.comb(5,1)*math.comb(6,1)/math.comb(13,2)
```

Out[2]:
```
0.38461538461538464
```

In [4]:
```
5/13
```

Out[4]:
```
0.38461538461538464
```

Q4. Picking a Student Solved

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

There are 100 students in a batch of Data Science 2022 and their enrolment number ranges from 1 to 100. What is the probability that the student picked has an enrolment number in a multiple of 5 or 7?

Choose the correct answer from below:

- ○ 17/50
- ● 8/25

In [ ]:
```
1
```

In [28]:
```
1
2 c = 0
3 for i in range(100):
4     if i % 5 == 0 or i %7 == 0:
5         c += 1
6 c
```

Out[28]: 32

In [29]:
```
1 32/100
```

Out[29]: 0.32

In [30]:
```
1 8/25
```

Out[30]: 0.32

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q5. DL division at company Solved

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

In a Deep Learning division of a company, 28 people are skilled at 'TensorFlow', 30 are skilled at 'PyTorch', 42 are skilled at 'OpenCV'. 5 are skilled at 'TensorFlow' and 'PyTorch'. 8 are skilled at 'PyTorch' and 'OpenCV'. 8 are skilled at 'OpenCV' and `Tensorflow`. 3 are skilled at all of it. What is the least number of people in the group?

Here let T = the set of people who are skilled at 'TensorFlow'
P = the set of people who are skilled at 'PyTorch'
O = the set of people who are skilled at 'OpenCV'

then given that
n(T)=28, n(P)=30, n(O)=42
n(T ∩ P) = 5, n(P ∩ O) = 8, n(O ∩ T)=8, n(T ∩ P ∩ O) = 3

Now, n(T ∪ P ∪ O) =n(T) + n(P) + n(O) – n(T∩P) – n(P∩O) – n(O ∩ T) + n(T ∩ P ∩ O)

= 28+30+42–5–8–8+3
= 103–21 = 82

Some persons may not be skilled at any of the mentioned Deep Learning Libraries. Hence there are at least 82 people in the group.

```
1 # P(A ∪ B ∪ C)  = P(A)  + P(B) + P(C) - P(A ∩ B) - P(B ∩ C) - P(A ∩ C) + P(A ∩ B ∩ C)
```

In [ ]:
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1
```

In [ ]:
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1
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In [ ]:
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1
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In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q6. Probability of event N Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

M and N are two independent events such that P(M U N) = 0.4 and P(M) = 0.3. What can be the value of P(N)?

Choose the correct an

- 1/3
- 1/10
- 1/7

```
M|N = M
M ∩ N / N = M
(M + N - (M U N))/N = M
(0.3 + N - 0.4)/N = 0.3
(N - 0.1) = 0.3N
-0.1 = 0.3N - N
0.1 = N(1-0.3)
N = 0.1/0.7
  = 1/7

```

```
Since M and N are independent events, we have
P(M ∩ N) = P(M) * P(N)
Now, P(M U N) = P(M) + P(N) - P(M ∩ N)
= P(M) + P(N) - P(M) * P(N)
= P(M) + P(N) (1-P(M))
0.4 = 0.3 + P(N) (1-0.3)
0.1 = P(N) * 0.7
P(N) = 1/7
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
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1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q7. Pump manufacturing company Solved

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

A pump manufactured by a company consists of two parts A and B. Out of 100 A's manufactured, 9 are likely to be defective and out of 100 B's manufactured, 5 are likely to be defective. Find the probability that a machine manufactured by the firm is free of any defect.

Choose the correct answe

- 0.7645
- 0.8645

Let event E: Part A of the pump is defective
and event F: Part B of the pump is defective.

By the given conditions,
P(E)= 9/100, P(F) = 5/100

Event E': Part A is not defective and
Event F': Part B is not defective.

P(E')= 1 - P(E) = 1 - (9/100) = 91/100
P(F') = 1–P(F) = 1 - (5/100) = 95/100

Since E and F are independent events, E' and F' are also independent.
Now, the machine manufactured is free of any defect is the event E' ∩ F'.

P(E' ∩ F') = P(E') * P(F')
= (91/100) * (95/100)
= 0.8645

In [31]:
```
1 (1-9/100)*(1-5/100)
```

Out[31]: 0.8644999999999999

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q9. Colored T-shirts Solved

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

Neha has 4 yellow t-shirts, 6 black t-shirts, and 2 blue t-shirts to choose from for her outfit today. She chooses a t-shirt randomly with each t-shirt equally likely to be chosen. Find the probability that a black or blue t-shirt is chosen for the outfit.

```
1 A=Neha chooses a black t-shirt.
2 B= Neha chooses a bluet-shirt.
3 Neha cannot choose both a black t-shirt and a blue t-shirt,
4 so the addition theorem of probability for independent events
```

```
5
6 P(A U B) = P(A) + P(B) = (6/12)+(2/12) = 0.666
```

In [37]:
```
1 (6/12)+(2/12)
```

Out[37]: 0.6666666666666666

In [39]:
```
1 2/3
```

Out[39]: 0.6666666666666666

In [ ]:
```
1
```

In [ ]:
```
1
```

Q10. Cosmetics _Contingency Solved

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

In one of the cities of India out of 1,00,000 people, 51,500 are male and 48,500 are female. Among the males, 9,000 use cosmetics. Among the women, 30,200 use cosmetics. If a person is selected at random, what is the probability that:

i. He or she uses cosmetics.

ii. A male or a person using cosmetics is chosen.

iii. A male who does not use cosmetics or a female who uses cosmetics is chosen.

Choose the correct answer from bel

- ○ 0.60 , 0.72 , 0.27
- ◉ 0.39 , 0.81 , 0.72
- ○ 0.77 , 0.90 , 0.27

User	Cosmetic	Don't Use	Total
Male	9000	42,500	51,500
Female	30,200	18,300	48,500
Total	39,200	50,800	100,000

i)He or she uses cosmetics.
Pcosmetics = 39200/100000 = 0.392

ii)A male or a person using cosmetics is chosen.
Pmale = 51500/100000
Pmale And cosmetics = 9000/100000
Pmale Or cosmetics = Pmale + Pcosmetics - (Pmale And cosmetics)
Pmale Or cosmetics= (51500/100000)+(39200/100000)-(9000/100000)=0.8170

iii)A male who does not use cosmetics or a female who uses cosmetics is chosen.
Pmale Nocosmetics = 42500/100000
Pfemale Using Cosmetics = 30200/100000
A male not using cosmetics or a female using cosmetics=
(PmaleNocosmetics+ PfemaleUsingCosmetics)=(42500/100000)+(30200/100000) =0.727

In [41]:
```
1 51500-9000
```

Out[41]: 42500

In [40]:
```
1 48500-30200
```

Out[40]: 18300

In [43]:
```
(9000+30200)/100000
```

Out[43]: 0.392

In [47]:
```
(51500/100000) + ((9000+30200)/100000) - (9000/100000)
```

Out[47]: 0.8170000000000001

In [45]:
```
(42500/100000) + (30200/100000)
```

Out[45]: 0.727

In [ ]:
```

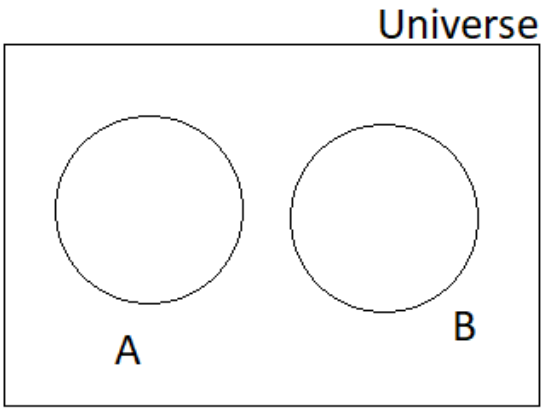
```

Problem solving session

In [ ]:
```

```

```
if A intersection B is empty set : A and B are mutually exclusive events
if A union B is Universal set : then A And B are mutually exhaustive events
```

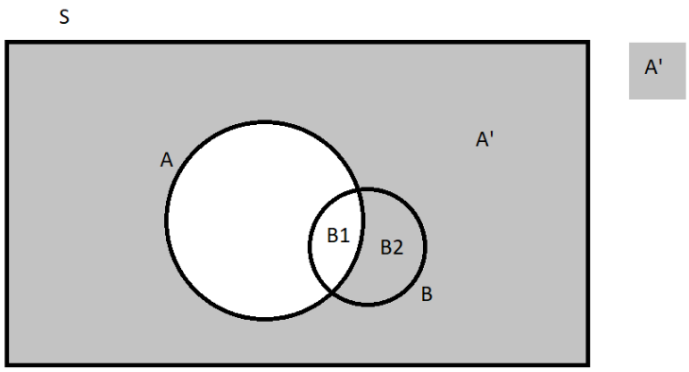


$$A \cap B = \{\}$$
$$A \cup B = \text{Universe}$$

```
P[A|B] = P[A ∩ B] / P[B]
       = P[B|A] * P[A]   / P[B]

P[A|B] = P[B|A] * P[A]   /
        (P[B|A] * P[A]   +   P[B|A'] * P[A'])
```

$$P[A|B] = \frac{P[B|A] * P[A]}{(P[B|A] * P[A] + P[B|A'] * P[A'])}$$



In [1]:
```
0.48+0.376-(0.55*0.376)
```

Out[1]: 0.6492

A family has 2 children. Given that at least one child is a girl, what is the probability that both are girls

Click on an option to submit your answer

A	1/2
B	2/3
C	1/4
D	1/3

```
sample space  : gg,by,gb,bb
           already given that one child is a girl
         so bb is not an element

            so , sample space is : gg,bg,gb

            one is girl that is given ,
            the probability of both are girl is :
                1/ 3
```

In [ ]:
```

```

```
P[ 2 Girls | atleast 1 girl ]  = P[2 Girls ] ∩ P[ atleast 1 girl]/
                                     P[atleast 1 girl]

                                = ( 1/4 ) / (3/4)
                                = 1/3

```

In [92]:
```
 ( 1/4 ) / (3/4)
```

Out[92]: 0.3333333333333333

In [93]:
```
1/3
```

Out[93]: 0.3333333333333333

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Type *Markdown* and LaTeX: α^2

In [ ]:
```
# what is the probability of two girls given that olderst is a girl
```

In [ ]:
```
{gg,gb}
```

In [ ]:
```
1/2
```

```
P[2G|olderst_girl] = P[2G] ∩ P[OG] / P[OG]
                   = 1/4           /  1/2
                   = 1/2
```

In [ ]:
```

```

In [ ]:
```

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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
```

```

In MCQ with 4 options, let 0.8 be the probability that the student knows the answer, and 0.2 the probability of guessing. What is the conditional probability that the student knew the answer to a question given that it was answered correctly?

Click on an option to submit your answer

A	10/17
B	12/17
C	14/17
D	16/17

In [2]:
```
# D
```

```
P[student knows the answer] = 0.8                P[K] = 0.8
P[~ student knows the ans ] = 0.2   (guessing )  P[G] = 0.2

P[correct ans]
P[ans is wrong]


P[knows ans| ans correctly] =  ? (Question )

P[K|C] = P[C|K]*P[K] / P[C|K]*P[K]  + P[C|K']*P[K']
       = P[C|K]*P[K] / P[C|K]*P[K]  + P[C|G]*P[G]

   P[C|K]  probability of correct ans given he knows the ans = 1
   P[k] is 0.8
   P[C|G] probability of correct ans guessing out of 4 questions = 1/4
```

```
  P[G] = 0.2

      = (1*0.8)  / ((1*(0.8)) +  ((1/4)*0.2))
```

In [3]:
```
(1*0.8)  / ((1*(0.8)) +  ((1/4)*0.2))
```

Out[3]: 0.9411764705882353

In [4]:
```
16/17
```

Out[4]: 0.9411764705882353

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:
```
# A ∩ B
# A ∪ B
# A ⊂ B
```

P(E) = 0.6

What can we say about P(E|F) when E and F are mutually exclusive

Click on an option to submit your answer

A	P(E|F) = 0.6
B	P(E|F) >= 0.6
C	P(E|F) <=0.6
D	P(E|F) = 0

```
P[E|F] = P[E ∩ F]/P[F]

here, E and F are mututally exclusive . that means :
E ∩ F = {}
P[E ∩ F] = 0

```

```
P[E|F] = 0/P[F]
       = 0
```

In [ ]:
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```

In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
```

```

In [ ]:
```

```

Let P(E) = 0.6

What can we say about P(E|F) when E is a subset of F

Click on an option to submit your answer

A	P(E|F) = 0.6
B	P(E|F) >= 0.6
C	P(E|F) <= 0.6
D	P(E|F) = 0

```
E is a subset of F :

P[E ∩ F] = P[E]




P[E|F] = P[E ∩ F]/P[F]
       = P[E]/P[F]
       =  0.6/P[F]

      P[E]/ P[E]   >= P[E]
ans is option B



P[E] = 0.6

```

```
P[E|F] = P[E]/P[F]

left say : P[E|F]== 0.5
           0.5= 0.6 / P[F]
           so , P[F] becomes >1 , which is not possible


           thats why P[E|F] should be >= 0.6
```

In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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```

In [ ]:
```
```

Let P(E) = 0.6

What can we say about P(E|F) when F is a subset of E

Click on an option to submit your answer

A	P(E|F) = 1
B	P(E|F) >= 0.6
C	P(E|F) <= 0.6
D	P(E|F) = 0

In [ ]:
```
 F is a subset of E :
       means F ∩ E = F

   P[E|F] = P[E ∩ F]/P[F]
          = P[F] / P[F]
          = 1

   option A is the ans
```

In [ ]:
```
```

In [ ]:
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1
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In [ ]:
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1
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In [ ]:
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1
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In [ ]:
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In [ ]:
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1
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In [ ]:
```
1
```

In [ ]:
```
1
```

A gambler has in his pocket a fair coin and a two-headed coin. He selects one of the coins at random, and when he flips it, it shows heads. What is the probability that it is the fair coin?

Click on an option to submit your answer

A	1/2
B	1/3
C	1/5
D	1

```
Fair coin      Biased coin
(HT)           (HH)

P[F] = 1/2     P[B] = 1/2

P[F|H] = ? (Question )



P[F|H]  =  P[H|F]*P[F]  /  P[H|F]*P[F] + P[H|B]*P[B]
        =  1/2 * 1/2    /    1/2 * 1/2 +     1 * 1/2

    P[H|F]  probability of heads given the coin is fair  is 50%
    P[F] probability offair coin is 1/2
    P[H|B] :  probility of heads given the biased coin :
              as biased coin has both sides heads   , probability of heads is 1
    P[B] = P[F]  due to randomness P[B] is 1/2  and P[F] is 1/2
```

In [5]:
```
((1/2) * (1/2))    / (   ((1/2) * (1/2)) +   (  1 * (1/2)   )  )
```

Out[5]: 0.3333333333333333

In [6]:
```
1/3 # ans is option B
```

Out[6]: 0.3333333333333333

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
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1
```

In [ ]:
```
1
```

In [ ]:
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1
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In [ ]:
```
1
```

In [ ]:
```
1
```

`

A gambler has in his pocket a fair coin and a two-headed coin. He selects one of the coins at random, and he flips it twice. It shows heads both the times. What is the probability that it is the fair coin?

Click on an option to submit your answer

A	1/2
B	1/3
C	1/5
D	1

```
Fair coin      Biased coin


P[F] = 1/2     P[B] = 1/2

P[F|HH] = ? (Question )



P[F|HH]  =  P[HH|F]*P[F]  /  P[HH|F]*P[F] + P[HH|B]*P[B]
        =  1/4 * 1/2    /    1/4 * 1/2 +     1 * 1/2

    P[HH|F]  probability of two heads(two flips) given the coin is fair  is 25% (1/2 *
1/2)
    P[F] probability offair coin is 1/2
    P[HH|B] :  probility of both heads given the biased coin :
             as biased coin has both sides heads   , probability of two heads is 1
    P[B] = P[F]  due to randomness P[B] is 1/2  and P[F] is 1/2
```

In [7]:
```
((1/4) * (1/2))    / (   ((1/4) * (1/2)) +   (  1 * (1/2)   )  )
```

Out[7]: 0.2

In [8]:
```
1/5  # ans is Option C
```

Out[8]: 0.2

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

A gambler has in his pocket a fair coin and a two-headed coin. He selects one of the coins at random, and he flips it three times. He gets {HHT}. What is the probability that it is the fair coin?

Click on an option to submit your answer

A	1/2
B	1/3
C	1/5
D	1

```
Fair coin      Biased coin


P[F] = 1/2     P[B] = 1/2

P[F|HHT] = ? (Question )



P[F|HHT]  =  P[HHT|F]*P[F]  /  P[HHT|F]*P[F] + P[HHT|B]*P[B]
          =      1/8 * 1/2  /    1/8 * 1/2   + 0 * 1/2
          =      1/16       /    1/16
          =   1


        probability of  tails in a two headed coin P[HHT|B] = 0


          Option D = 1 is the ans
```

In [ ]:
```

```

In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
```

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In [ ]:
```

```

airline case of overbooking :

```

```

```
# airline case of overbooking :

50 seats are aavilbale in aircraft
52 tickekts has been sold
5% of people dont show up

Q: P[all who show up gets the seat] = ?


probability  of all 52 people show up :
    P[all of people who bought ticket shows up]


    p[one person show up] = 1- P[person dont shw up]
                          = 1- 5%
                          = 0.95
```

```
P[all of people who bought ticket shows up] = (0.95)**52



P[51 people show up] = C(52,51 ) * ((0.95)**51) * (0.05)
                                  51 show-up       1 dont show up


so , probability of 50 people show up so they all have seat is :

    = 1 - P[52 people show up] - P[51 people showup]
    = 1 - (0.95**52) - (52 * (0.95**51)*0.05)
```

In [82]:
```
1 - (0.95**52) - (52 * (0.95**51)*0.05)
```

Out[82]: 0.7405030708792849

```
all who show up will have 74% chances to get seat
```

In [2]:
```
math.comb(52,51)
```

Out[2]: 52

In [1]:
```
import math
```

```
              = nCx p**x (1-p)**n-x
P[52 show-up]  = C(52,0) * ((0.05)**0) * ((1-0.05)**(52-0))

n = 52
x = 0
```

In [85]:
```
(math.comb(52,0)) * ((0.05)**0) * ((1-0.05)**(52-0))  # P[52 show up]
```

Out[85]: 0.06944284018723361

```
P[51 show-up]  = C(52,1) * ((0.05)**1) * ((1-0.05)**(52-1))
               =   nCx   *   p**x      *     (1-p)**n-x
    n = 52
    x = 1
```

In [88]:
```
math.comb(52,1) * ((0.05)**1) * ((1-0.05)**(52-1)) # P[51 show up]
```

Out[88]: 0.1900540889334815

In [91]:
```
(1- 0.06944284018723361-0.1900540889334815)*100
```

Out[91]: 74.05030708792849

```
all who show up will have 74% chances to get seat
```

In [ ]:

In [ ]:

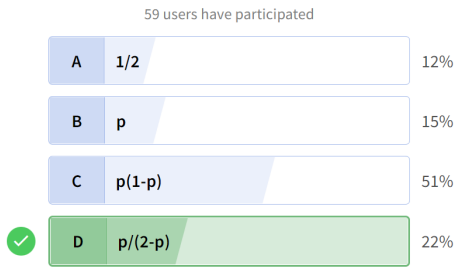
In [ ]:

In [ ]:

In [ ]:

In [ ]:
```
1
```

A and B toss a coin alternatively till one of them gets a heads. The probability of heads is "p". Game starts with A tossing first. What is the probability that A wins the game?




```
definind sample space :
    till get heads , A and B keep tossing alternatively .

    S = { H, TH, TTH ,TTTH ,TTTTH , TTTTTH , ........ }

    since A starts the tossing :

    S = { H, TH, TTH ,TTTH ,TTTTH , TTTTTH , TTTTTTH........ }
          A      ABA        ABABA            ABABABA ....

            in above cases A wins (Q)

       P[first event] = H : 1/2 :  p                                          p
       P[3rd event] = TTH : 1/8 :  (1-p)(1-p)*p                        (1-p)**2  * p
       P[5th event]       :     :  (1-p)(1-p)(1-p)(1-p) * p               (1-p)**4  * p
       P[7th event]           :  (1-p)(1-p)(1-p)(1-p)(1-p)(1-p)*p       (1-p)**6  * p
       .
       .
       .
       .
P[A wins] = P    +    (1-p)^2  * p    +  (1-p)^4  * p     +   (1-p)^6  * p  +  .....

lets say (1-p)^2 = r

P[A wins] = p + rp + r^2p + r^3p +.....



sum of above GP :

P[A wins] = P / 1-r
          = p / (1-((1-p)^2))
            = 1 / (2-p)


            Option 4 : is given wrong

            ans is : 1/(2-p)
```

In [ ]:
```
1 --
```

Probability and Statistics 2

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q1. Three guns Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

One shot is fired from each of the three guns. E1, E2, E3 denote the events that the target is hit by the first, second and third gun respectively. If P(E1) = 0·5, P(E2) = 0·6 and P(E3) = 0·8 and. E1, E2, E3 are independent events, find the probability that

(i) exactly one hit is registered

(ii) at least two hits are registered.

Choose the correct answer from below:

- 0.32 ,0.70
- 0.26 ,0.51
- 0.32 , 0.51
- **0·26, 0·70** ✓

In [ ]:
```
1
```

```
1: Exactly one hit is registered:

 Gun 1 hits but Gun 2 and Gun 3 not hits     E1  E2'  E3'
 Gun 2 hits but Gun 1 and Gun 3 not hits     E1' E2   E3'
 Gun 3 hits but Gun 1 and Gun 2 not hits     E1' E2'  E3

P[E1] = 0.5 , P[E1'] = 0.5
P[E2] = 0.6 , P[E2'] = 0.4
P[E3] = 0.8 , P[E3'] = 0.2

[E1]  [E2']  [E3'] +  [E1'] [E2] [E3'] + [E1'] [E2'] [E3]
0.5 * 0.4 * 0.2    +   0.5* 0.6 * 0.2  + 0.5*0.4*0.8

```

In [94]:
```
(0.5 * 0.4 * 0.2 )   +  ( 0.5* 0.6 * 0.2)  + (0.5*0.4*0.8)
```

Out[94]: 0.26

In [ ]:
```
1
```

```
2 : At least two hits are registered:

Any two guns hits the target     E1 E2 E3'+ E1 E2' E3+ E1' E2 E3
All three guns hits the target   E1 E2 E3

 Any two guns hits the target                        +   All three guns hits the target
 [E1] [E2] [E3']+ [E1] [E2'] [E3]+ [E1'] [E2] [E3] +    [E1] [E2] [E3]

 (0.5*0.6*0.2)  + (0.5*0.4*0.8)  + (0.5*0.6*0.8) + (0.5*0.8*0.6)

```

In [95]:
```
(0.5*0.6*0.2)  + (0.5*0.4*0.8)  + (0.5*0.6*0.8) + (0.5*0.8*0.6)
```

Out[95]: 0.7

In [ ]:
```
1
```

In [ ]:
```
1
```

Q2. tell the truth

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The probabilities that “A” and “B” will tell the truth are 2/3 and 4/5 respectively. What is the probability that

i) they agree with each other

ii) they contradict each other while giving a witness in the court.

Choose the correct

- 0.6,0.4
- 0.5,0.7
- 0.8,0.6
- 0.7,0.5

In [ ]:

```

    A     B
T  2/3   4/5
F 1-2/3 1-4/5


```

```
P[ do not agree each other ] =

A intersect B' + B intersects A'
```

In [97]:

```
((2/3 )*(1-4/5)) + ((4/5)*(1-2/3))

#  A   *  B'     +    B  * A'
```

Out[97]: 0.4

```
P[agree each other] = A intersection B + A' intersection B'
```

In [99]:

```
((2/3)*(4/5))+((1-2/3)*(1-4/5))
```

Out[99]: 0.6

In [ ]:

```

```

Q3. Boy or girl paradox

Solved

Asked in: PP

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Supposedly a friend of yours has 2 children and at least one of them is a boy. What is the probability that the other is also a boy?

Choose the correct

- ○ 1/2
- ● 1/3
- ○ 2/5
- ○ 2/3

In [ ]:

```
P[ 2 boy | atleast 1 boy ]  = P[2 boys ] ∩ P[ atleast 1 boy]/
                                    P[atleast 1 boy]

                            = ( 1/4 ) / (3/4)
                            = 1/3
```

A family has 2 children. Given that at least one child is a girl, what is the probability that both are girls

Click on an option to submit your answer

A	1/2
B	2/3
C	1/4
D	1/3

```
sample space  : gg,by,gb,bb
           already given that one child is a girl
         so bb is not an element

            so , sample space is : gg,bg,gb

            one is girl that is given ,
            the probability of both are girl is :
                1/ 3
```

In [ ]:

In [ ]:

In [ ]:

Q2. Tell the truth Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The probabilities that “A” and “B” will tell the truth are 2/3 and 4/5 respectively. What is the probability that

i) they agree with each other

ii) they contradict each other while giving a witness in the court.

Choose the correct answe

- (●) 0.6,0.4
- ( ) 0.5,0.7
- ( ) 0.8,0.6

Probability of A telling truth => Pa = 2/3
Probability of B telling truth => Pb = 4/5

i)they agree with each other is equal to both speaking truth or both speaking false
Pa Agree b = (Pa * Pb) + ((1-Pa) * (1-Pb)) = 0.6

ii) they contradict each other while giving a witness in the court means one of them tells the truth other does not agree.
PaContradictb = (Pa * (1-Pb)) + ((1-Pa)*Pb) = 0.4

```
    T    T'
A   2/3  1-2/3
B   4/5  1-4/5

agree : ((2/3)*(4/5)) + ((1-2/3) * (1-4/5))

```

In [48]:
```
((2/3)*(4/5)) + ((1-2/3) * (1-4/5))
```

Out[48]: 0.6

```
do not agree :

((2/3)*(1-4/5))+((4/5)*(1-2/3))
```

In [49]:
```
((2/3)*(1-4/5))+((4/5)*(1-2/3))
```

Out[49]: 0.4

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Q4. Target Hitting

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The probability of one person hitting a target is 3/ 5. The probability of another person not hitting the target is 2/3. If each of them fires once at the target, find the probability that:

i) both of them hit it

ii) at least one of them hit the target.

Choose the correct answer from below:

- [x] 0.2,0.73
- [ ] 0.39,0.26
- [ ] 0.2,0.26
- [ ] 0.13,0.80

```
1
2
      Hit      Not Hit
3 P1  3/5      1-3/5
4 P2  1-2/3    2/3
```

In [100]:
```
1 3/5
```

Out[100]: 0.6

```
1 P[Both hit] = P[P1|H]*P[P2|H]
2               (3/5)  * (1-2/3)
```

In [107]:
```
1 (3/5)  * (1-(2/3))
```

Out[107]: 0.2

```
1 P[atleast one hit] = P[both|hit] +  P[p1| hit]    + P[P2 |hit]
2                    = 0.2         + ((3/5)*(2/3)) +  ((1-2/3)*(1-3/5))
```

In [111]:
```
1  0.2         + ((3/5)*(2/3)) +  ((1-2/3)*(1-3/5))
```

Out[111]: 0.7333333333333334

In [ ]:
```
1
```

In [54]:
```
1 21/6
```

Out[54]: 3.5

In [ ]:
```
1
```

In [ ]:
```
1
```

Two men hit at a target with probabilities 1/2 and 1/3 respectively. What is the probability that exactly one of them hits the target?

Concept:

$P(\bar{A}) = 1 - P(A)$

Calculation:

Here, let probability of a man hitting target P(A) = 1/2 and

Probability of another man hitting target P(B) = 1/3

So, probability of a man not hitting target = $P(\bar{A}) = 1 - 1/2 = 1/2$ and

Probability of another man not hitting target = $P(\bar{B}) = 1 - 1/3 = 2/3$

Now, required probability = $P(A)P(\bar{B}) + P(B)P(\bar{A})$

$$\Rightarrow \left(\frac{1}{2}\right)\left(\frac{2}{3}\right) + \left(\frac{1}{3}\right)\left(\frac{1}{2}\right)$$
$$\Rightarrow \frac{2}{6} + \frac{1}{6}$$
$$\Rightarrow \frac{1}{2}$$

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q5. White Marble Probability Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

There are 6 marbles in a bag and only one of them is white. You are allowed to draw a marble from the bag 100 times. After drawing a marble, it is placed back in the bag. What is the probability of drawing the white marble at least once?

Choose the correct answer from below:

- ○ 5/6
- ○ (5/6)^100
- ● 1 - (5/6)^100
- ○ Insufficient Information

In [ ]:
```
1 P[not white marble] = 5/6
```

In [ ]:
```
1 P[not white marble 100 times] = (5/6)^100
```

In [ ]:
```
1 P[white marble 100 times] = 1- ((5/6)^100)
```

In [31]:
```
1 1- ((5/6)**100)
```

Out[31]:
```
0.9999999879253265
```

In [ ]:
```
1
```

In [ ]:
```
1 ATLEAST
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q6. Will it Rain? Solved

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

Get help from TA.

Consider the situation where there are two cities, city1 and city2. The cities are close enough that they are generally affected by the same weather, yet they are far enough apart that they do not get identical weather.

We can consider discrete weather classifications for these cities on a given day, such as sunny, cloudy, and rainy. When it is sunny in city1, it is usually sunny in city2, but not always. As such, there is a dependency between the weather in the two cities.

The table below summarizes the probability of each discrete weather for the two cities, with city1 defined across the top (x-axis) and city2 defined along the side (y-axis).

	Sunny	Cloudy	Rainy
Sunny	6/20	1/20	1/20
Cloudy	1/20	5/20	2/20
Rainy	0/20	1/20	3/20

Using the table find the probability of city1 having sunny weather.

Choose the correct answer from below:

- (●) 0.35
- ( ) 0.2
- ( ) 0.15
- ( ) 0.7

Submit

```
1
2 P[ city1=sunny | city2=sunny ]    6/20
3 P[ city1=sunny | city2=cloudy ]   1/20
4 P[ city1=sunny | city2=rainy ]    0/20
5
6 P[c1=s|c2=s]  + P[c1=s|c2=c] +  P[c1=s|c2=r]
7 6/20          +   1/20       + 0/20
8
```

In [30]:
```
1 7/20
```

Out[30]: 0.35

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q7. Marbles in Jar

Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

You have two jars, 50 red marbles and 50 blue marbles. You need to place all the marbles into the jars such that when you blindly pick one marble out of one jar, you maximize the chances that it will be red. When picking, you'll first randomly pick a jar, and then randomly pick a marble out of that jar. You can arrange the marbles however you like, but each marble must be in a jar. What is the maximum probability?

Answer in decimal rounded off to 2 decimal places. For example, if the answer is 2/3, the response should be 0.67

```
50Red balls % 50 Blues balls

1 jar  + 1 jar
P(1st jar) = 1/2
P(2nd jar) = 1/2

to maximise the probability of getting red from any jars of two
we can place one red ball in jar one .
and rest of all balls in other jar .

max probability of red = ((1/2)*(one red ball out of 1 red ball))
                        + (1/2)*(leftover red ball out of leftover total balls)
                = ((1/2)*1)+((1/2)*(49/99))
```

In [31]:
```
0.5*(49/99)+(1/2)
```

Out[31]: 0.7474747474747475

In [33]:
```
np.round(((1/2)*1)+((1/2)*(49/99)),2)
```

<IPython.core.display.Javascript object>

Out[33]: 0.75

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Q8. Probability 09 Solved

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

Company A produces 10% defective products, Company B produces 20% defective products and C produces 5% defective products. If choosing a company is an equally likely event, then find the probability that the product chosen is defective.

Choose the correct answer from below:

- 0.22
- **0.12** ✓
- 0.11
- 0.21

```
defective P[D]

= (E1 * D|E1) + (E2 * D|E2) + (E3 * D|E3)
=  1/3 * 0.1  +  1/3 * 0.2  + 1/3 * 0.05
```

In [43]:
```
(1/3 * 0.1)  +  (1/3 * 0.2)  + (1/3 * 0.05)
```

Out[43]: 0.11666666666666667

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Q9. Probabilty 10 Solved

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

The probability that person A completes all the tasks assigned is 50% and that of person B is 20%. Find the probability that all the tasks are completed.

Choose the correct answer from below:

- 0.15
- 0.25
- **0.35** ✓
- 0.45

```
p[task complete]

P[TC] = P[A]*P[TC|A] + P[B]*P[TC|B]
      = ((1/2) * (50/100)) + ((1/2) * (20/100) )
```

In [44]:
```
((1/2) * (50/100)) + ((1/2) * (20/100) )
```

Out[44]: 0.35

In [ ]:
```

```

In [ ]:
```

```

Q8. Biased Dice Solved

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

A 6-sided die is biased. Now, the numbers one to four are equally likely to happen, but five and six are thrice as likely to land face up as each of the other numbers. If X is the number shown on the uppermost face, determine the expected value of X when 6 is shown on the uppermost face.

Choose the correct answer from below:

- ○ 13/4
- ○ 3/5
- ◉ 43/10

```
x+x+x+x+3x+3x = 1
x = 1/10
```

In [56]:
```
(1+2+3+4+15+18)/10
```

Out[56]: 4.3

Let P(1) = P(2) = P(3) = P(4) = p and P(5) = P(6) = 3p.
We know that the sum of all probabilities must be 1
⇒ p + p + p + p + 3p + 3p = 1
⇒ 10p=1
⇒ p = 1/10

Expected Value: = 1 x (1/10) +2 x (1/10) +3 x (1/10) +4 x (1/10) +5 x (3/10) +6 x (3/10) = 43/10

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

```

A Fair coin is tossed ten times and the sequence that comes is written on the board. A child walks by, and for each letter written on the board, he either wipes it off or keeps it as it is. This wiping is done with probability 0.5.
Of the remaining number of letters on the board, find the probability that there are 4 heads.
```

In [ ]:
```

```

```
 A bag has 10 fair coins. A man randomly grabs a few coins, any number between 1 to 10 being equally likely, and tosses all of them once. What is the probability that there are 4 heads.
```

```
  Nadal and Zverev are in a tiebreaker in tennis, the scores are 5-5. The chance of Nadal winning any point is “p”. What is the probability that he will win the set?
```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Q9. Interview Confusion Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Arjun is having an online interview aptitude test. He desperately wants to clear the aptitude test. In the test, Arjun either guesses (or) copies from reliable sources (or) know the answer to a multiple-choice question with 4 choices. The probability that he makes a guess is 1/3, he copies the answer is 1/6. The probability that his answer is correct given that he copied it is 1/8. Find the probability that he knew the answer to the question. Given that he correctly answered it.

Choose the correct answer

- 21/25
- 24/29
- 47/50
- 73/35

In [ ]:
```

```

```
P[guess] = 1/3
P[copy] = 1/6
P[knows] = 1- P[guess]-P[copy] = 1-(1/3)-(1/6) = 1/2
```

In [64]:
```
1-(1/3)-(1/6)
```

Out[64]:
```
0.5000000000000001
```

```
P[correct|copy] = 1/8
```

```
P[knows|correct] = ?
```

```
P[correcct|knows] = 1
P[correcct|guess] 1/4
P[correcct|copy] = 1/8 (given)
```

```
P[knows|correct] = P[k intersection Corect]
                        / P[correct]
                = P[correcct|knows]*P[knows]
                        / P[correcct]
                =  P[correcct|knows]*P[knows]
                   / P[correcct|knows]*P[knows] + P[correcct|guess]*P[guess] +
P[correcct|copy]*P[copy]

                = (1*(1/2))/
                ((1*(1/2)) + ((1/4)*(1/3)) + ((1/8)*(1/6)))
```

In [65]:
```
((1*(1/2)) + ((1/4)*(1/3)) + ((1/8)*(1/6)))
```

Out[65]: 0.6041666666666667

In [58]:
```
(1/2)/0.6041666666666667
```

Out[58]: 0.8275862068965516

In [59]:
```
0.8275
```

Out[59]: 0.8275

In [61]:
```
24/29
```

Out[61]: 0.8275862068965517

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Q10. Fruit Seller Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

A Wholesale fruit seller sells fruits that are either good (85%), slightly rotten (5%), or gone rotten (10%). These fruits go through a quality check which identifies completely gone rotten fruits and discards them. What is the probability that he will be able to sell good fruits?

Choose the correct answ

- 0.97
- 0.85
- 0.92
- 0.94

In [ ]:
```

```

```
P[G] = 0.85    good                85%

P[SR] = 0.05   slightly rotton    5%
P[GR] = 0.10   gone rotton         10%
```

In [71]:
```
# after removing gone rottobn : left total = 90%
# probability of those 85% good fruits is now : 85/90
85/90
```

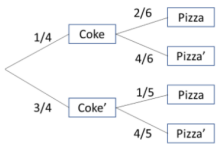
Out[71]: 0.9444444444444444

In [ ]:
```
1
```

In [ ]:
```
1
```

Q11. Prob of pizza Solved

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



Consider the above probability tree. Here, each of the values labeled shows the probability of that event occurring. Given this tree, Calculate the probability of P(Pizza)?

Choose the correct answer from below:

- (●) 7/30
- ( ) 7/15
- ( ) 1/5
- ( ) 8/15

```
1 P[coke and pIzza]  +  P[coke' and pIzza]
2
3 ((1/4) * (2/6))    +   ((3/4) * (1/5))
```

In [72]:
```
1 ((1/4) * (2/6))    +   ((3/4) * (1/5))
```

Out[72]: 0.23333333333333334

In [73]:
```
1 7/30
```

Out[73]: 0.23333333333333334

In [ ]:
```
1
```

Q12. Condition Prob on Marbles Solved

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

A jar contains 8 marbles out of which 4 are red and 4 are blue. We pick two balls, one after another, without replacement. Given that the first ball was red, what is the probability that the second one is also red?

Choose the correct answer from below:

- ( ) 4/13
- ( ) 4/7
- ( ) 3/7
- ( ) 8/15

```
1 total 8 balls
2 4 red
3 4 blue
4 first ball : P[first picked red] = 4/8
5     now 3 red left out of 7 total
6     :P[2nd picked red] = 3/7
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q13. HHT or HTT? Solved

Asked in:

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

Get help from TA.

You flip a coin until either Head Heads Tails or Heads Tail Tails shows up. What's more likely to appear 1st?

Choose the correct answer from below:

- [x] HHT
- [ ] HTT
- [ ] insufficient information
- [ ] None of the above

In [ ]:
```
1
```

In [ ]:
```
1
```

Q14. Dangerous fire Solved

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

Get help from TA.

If dangerous fires are rare (3%) but smoke is fairly common (15%) due to barbecues, and 85% of dangerous fires make smoke then what is the probability of dangerous fire when there is Smoke.

Choose the correct answer from below:

- [ ] 0.11
- [ ] 0.09
- [x] 0.17
- [ ] 0.90

```
1  P[dangerous fire] = 0.03
2  P[smoky fire]    =  0.15
3
4  P[Smokey|dangerous ] = 0.85
5
6
7  P[dangerous fire| Smokey fire] =
8
9  P[sm|df]*P[df]   /  P[sm]
10
11 (0.85 * 0.03) / 0.15
```

In [37]:
```
1 (0.85 * 0.03) / 0.15
```

Out[37]: 0.16999999999999998

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

```
1
```

In [ ]:
```
1
```

Q15. Becoming managers Solved

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

Get help from TA.

The probability of Ashok, Priya, Naveen becoming managers is 4/9, 2/9, and 1/3 respectively. The probability that the Bonus scheme will be introduced if Ashok, Priya, and Naveen become Managers is 3/10,1/ 2, and 4/5 respectively.

i. What is the probability that a Bonus scheme will be introduced?

ii. If the bonus scheme has been introduced what is the probability that the manager appointed is Ashok.

Choose the correct answer from below:

- 0.45, 0.28
- 0.48 , 0.19
- **0.51 , 0.26** ✓
- 0.54 ,0.13

In [ ]:
```
1  i       x        y        z
2        ashok     priya     Naveen              i = (x,y,z)
3
4  P(i)     4/9      2/9      1/3
5
6  P(B|i)  3/10      1/2      4/5
7
8
9
10 P[Bonus] = P[B] =  P[x]*P[B|x]  +  P[y]*P[B|y]  +  P[z]P[B|z]
11                 ((4/9)*(3/10)) + ((2/9)*(1/2)) + ((1/3) *( 4/5))
12
```

In [23]:
```
1  ((4/9)*(3/10)) + ((2/9)*(1/2)) + ((1/3) *( 4/5))
```

Out[23]:
```
0.5111111111111111
```

In [ ]:
```
1  P[Ashok become manager | bonus introduced ]
2
3  P[x|B]  = P[B|x] * P[x]
4             /  P[B]
5          = ((3/10)*(4/9))/(0.5111111111111111)
```

In [24]:
```
1  ((3/10)*(4/9))/(0.5111111111111111)
```

Out[24]:
```
0.2608695652173913
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q16. Bayes' Theorem </> Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

As you know, Covid-19 tests are common nowadays,but some results of tests are not true.Given that the probability of getting covid is 60%, People who tested positive and have covid is 90% but people who tested positive and don't have covid is 10%. What is the probability that they actually have covid?

Write a program that calculates the required probability using the P(covid), P(positive|covid) and P(positive|~covid) as the input parameters. Take care that the inputs are taken as strings therefore if you are using those variables ensure to typecast them into floats.

Constraint: 0<input probabilities<1

Input Format

```
Number of testcases
P(covid)
P(positive|covid)
P(positive|~covid)
```

In [124]:
```
import numpy as np
def bayes_theorem(P_covid_,positive_covid,positive_not_covid):
    # YOUR CODE GOES HERE
    P_covid_ = float(P_covid_)
    positive_covid = float(positive_covid)
    positive_not_covid = float(positive_not_covid)
    ans=  np.round(  (positive_covid*P_covid_) / ( (positive_covid*P_covid_)+(positive_not
    return ans;

```

In [125]:
```
P_covid_ = 0.6
P_positive_covid_ = 0.9
P_positive_not_covid_ = 0.1
bayes_theorem(P_covid_,P_positive_covid_,P_positive_not_covid_)
```

Out[125]: 0.931

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Probability Distribution 1

In [ ]:

Q2. Probability to wait Solved

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

Get help from TA.

Let X denote the time a person waits for an elevator to arrive. Suppose the longest one would need to wait for the elevator is 2 minutes so that the possible values of x (in minutes) are given by the interval [0,2].

$$f(x) = \begin{cases} x, 0 < x <= 1 \\ 2 - x, 1 < x <= 2 \\ 0, otherwise \end{cases}$$

What's the probability that a person waits less than 30 seconds for the elevator to arrive?

Choose the correct answer from below:

- 0.250
- 0.600
- **0.125** ✓
- 0.550

$$P(a \leq X \leq b) = P(a < X < b) = P(a \leq X < b) = P(a < X \leq b) = \int_a^b f(x)\,dx$$

$$F(x) = P(X \leq x) = \int_{-\infty}^{x} f(t)\,dt, \quad \text{for } x \in \mathbb{R}.$$

$$f(x) = \frac{d}{dx}[F(x)]$$

$$F(0.5) = \int_{-\infty}^{0.5} f(t)\,dt = \int_{0}^{0.5} t\,dt = \frac{t^2}{2}\Big|_0^{0.5} = 0.125$$

```
P(a <= x <=b)    = ∫f(x).dx in range [a,b],
                            here a = 0 and b = 0.5

P(0 <= x <= 0.5) = ∫f(x).dx in the range[0, 0.5]  # [0-1] 0.50
                                                  # [1-2] 0.50
f(x) in this range = x

So, P(0 <= x <= 0.5) = [x^2 / 2],
                     = 0.5^2 / 2
                     = 0.125
```

In [ ]:

In [ ]:

In [ ]:

Q3. Smiling Baby

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The below data represents 20 smiling times in seconds of a 6-week-old baby. which follows uniform distribution from 0 to 24 seconds and all the values are equally likely.

```
data=
[10.4,16.8,16.3,14.5,8.9,22.8,20.0,11.9
,0.7,4.5,10.0,11.6,3.3,15.9,22.8,17.9,2
4.0,8.9,1.3,13.9]
```

i) What is the probability that a randomly chosen 6-week-old baby smiles between 4-15 seconds?

ii)What is the probability that a randomly chosen 6-week-old baby smiles less than or equal to 10 seconds?

Choose the correct answer from below:

- 11/24, 5/12
- 19/24, 10/ 24
- 2/12, 9/24
- 15/24, 9/12

In [74]:

```
data=[10.4,16.8,16.3,14.5,8.9,22.8,20.0,11.9,0.7,4.5,
      10.0,11.6,3.3,15.9,22.8,17.9,24.0,8.9,1.3,13.9]
```

```
P[4-15] = b-a / x2-x1
        = 15-4 / 24-0
        = 11/24
P[<=10] = b-a / x2-x1
        = 10-0 / 24-0
        = 10/24
        = 5/12
```

In [ ]:

In [ ]:

In [ ]:

Q4. P(x) in normal distribution

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

If a normal distribution with μ = 200 have P(X > 225) = 0.1587, then P(X < 175) equal to:

Choose the correct answer from below:

- 0.3413
- 0.8413
- 0.1587
- 0.5000

In [ ]:
```
mean = 200
P[x > 225] = 0.1587
```

In [ ]:
```
225 - mean
mean - 175
```

In [75]:
```
225-200,200-175
```

Out[75]: (25, 25)

In [76]:
```
std = 25
```

In [78]:
```
from scipy.stats import norm
```

In [79]:
```
norm.cdf(175,loc = 200 , scale = 25)  # same for both sides .
```

Out[79]: 0.15865525393145707

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Q5. Coke bottles

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The mean filling capacity for a coke bottle is 550 ml with a standard deviation of 20ml. The random variable filled capacity of the bottles follows a normal distribution.

a. What is the probability that the bottle filled less than 500 ml?

b. What is the probability that the bottle filled more than 570 ml?

c. What is the probability that the bottle filled between 460 ml to 575 ml?

NOTE: Use the cdf approach to solve the question.

In [80]:
```
mean = 550
std = 20
```

In [81]:
```
norm.cdf(500,550,20)
```

Out[81]: 0.006209665325776132

In [82]:
```
1-norm.cdf(570,550,20)
```

Out[82]: 0.15865525393145707

In [83]:
```
norm.cdf(575,550,20)-norm.cdf(460,550,20)
```

Out[83]: 0.8943468286600199

In [ ]:
```
1
```

In [ ]:
```
1
```

Q7. Mean of the tosses

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

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** ✓

```
1 mean = n*p
2      = 10*0.5
```

In [93]:
```
1 10*0.5
```

Out[93]: 5.0

In [ ]:
```
1 variance = np(1-p)
2          = 10* (0.5)* (0.5)
```

In [94]:
```
1 10* (0.5)* (0.5)
```

Out[94]: 2.5

In [ ]:
```
1
```

Q8. 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** ✓
- n=9, p=3/5, q=2/5

```
1  mean = n*p = 3
2  std = 3/2
3
4  npq = 9/4
5  3*q = 9/4
6  q = 3/4
7
8  p = 1-q = 1-3/4 = 1/4
9
10 n = 3/p = 3/(1/4) = 12
11
```

In [ ]:
```
1
```

Q9. 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
- ○ 0.563

In [95]:
```
1 math.comb(5,3)*((0.6)**3)*((1-0.6)**(5-3))
```

Out[95]:
```
0.3456
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Q10. 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 [ ]:
```
1
```

In [96]:
```
1 math.comb(40,10)*((0.25)**10)*((1-0.25)**(40-10))
```

Out[96]:
```
0.14436434635625678
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Problem solving session Day 66

In [ ]:
```
1
```

For the RV shown there, what is the expectation

37 users have participated

	A 1.5	19%
✓	B 1.8	46%

```
RV : X {0,1,3}
x    P(x)
0     0.2
1     0.3
3     0.5

E(X) = (0*0.2)+(1*0.3)+(3*0.5)
```

In [168]:
```
1 (0*0.2)+(1*0.3)+(3*0.5)
```

Out[168]: 1.8

What is E[X^2] for the RV shown?

50 users have participated

	A 3	18%
	B 4.5	16%
	C 5	4%
✓	D 4.8	62%

```
E(X^2)

0 0.2
1 0.3
9 0.5

E(X^2) = (0*0.2)+(1*0.3)+(9*0.5)
```

In [169]:
```
(0*0.2)+(1*0.3)+(9*0.5)
```

Out[169]: 4.8

What is the variance of X

36 users have participated

A	1.48	22%
✓ B	1.56	58%

In [ ]:
```
Var(X) = E(x^2)-(E(x))^2
       = 4.8 - (1.8)^2
```

In [171]:
```
4.8 - ((1.8)**2)
```

Out[171]: 1.5599999999999996

For the RV shown, what is the expectation of the sample mean, when n = 3

27 users have participated

A	1	0%
B	1.5	48%
✓ C	1.8	48%

In [ ]:
```
E(xbar) = E(x) = 1.8
```

For the RV shown, what is Variance of the sample mean when n = 2

41 users have participated

A	0.56	15%
B	0.62	20%
C	0.72	22%
✓ D	0.78	44%

In [ ]:
```
Var[Xbar] = Var(X)/n
          = 1.56 / 2
```

In [172]:
```
1.56 / 2
```

Out[172]: 0.78

For the random variable shown, what is the variance of the sample mean when n = 3

46 users have participated

✓ A	0.52	70%

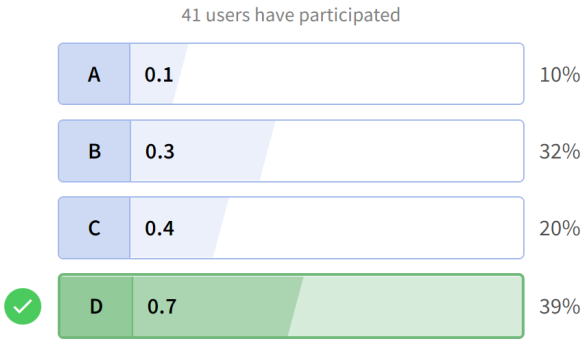
In [173]:
```
1.56 / 3
```

Out[173]: 0.52

In [ ]:
```

```

In [ ]:
```

```

10 fair dice are rolled. Approximate the prob that the sum of the values is between 30 and 40




```
for dice : E(X) = 3.5
    sum for 10 dice : E(Y) = x1 + x2 + ... +X10
                            = 10*3.5
                            = 35
Variance Var(X) = E(x^2)-(E(x))^2
                = 35/12
    Var(Y) = Var(x1+x2+...+xn)
           = n * Var(X)
           = 10 * 35/12

Z[x=40] = (x - E(Xbar))
        / (sqrt(Var(xbar)))
      = 40-35/(np.sqrt(350/12))

Z[x=30] = (x - E(Xbar))
        / (sqrt(Var(xbar)))
      = 30-35/(np.sqrt(350/12))
```

In [182]:
```
(1*(1/6))+(4*(1/6))+(9*(1/6))+(16*(1/6))+(25*(1/6))+(36*(1/6))-(3.5)**2
```

Out[182]: 2.916666666666666

In [181]:
```
35/12
```

Out[181]: 2.9166666666666665

In [ ]:
```

```

In [1]:
```
np.sqrt(350/12)
```

```
<IPython.core.display.Javascript object>
```

Out[1]: 5.400617248673217

In [6]:
```
norm.cdf(40,35,5.400)
```

Out[6]: 0.822757761563344

In [7]:
```
norm.cdf(30,35,5.400)
```

Out[7]: 0.17724223843665599

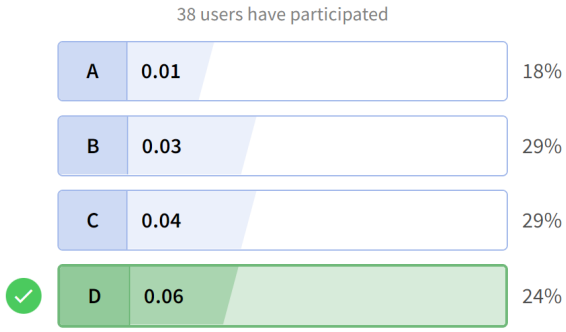
In [4]:
```
norm.cdf(40,35,5.400)-norm.cdf(30,35,5.400)
```

Out[4]:
```
0.645515523126688
```

In [ ]:
```

```

In [3]:
```
from scipy.stats import norm
```

Battery has mean lifetime to be 5 weeks and std deviation 1.5 weeks. Approximate the probability of needing 13 or more batteries in a year




```
we need to check P[ >=13  batteries needed in  a year] :

1 year = 52 weeks .

n = 12

one battery runs for 5 weeks .
E(Y) = n*E(x) = 12 * 5 = 60 weeks

test if y =52 weeks with E(Y) = 60 weeks


```

In [184]:
```
365/7
```

Out[184]:
```
52.142857142857146
```

In [ ]:
```
52 weeks in a year

P[needing 13 or more batteries ]
P[Y <= 52 weeks]
```

```
Y-E(Y)/ sq(Var(Y))

Y = 52
E(Y) = 5*12= 60 weeks
Var(x) = 1.5 weeks
Var(Y) = n*Var(x)
       = 12 * (1.5)^2

```

In [11]:
```
Z = (52-60) / (np.sqrt(12*(1.5)**2))
Z
```

```
<IPython.core.display.Javascript object>
```

Out[11]:
```
-1.539600717839002
```

In [188]:
```
norm.cdf(Z)
```

Out[188]:
```
0.06182885520141673
```

In [12]:
```
norm.cdf((52-60) / (np.sqrt(12*(1.5)**2)))
```

<IPython.core.display.Javascript object>

Out[12]: 0.06182885520141673

In [ ]:
```

```

In [ ]:
```

```

A dice is rolled and the values are added. We roll till we reach 450. Approximate the probability that this will require more than 140 rolls

33 users have participated

In [ ]:
```
P[sum of first 140 rolls < 450]
sum of first 140 < 450 , only after than ull need more than 140 rolls
n = 140
```

```
Y = x1+x2+...+x140 = 450

E(X) =  3.5     E(Y) = n*E(x) =140*3.5
Var(X) = 35/12  Var(Y) = n*Var(X) = 140* (35/12)


```

In [ ]:
```
Y-E(Y) / sq(Var(Y))
 = (450- (140*3.5) )/(np.sqrt(140*(35/12)))
```

In [189]:
```
 (450- (140*3.5) )/(np.sqrt(140*(35/12)))
```

<IPython.core.display.Javascript object>

Out[189]: -1.979486637221574

In [190]:
```
norm.cdf(-1.979)
```

Out[190]: 0.02390800313207332

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Life time of an electric part has mean 100 hours and std deviation 20 hours. If 16 parts are tested, approximate the probability that the sample mean is less than 104 hours

32 users have participated

	A	0.5	13%
	B	0.6	28%
	C	0.7	16%
✓	D	0.8	44%

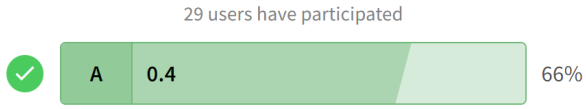
In [ ]:
```
n = 16
sigma = 20
mean = 100
```

In [200]:
```
norm.cdf( (104-100)/(20/np.sqrt(16)) )
```

<IPython.core.display.Javascript object>

Out[200]: 0.7881446014166034

In same example as before, find the prob that same mean is between 98 and 104



In [202]:
```
norm.cdf( (104-100)/(20/np.sqrt(16)) )-norm.cdf( (98-100)/(20/np.sqrt(16)) )
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

Out[202]: 0.44356634302692755

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Students marks have a mean of 77 and std dev of 15.
In a class with 25 students, apporximate the probability that the average score was between 72 and 82

In [203]:
```
norm.cdf( (82-77)/(15/np.sqrt(25)) )-norm.cdf( (72-77)/(15/np.sqrt(25)) )
```

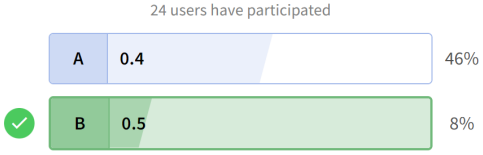
<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

Out[203]: 0.9044192954543706

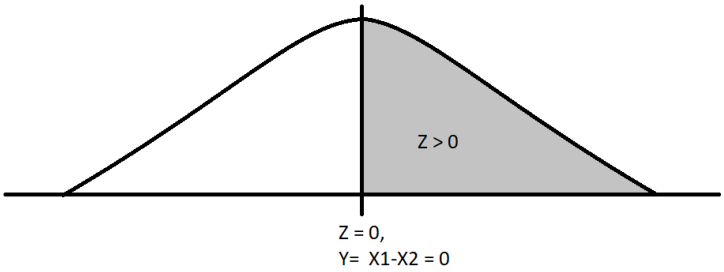
In [ ]:
```

```

Batch1 has 25 students, and Batch2 has 64 students. What is the probability that the average test score in Batch 1 is higher than that of the average test score in Batch 2




```
batch 1 : average score X1
    batch 2 : average score X2

```

```
        P[X1 > X2 ]
        P[X1-X2 = 0] we want to test !

      Y = X2 - X1
    E(Y) = E(X1) - E(X2)

    Z at X1 - X2 at 0 ,
    for X1 is higher . Z >0

    P[Z>0] = 0.5
```



In [ ]:
```
```

In [ ]:
```
```

In [ ]:
```
```

In [ ]:
```
```

Problem solving Day 66

In [ ]:
```
```

Q1. Gambler Bets

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

A gambler bets "1 dollar" that a fair coin lands heads. If he wins, he quits. If he loses, then he bets "2 dollars" that the next coin loss is heads, and then regardless of the outcome, he quits. What is the probability that he goes home a winner?

```
P[W] = P[W|H]*P[H] + P[W|T]*P[T]

    P[W|T] = P[W|HT]*P[H] + P[W|TT]*P[T]   if tails come at first, then he bets 2$ on next tails and then quit.
           =   1 * 1/2    + 0                                so , P[W|TT] = 0
           = 1/2

P[W] = P[W|H]*P[H] + P[W|T]*P[T]
     = 1*  1/2     + 1/2*1/2
     = 1/2 + 1/4
     = 3/4
```

```
first toss:


```

```
                    H  wins Quit
1$ bet for heads
                    T  lose:                        next toss: H  won : quits
                       bets 2$ on next heads
                                                               T : loses

              P[winner] = first toss win + 2nd toss win
                        =  (1/2) +         + ((1/2)*(1/2))
```

In [52]:
```
(1/2) +         + ((1/2)*(1/2))
```

Out[52]: 0.75

In [54]:
```
3/4
```

Out[54]: 0.75

In [ ]:
```

```

In [ ]:
```

```

Q2. First round

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Suppose each of three persons tosses a biased coin with a probability of heads being 1/4. If the outcome of one of the tosses differs from the other outcomes, then the game ends. If not, then the persons start over and retoss their coins. What is the probability that the game will end at the first round?

```
P[H] = 1/4

HHH = (1/4)**3
TTT = (1-(1/4))**3
```

In [21]:
```
(1/4)**3+(1-(1/4))**3
```

Out[21]: 0.4375

In [23]:
```
1-((1/4)**3+(1-(1/4))**3)
```

Out[23]: 0.5625

In [24]:
```
9/16 # is the ans
```

Out[24]: 0.5625

```
P[end] = 1-P[continue]
       = 1 - P[{HHH} U {TTT}]
```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```
1
```

Q3. Color blind

Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Suppose 5 percent of men and 0.25 percent of the women are color-blind. A random color-blind person is chosen. What is the probability of this person being male? Assume there are equal number of men and women overall.

```
1 p[CB|M] = 0.05
2 p[CB|F] = 0.0025
```

```
1 P[M|CB]  =  ?
2
3 M|CB  =         (CB|M * M )
4       /  ( (CB|M * M ) +  (CB|F * F))
```

In [15]:
```
1         0.05 * 0.5    / (  (0.05*0.5) +  (0.0025*0.5)  )
```

Out[15]:
```
0.9523809523809523
```

In [ ]:
```
1
```

Q4. Three coins

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

There are three coins in a box. One is a two-headed coin, another is a fair coin, and the third is a biased coin that comes up heads 75 percent of the time. When one of the three coins is selected at random and flipped, it shows heads. What is the probability that it was the two-headed coin?

Choose the correct answer from below:

- 1/9
- 2/9
- 1/3
- 4/9

In [ ]:
```

```

```
TOTAL 3 COINS :

    p[2headed] = 1/3
    P[fair] = 1/3
    P[biased] = 1/3


    P[H|biased] = 0.75
    P[H|2headed] = 1
    P[H|fiar] = 1/2

    P[2headed|H] = P[H|2headed] * P[2headed] /
         (P[H|2headed] * P[2headed]) + (P[H|2headed'] * P[2headed'])
```

In [63]:
```
1 * (1/3)
```

Out[63]: 0.3333333333333333

In [66]:
```
(( 0.75 + (1/2))/2 ) * (1-(1/3))
```

Out[66]: 0.41666666666666674

In [67]:
```
(1 * (1/3)) +  (( 0.75 + (1/2))/2 ) * (1-(1/3))
```

Out[67]: 0.75

In [69]:
```
(1 * (1/3) ) / ((1 * (1/3)) +  (( 0.75 + (1/2))/2 ) * (1-(1/3)))
```

Out[69]: 0.4444444444444444

In [73]:
```
4/9
```

Out[73]: 0.4444444444444444

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Q5. Ten coins Solved

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

There are ten coins numbered from 1 to 10, where the probability of the heads is i/10, i=1,2,...,10. One of the coins is randomly selected and flipped, it shows heads. What is the conditional probability that it was the 5^{th} coin?

Choose the correct answer from below:

- 5/11
- **1/11**
- 5/10
- 1/10

```
P[C5|H]  = ?
P[]



P[C5|H]  =                          P[H|C5] * P[C5]/
                      P[H|C5] * P[C5]    +   P[H|C5'] * P[C5']

         =                          P[H|C5] * P[C5]/
                      P[H|C5] * P[C5]    +   P[H|C1] * P[C1]
                                         +   P[H|C2] * P[C2]
                                         +   P[H|C3] * P[C3]
                                         +   P[H|C4] * P[C4]
                                         +   P[H|C6] * P[C6]
                                         +   P[H|C7] * P[C7]
                                         +   P[H|C8] * P[C8]
                                         +   P[H|C9] * P[C9]
                                         +   P[H|C10] * P[C10]


         =          5/10 * 1/10
            /  ( 5/10 * 1/10 ) + ( (0.1+0.2+0.3+0.4+0.6+0.7+0.8+0.9+1)/9 )*(1-(1/10))

```

In [ ]:
```
P[H] for 1 to 10th coins
      1/10,2/10,3/10,...,10/10
```

In [101]:
```
((5/10) * (1/10))/  (( (5/10) * (1/10) ) + ( (0.1+0.2+0.3+0.4+0.6+0.7+0.8+0.9+1)/9 )*(1-(1
```

Out[101]: 0.09090909090909091

In [102]:
```
1/11
```

Out[102]: 0.09090909090909091

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Q6. Two Urns

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Urn 1 has five white and seven black balls. Urn 2 has three white and twele black balls. We flip a fair coin. If the outcome is heads, then a ball from urn 1 is selected, while if the outcome is tails, then a ball from urn 2 is selected. Suppose that a white ball is selected. What is the probability that the coin landed tails?

Choose the correct answer from below:

- [x] 12/37
- [ ] 25/37
- [ ] 20/37
- [ ] 5/37

```
Urn1              Urn2
5 white balls      3 white balls
7 black balls      12 black balls

Heads             Tails


if heads : ball from Urn1 is selected
if tails : ball from Urn2 is selected

probability of tails given white ball is selected :
P[T|W] = ?

P[T|W]  = P[W|T]* P[T]/
      P[W|T]* P[T] + P[W|T']* P[T']

        = P[W|T]* P[T]/
      P[W|T]* P[T] + P[W|H]* P[H]

  P[W|T]  white balls given tails : 3 / (3+12) = 3/15
  P[W|H]  white ball given not tail : 5 / (5+7) = 5/ 12


P[T|W]=             P[W|T]* P[T]/
              P[W|T]* P[T] + P[W|H]* P[H]
```

In [79]:
```
(3/15)*(1/2)
```

Out[79]: 0.1

In [80]:
```
(3/15)*(1/2) + ((5/12)*0.5)
```

Out[80]: 0.30833333333333335

In [81]:
```
0.1/0.308333
```

Out[81]: 0.3243246749455945

In [78]:
```
12/37
```

Out[78]: 0.32432432432432434

In [ ]:
```

```

In [ ]:
```
1
```

Q7. Winner is A

Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

A and B play a series of games with A winning each game with the probabilty p. The overall winner is the first player to have won two more games than the other. Find the probability that A is the overall winner.

```
Let “y” be the no.of games A won in first 2.

0 games won by A
1 games won by A
2 games won by A

Y = [0,1,2]

 expected for y -   sum( xP(x))


P(A) = p(A/y=0) x p(y=0) + p(A/y=1) x p(y=1) + p(A/y=2) x p(y=2)
        =       0        + P(A) 2p(1-p)      + p^2
        =       0        + P[A] 2p(1-p)      + p^2
P[A]    =   P[A] 2p(1-p)      + p^2
P[A](1-2p(1-p)) = p^2

P(A) =  p^2
     / (1-2p(1-p))

```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

Probability Distribution 2

In [ ]:
```
1
```

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

- reduced by 1/3
- increased by 10/3
- reduced by 10/3

m

In [ ]:
```
lets say data :
```

In [91]:
```
# what we did wrongly
mistakendata = [1,2,3,4,5,6,7,8,9,10,81,12,13,14,15]
   #
```

In [92]:
```
# what we should have done
expected_data = [1,2,3,4,5,6,7,8,9,10,31,12,13,14,15]
```

In [93]:
```
np.mean(mistakendata), np.mean(expected_data)
```

Out[93]: (12.666666666666666, 9.333333333333334)

In [94]:
```
12.666-9.333
```

Out[94]: 3.333

In [95]:
```
10/3
```

Out[95]: 3.3333333333333335

In [ ]:

In [ ]:

In [ ]:

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?

In [66]:
```
(25*90+15*87)/40
```

Out[66]: 88.875

In [ ]:

In [ ]:

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 [96]:
data=[10,23,24,24,28,29,20,32,33,25,38,29,25,41,50,25,31,60,70]

In [97]:
import scipy.stats

In [98]:
stats.iqr(data)

Out[98]: 11.0

In [99]:
np.percentile(data,0.75)

Out[99]: 11.35

In [ ]:
# q3 + 1.5(IQR)


In [100]:
np.percentile(data,0.75)+ 1.5*stats.iqr(data)

Out[100]: 27.85

In [102]:
data = np.array(data)

In [104]:
newdata = data[data > 27.85]

In [105]:
np.median(data), np.median(newdata)

Out[105]: (29.0, 33.0)

In [106]:
np.mean(data), np.mean(newdata)

Out[106]: (32.473684210526315, 40.09090909090909)

In [ ]:


In [ ]:


In [ ]:


In [107]:
import pandas as pd
```

Q16. Weighted mean Solved

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 [119]:
```
((1*70) + (2*385) + (3*523) + (4*22))/(70+385+523+22)
```

Out[119]: 2.497

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

Probability Distribution 3

Q1. Text messages Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Data on the number of text messages sent one weekend by girls and boys in school is summarized as follows:

Min	Q1	Median	Q3	Max	Mean	SD
6	14	45	90	160	60	42.4

A Statistics student checking the calculations finds that the message counts for all the students were underreported by 5. When the numbers are corrected, what are the corrected IQR and standard deviation?

In [126]:
```
minn = 6
q1 = 14
median = 45
q3  = 90
maxx = 160
mean = 60
sd = 42.4
```

In [128]:
```
IQR = q3-q1
IQR
```

Out[128]: 76

In [ ]: 1

Q2. Outliers impact on measures Solved

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

The below data represents the salaries of data scientists per month. When there are outliers for a given set of data. Which of the following measures can be used?

data=
[1500,10000,17000,26000,30000,22000,15000,25000,32000,35000,29000,65000,80000]

Choose the correct answer from below:

- ○ mean and standard deviation
- ○ mean and variance
- ○ median and range
- ● median and interquartile range

In [ ]: 1

Q3. Pop vs Sample Solved

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

A survey was conducted to know the average height of 12-year boys in India. For this survey, we randomly select 50 boys whose age is 12 years old and check their height. Identify the population and sample in this setting.

Choose the correct answer from below:

- ○ The population is all the people in India, the sample is of 50, 12-year old boys.
- ○ The population is all boys in India, the sample is 12-year old boys.
- ● The population is all 12-year old boys in India, the sample is of 50, 12-year old boys.

In [ ]: 1

Q4. Distribution Solved

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

Given a distribution of a continuous random variable, where the mean of the distribution is 0 and the standard deviation is 1. Then which of the following holds true.

Choose the correct answer from below:

- ○ The given distribution forms a Gaussian distribution.
- ○ Increasing every observation in this data by 4 will increase the standard deviation of the distribution by 2.
- ○ Increasing every observation in the data by 100% will increase the mean by 100% and the standard deviation by 10%
- ● Increasing every observation by 4 will have no effect on the variance of the distribution.

In [ ]: 1

In [ ]: 1

Q9. Class 1 Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Consider the dataset given below. It is given that X1 follows a normal distribution.

S.no	X1	y
1	10	0
2	15	0
3	16	1
4	11	1
5	8	0
6	5	0
7	4	0
8	1	1
9	15	1
10	12	1

Based on this information what is the probability that X_1=10, belongs to class 1?

Choose the correct answer from below:

- 0.042
- 0.080
- **0.022** ✓
- 0.010

In [131]:
```
x1= np.array([10,15,16,11,8,5,4,1,15,12])
```

In [132]:
```
np.mean(x1)
```

Out[132]: 9.7

In [133]:
```
np.std(x1)
```

Out[133]: 4.859012245302536

In [136]:
```
from scipy.stats import norm
```

In [ ]:
```

```

Q10. Labor of Statistics Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The Indian labor of Statistics released the numbers on the full-time wage and salary of workers with flexible schedules. The numbers of full-time wage and salary workers in each age category are almost uniformly distributed by age, that is ranging from 21 to 68 years. If a worker with a flexible schedule is randomly drawn from the Indian workforce. Calculate the height of this distribution, mean and standard deviation.

Choose the correct answer from below:

- 0.21, 44.5, 14.25
- **0.021, 44.5, 13.56** ✓
- 0.21, 43.5, 14.25
- 0.031, 43.5, 13.56

```
a= 21, b= 68 that means:
P(x<21)=0 and P(x>68)=0

The height of the distribution: f(x) = 1/b-a
f(x) = 1/68-21
f(x) = 1/47
```

```
f(x) = 0.0212


The mean of the distribution is: μ=a+b/2
μ = 21+68/2
μ = 89/2
μ = 44.5


The standard deviation of the distribution: σ = v(x) = √(b-a)2 / 12
σ = √(47)2/12
σ = √2209/12
σ = √184.083
σ = √184.083
σ = 13.567
```

In [ ]:

```

```

Q11. IQR outlier detection </> Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Outliers are certain points in the data set which deviate from the general trends in the dataset. There are several ways to detect outliers. In this problem, we will use the median absolute deviation method to find outliers. According to this method:

1. Find the Inter-quartile range [Q3 - Q1]
2. Upper range is computed as Q3 + 1.5*IQR
3. Lower range is computed as Q1 - 1.5*IQR
4. Values that have high values than upper range are suspected to be outliers.
5. Values that have low values than lower range are suspected to be outliers.

Complete the function that identifies the outliers and return them by applying the function on the input list. In case no outliers are present, return an empty list.

In [142]:

```python
import numpy as np
def outlier(data):
    '''
    Input:
    data: input data in the form of a python list
    Output:
    ans: return the list of outliers in the form of a python list. If no outliers are pres
    '''
    ans = []
    # YOUR CODE GOES HERE
    import numpy as np

    A =np.array(data)
    IQR = np.percentile(A,75)-np.percentile(A,25)

    upper_bound = np.percentile(A,75) + (1.5*IQR)
    lower_bound = np.percentile(A,25) - (1.5*IQR)

    for i in data:
        if i < lower_bound or i > upper_bound:
            ans.append(i)

    # Code ends here
    return ans

```

In [143]:
```
1 data = [int(x) for x in "10 8 9 7 6 11 7 1 9 929 100".split()]
```

In [144]:
```
1 data
```

Out[144]:
```
[10, 8, 9, 7, 6, 11, 7, 1, 9, 929, 100]
```

In [145]:
```
1 outlier(data)
```

Out[145]:
```
[1, 929, 100]
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [3]:
```
1 import math
```

Q4. Telephones warranty Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Fifteen percent of all telephones of a certain type are submitted for service while under warranty. Of these, 60% can be repaired, whereas the other 40% must be replaced with new units. If a company purchases ten of these telephones, what is the probability that exactly three will end up being replaced under warranty?

Choose the correct answer

- (●) 0.016
- ( ) 0.147
- ( ) 0.027

```
15% PHONES SUBMITTED :
    OUT OF  15% , 40% REPLACED
                  60% REPAIRED

        RAPLACED PHONES ARE : 0.15 * 0.40

```

In [1]:
```
0.15 * 0.40
```

Out[1]: 0.06

```
FROM 10 chosen phones what is the probability of 3 end up being replaced  :
```

In [4]:
```
math.comb(10,3)*(0.06**3)*((1-0.06)**(10-3))
```

Out[4]: 0.016808539241473217

In [ ]:
```

```

Q3. No errors Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

The first assessment in a statistical class involves computing a short program. If past experience indicates that 30% of all students will make no errors in the program, use an appropriate normal approximation to compute the probability that in a class of 70 students at least 28 will make no errors.

The options are rounded off to two decimal places.

Choose the correct answer from below:

- 0.015
- 0.034
- 0.068
- 0.026

In [30]:
```
1-norm.cdf((28-21)/(np.sqrt(70*0.30*0.70)))
```

<IPython.core.display.Javascript object>

Out[30]: 0.0339445774309145

In [ ]:
```

```

In [ ]:
```

```

In [6]:
```
from scipy.stats import norm
```

In [ ]:
```

```

Q3. Driver Unsolved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

Suppose that only 28% of all drivers come to a complete stop at an intersection having flashing red lights in all directions when no other cars are visible. What is the standard deviation of the number of drivers among the 15 that come to a complete stop?

Choose the correct answer from below:

- 1.52
- 1.94
- 1.73

In [ ]:
```
n = 15
p = 0.28
```

In [19]:
```
np.sqrt(15*0.28*(1-0.28))
```

```
<IPython.core.display.Javascript object>
```

Out[19]:
```
1.7389652095427326
```

Q4. Gas Station Unsolved

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

Customers at a gas station pay with a credit card (A), debit card (B), or cash (C). Assume that successive customers make independent choices, with P(A)=0.5, P(B) =0 .2, and P(C)=0 .3. Among the next 100 customers, what are the mean and variance of those who don't pay with cash?

Choose the correct answer from below:

- (●) 70,21
- ( ) 20,16
- ( ) 50,25

In [18]:
```
100*0.7*(1-0.70)
```

Out[18]:
```
21.000000000000004
```

In [20]:
```
100*0.70
```

Out[20]:
```
70.0
```

Q5. Urban Freeway Unsolved

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

Based on extensive data from an urban freeway near Toronto, Canada. It is assumed that free speeds can best be represented by a normal distribution. The mean and standard deviation reported was 119 km/h and 13.1 km/h, respectively. What speed characterizes the fastest 10% of all speeds?

Choose the correct answer from below:

- ( ) 155.1 kph
- ( ) 100.4 kph
- ( ) 120.5 kph
- (●) 135.8 kph

In [ ]:
```
Z scorea at fastest 10% = @0.90 = 1.28
x = Z*std + mean
  = 1.28 * 13.1 + 119
```

In [21]:
```
1.28 * 13.1 + 119
```

Out[21]:
```
135.768
```

In [ ]:
```

```

Q11. CDF array </> Solved

Stuck somewhere?

Ask for help from a TA and get it resolved.

Get help from TA.

You are provided an array of random discrete variables. The task here is to return a numpy array consisting of the CDF of the 10 bins of the array.

In [35]:
```
1 import numpy as np
2
```

In [44]:
```
1 data = [float(x) for x in "0.37743739030637646 0.39641843776795693 -1.054860012987713 -0.7
```

In [45]:
```
1 data
```

Out[45]:
```
[0.37743739030637646,
 0.39641843776795693,
 -1.054860012987713,
 -0.7791213689652914,
 -1.0936368765688598]
```

In [46]:
```
1 A = np.array(data)
```

In [47]:
```
1 A
```

Out[47]:
```
array([ 0.37743739,  0.39641844, -1.05486001, -0.77912137, -1.09363688])
```

In [48]:
```
1 hist,bin_edges = np.histogram(A, density=True)
```

In [ ]:
```
1
```

In [49]:
```
1 bin_edges
```

Out[49]:
```
array([-1.09363688, -0.94463135, -0.79562581, -0.64662028, -0.49761475,
       -0.34860922, -0.19960369, -0.05059816,  0.09840737,  0.24741291,
        0.39641844])
```

In [50]:
```
1 cdf_arr = np.cumsum(hist*np.diff(bin_edges))
```

In [51]:
```
1 cdf_arr
```

Out[51]:
```
array([0.4, 0.4, 0.6, 0.6, 0.6, 0.6, 0.6, 0.6, 0.6, 1. ])
```

In [ ]:
```
1
```

In [ ]:
```
1
```