Q3. Keep Revising Solved

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

A Machine Learning course contains 5 'Supervised Learning', 6 'Unsupervised Learning', and 2 'Reinforcement Learning' modules. One of the students wants to revise these topics and picks two modules at random. Find the probability that one module is of 'Unsupervised Learning' and one is of 'Supervised Learning'.

Choose the correct answer from below:

- ○ 11/13
- ● 5/13

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 [ ]:
```

```

In [28]:
```

c = 0
for i in range(100):
    if i % 5 == 0 or i %7 == 0:
        c += 1
c
```

Out[28]: 32

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

Out[29]: 0.32

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

Out[30]: 0.32

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

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 U P U 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.

```
# P(A U B U 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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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
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In [ ]:
```

```

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 = N
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 [ ]:
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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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```

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

Out[31]:
```
0.8644999999999999
```

In [ ]:
```

```

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]:
```
51500-9000
```
Out[41]: 42500

In [40]:
```
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 [ ]:
```

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In [ ]:
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In [ ]:
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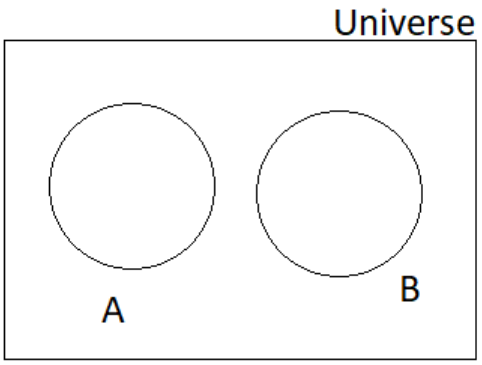
```

```
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
```

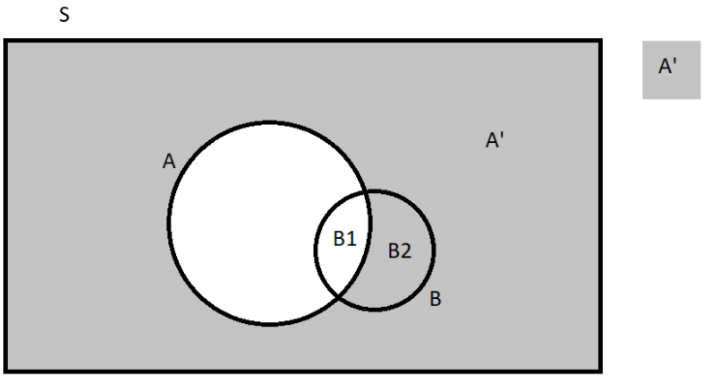


$$A \cap B = \{\}$$
$$A \cup B = \text{Universe}$$

```
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 [ ]:

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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 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 [ ]:
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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 [ ]:
```
# 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 [ ]:
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```

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 [ ]:
```

```

In [ ]:
```
1
```

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 [ ]:
```
1
```

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

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

`

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 [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

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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Type *Markdown* and LaTeX: α^2

In [ ]:
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In [ ]:
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In [ ]:
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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.

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

```
P[M|CB]  =  ?

M|CB  =         (CB|M * M )
      /  ( (CB|M * M ) +  (CB|F * F))
```

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

Out[15]: 0.9523809523809523

In [ ]:
```

```

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 [ ]:
```
1
```

In [ ]:
```
1
```

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

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-(1/10)))
```

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 [ ]:
```

```

In [ ]:
```

```

airline case of overbooking :

```
# airline case of overbooking :

50 seats are aavilbale in aircraft
52 ticekts 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
```

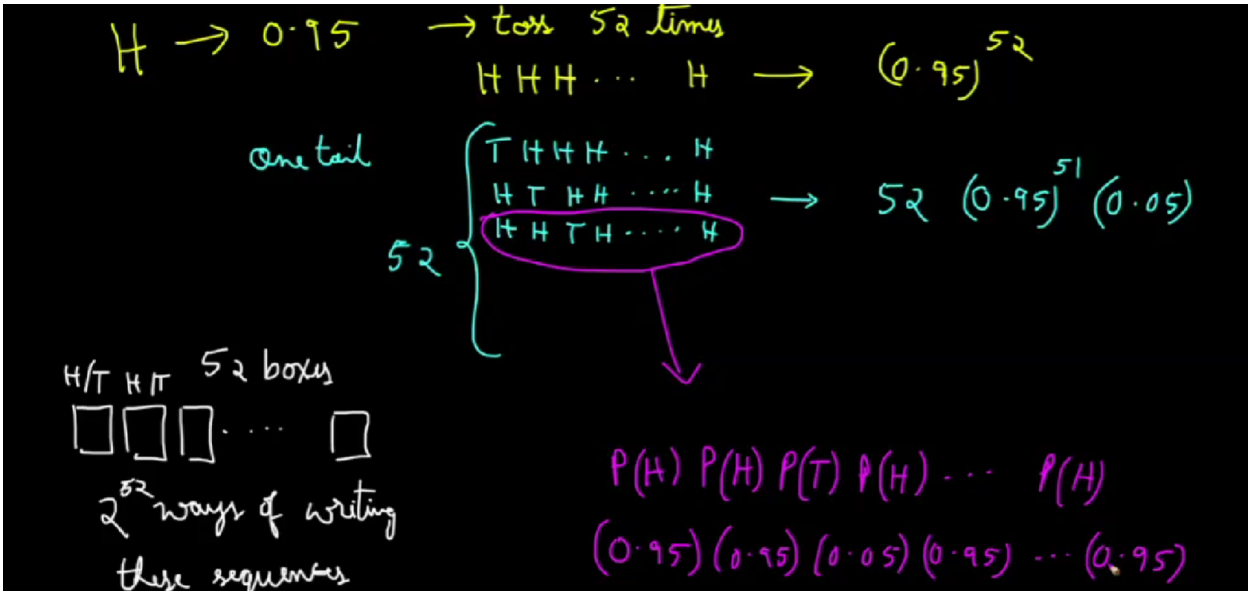
In [88]:
```
math.comb(52,1) * ((0.05)**1) * ((1-0.05)**(52-1)) # P[51 show up]
```

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

Out[1]: 0.6666666666666666

In [ ]:

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?

59 users have participated

A	1/2	12%
B	p	15%
C	p(1-p)	51%
✓ D	p/(2-p)	22%

```
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 [ ]:
```
--
```

Type *Markdown* and LaTeX: α^2

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

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 [ ]:
```
1
```

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 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:

- (●) 0.2,0.73
- ( ) 0.39,0.26
- ( ) 0.2,0.26
- ( ) 0.13,0.80

```

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

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

Out[100]: 0.6

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

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

Out[107]: 0.2

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

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

Out[111]: 0.7333333333333334

In [ ]:
```

```

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

Out[54]: 3.5

In [ ]:
```

```

In [ ]:
```

```

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 [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

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

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

```
P[ city1=sunny | city2=sunny ]    6/20
P[ city1=sunny | city2=cloudy ]   1/20
P[ city1=sunny | city2=rainy ]    0/20

P[c1=s|c2=s]  + P[c1=s|c2=c] +  P[c1=s|c2=r]
6/20          +   1/20       + 0/20
```

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

Out[30]: 0.35

In [ ]:

In [ ]:

In [ ]:

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 [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

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 [ ]:
```
1
```

```
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
```

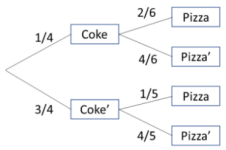
Out[71]: 0.9444444444444444

In [ ]:

In [ ]:

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

```
P[coke and pIzza]  +  P[coke' and pIzza]

((1/4) * (2/6))    +   ((3/4) * (1/5))
```

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

Out[72]: 0.23333333333333334

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

Out[73]: 0.23333333333333334

In [ ]:
```

```

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

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

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

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
```

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 [ ]:

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
```

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?

Choose the correct answer from below:

- ○ 12/16
- ◉ 9/16
- ○ 3/8
- ○ 6/16

```
P[end] = 1 - P[continue]
       = 1 - P[{HHH} U {TTT}]
       = 1 - ( P[HHH] + P[TTT] )
       = 1 - (1/4)^3 - (3/4)^3
```

In [98]:
```
1 - ((1/4)**3) - ((3/4)**3)
```

Out[98]: 0.5625

In [99]:
```
9/16
```

Out[99]: 0.5625

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

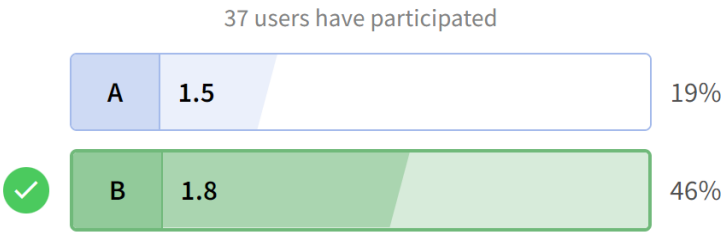
In [ ]:
```

```

In [ ]:
```

```

For the RV shown there, what is the expectation



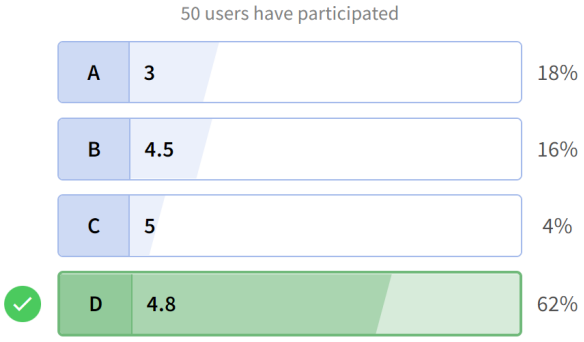

```
RV : X {0,1,3}
x    P(x)
0     0.2
1     0.3
3     0.5

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

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

Out[168]: 1.8

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




```
E(X^2)

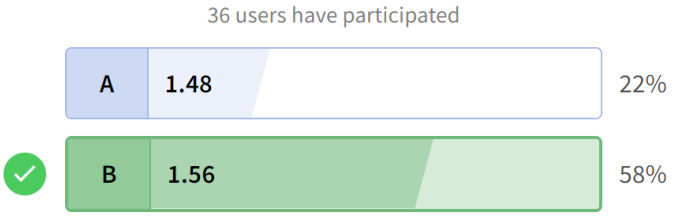
0 0.2
1 0.3
9 0.5

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

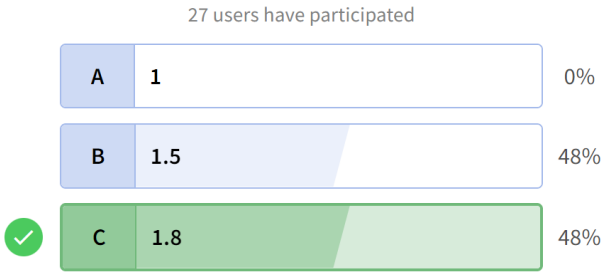


In [ ]:
```
Var(X) = E(x^2)-(E(x))^2
       = 4.8 - (1.8)^2
```

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

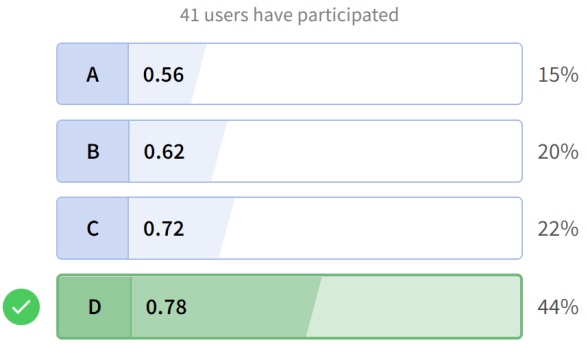
Out[171]: 1.5599999999999996

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




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

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

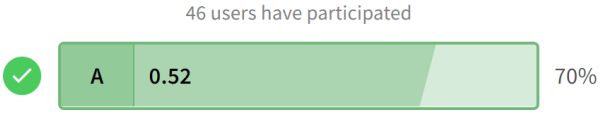



```
In [ ]:
1 Var[Xbar] = Var(X)/n
2           = 1.56 / 2
```

```
In [172]:
1 1.56 / 2
```

```
Out[172]: 0.78
```

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



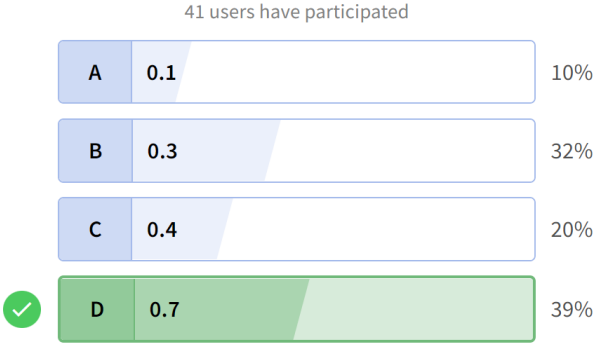

```
In [173]:
1 1.56 / 3
```

```
Out[173]: 0.52
```

```
In [ ]:
1
```

```
In [ ]:
1
```

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 [175]:
```
np.sqrt(350/12)
```

Out[175]: 5.400617248673217

In [176]:
```
norm.cdf(40,35,5.400)-norm.cdf(30,35,5.400)
```

Out[176]: 0.645515523126688

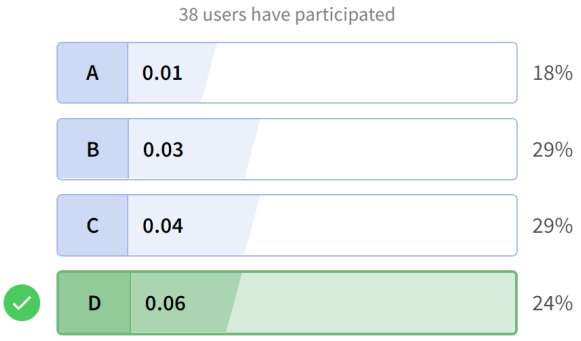
In [ ]:
```

```

In [ ]:
```

```

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



In [ ]:
```
test x = weeks in a year
```

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

Out[184]: 52.142857142857146

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

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

In [ ]:
```
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 [185]:
```
Z = (52-60) / (np.sqrt(12*(1.5)**2))
```

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

Out[188]: 0.06182885520141673

In [199]:
```
norm.cdf((52-60) / (np.sqrt(12*(1.5)**2)))
```

Out[199]: 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]

```

In [ ]:
```
Y = x1+x2+...+x140 = 450

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

Out[189]: -1.979486637221574

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

Out[190]: 0.02390800313207332

In [ ]:
```

```

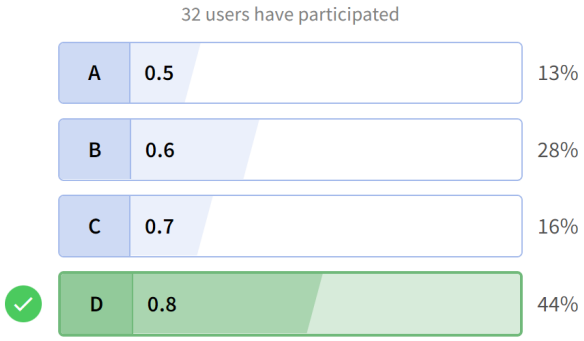
In [ ]:
```

```

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

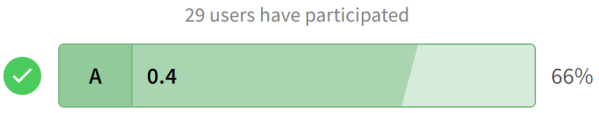


In [ ]:
```
n = 16
sigma = 20
mean = 100
```

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

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)) )
```

Out[202]: 0.44356634302692755

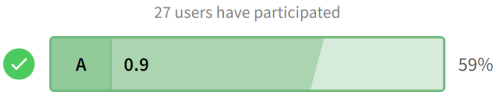
In [ ]:
```

```

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



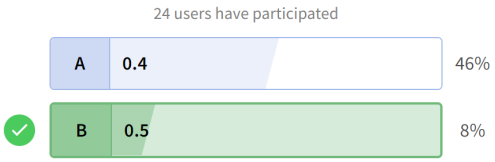
In [203]:
```
norm.cdf( (82-77)/(15/np.sqrt(25)) )-norm.cdf( (72-77)/(15/np.sqrt(25)) )
```

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



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In [103]:
```
1 -7/0.196
```

Out[103]: -35.714285714285715

In [ ]:
```
1 E(x) = 3.5
```

In [129]:
```
1 35/12
```

Out[129]: 2.9166666666666665

In [127]:
```
1 10*(1/6)*(1-(1/6))
```

Out[127]: 1.3888888888888888

In [117]:
```
1 n*p
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
~\AppData\Local\Temp/ipykernel_6592/2500517548.py in <module>
----> 1 n*p

NameError: name 'n' is not defined
```

In [135]:
```
1 (30-35)/(np.sqrt(350/12))
```

Out[135]: -0.9258200997725515

In [137]:
```
1 (40-35)/(np.sqrt(350/12))
```

Out[137]: 0.9258200997725515

In [104]:
```
1 from scipy.stats import norm
2 i
3
```

In [141]:
```
1 -norm.cdf(-0.9258200997725515)+norm.cdf(0.9258200997725515)
```

Out[141]: 0.6454605202264987

In [107]:
```
1 1*(0.3**2)+*(0.5**2)
```

Out[107]: 0.84

In [ ]:
```
1
```

In [ ]:
```
1 E(x^2)-(E(x))^2
```

In [ ]:
```
1
```

In [116]:
```
np.sqrt(4.2)/2
```

Out[116]: 1.02469507659596

In [149]:
```
365/12
```

Out[149]: 30.416666666666668

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```
E(Y) =
```

In [ ]:
```
450
```

In [166]:
```
(64+25)/2
```

Out[166]: 44.5

In [ ]:
```
norm.cdf(25-44)
```

In [164]:
```
norm.cdf((82-(77))/np.sqrt(15*15/25))-norm.cdf((72-(77))/np.sqrt(15*15/25))
```

Out[164]: 0.9044192954543706

In [165]:
```
norm.cdf((82-(77))/np.sqrt(15*15/64))-norm.cdf((72-(77))/np.sqrt(15*15/64))
```

Out[165]: 0.9923392388648204

In [167]:
```
90/99

```

Out[167]: 0.9090909090909091

In [147]:
```
12*4
```

Out[147]: 48

In [148]:
```
365/7
```

Out[148]: 52.142857142857146

In [ ]:
```

```