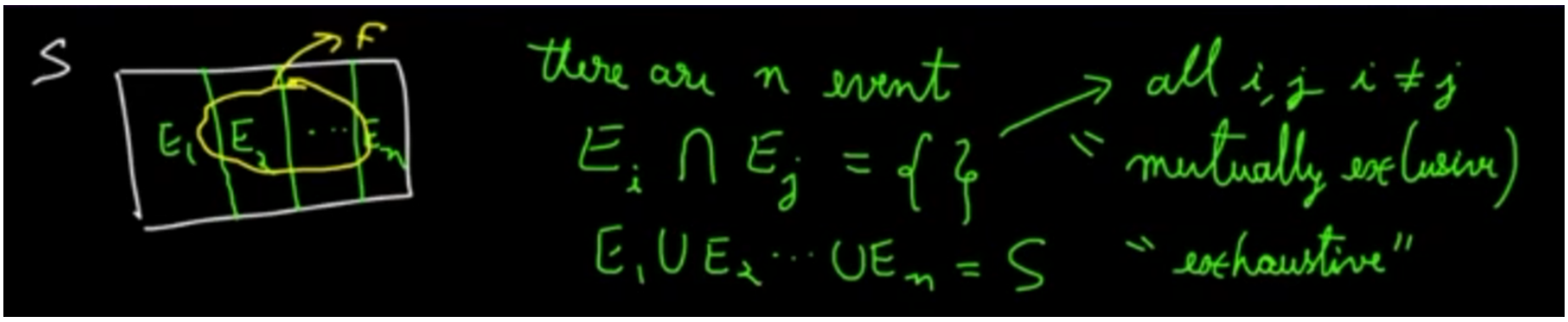

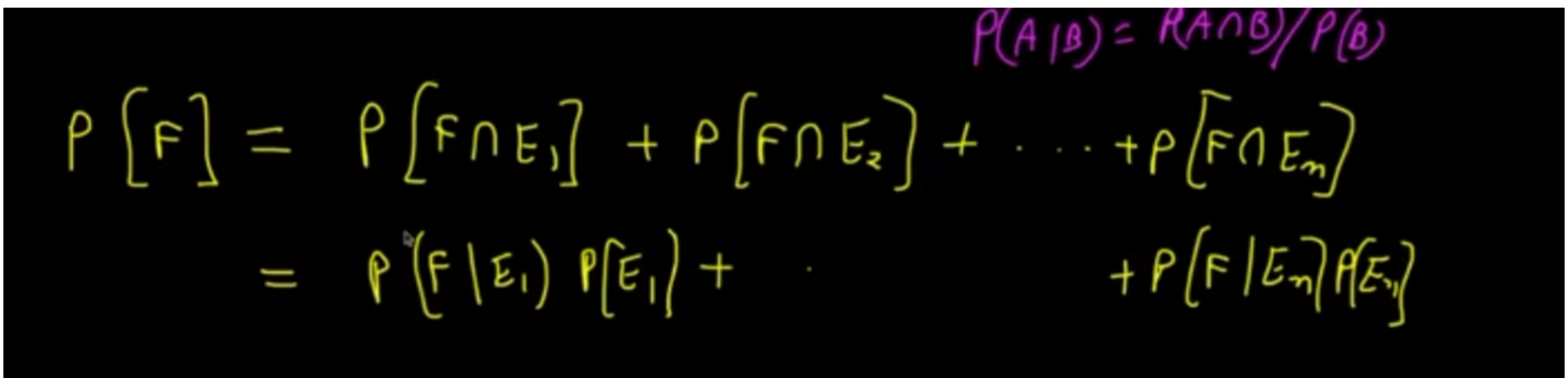

In [ ]:
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A family has 2 children. Given that at least one child is a girl, what is the probability that both are girls

Click on an option to submit your answer

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

```
1  sample space  : gg,by,gb,bb
2            already given that one child is a girl
3          so bb is not an element
4
5             so , sample space is : gg,bg,gb
6
7             one is girl that is given ,
8             the probability of both are girl is :
9                 1/ 3
```

Family has 2 children . Atleast one is a girl. What is the probability that both are girls? → only 28% got this right

$$S = \{ bb, bg, gb, gg \}$$ → numerator

$$P\left[\{gg\} \mid \{bg, gb, gg\}\right] = \frac{P\left[\{gg\}\right]}{P\left[\{bg, gb, gg\}\right]} = \frac{1/4}{3/4} = \frac{1}{3}$$

A | B

$$P[A|B] = \frac{P[A \cap B]}{P[B]}$$

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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]:
```
1 # D
```

```
1 P[student knows the answer] = 0.8                P[K] = 0.8
2 P[~ student knows the ans ] = 0.2   (guessing )  P[G] = 0.2
3
4 P[correct ans]
5 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 [ ]:

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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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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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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 [ ]:
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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
```

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`

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 [ ]:
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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
```

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Type *Markdown* and LaTeX: α^2

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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

```

```
7
8     P[H|biased] = 0.75
9     P[H|2headed] = 1
10    P[H|fiar] = 1/2
11
12    P[2headed|H] = P[H|2headed] * P[2headed] /
13         (P[H|2headed] * P[2headed]) + (P[H|2headed'] * P[2headed'])
```

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

Out[63]: 0.3333333333333333

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

Out[66]: 0.41666666666666674

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

Out[67]: 0.75

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

Out[69]: 0.4444444444444444

In [73]:
```
1 4/9
```

Out[73]: 0.4444444444444444

In [ ]:
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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

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



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


```

In [ ]:
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In [ ]:
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In [ ]:
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In [58]:
```
(0.1+0.2+0.3+0.4+0.6+0.7+0.8+0.9+1)/9
```

Out[58]: 0.5555555555555556

In [59]:
```
1-(1/10)
```

Out[59]: 0.9

In [60]:
```
(5/10)*(1/10)
```

Out[60]: 0.05

In [61]:
```
(5/10)*(1/10) + (0.555*0.9)
```

Out[61]: 0.5495000000000001

In [62]:
```
0.05/0.549500
```

Out[62]: 0.09099181073703368

In [74]:
```
1/11
```

Out[74]: 0.09090909090909091

In [ ]:
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In [ ]:
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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:

- **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 [ ]:
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In [ ]:
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 # 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(52,1) * ((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 :
```

```
19
20          = 1 - P[52 people show up] - P[51 people showup]
21          = 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 [ ]:

In [90]:
```
import math
```

In [ ]:
```
                = 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

In [ ]:
```
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
```

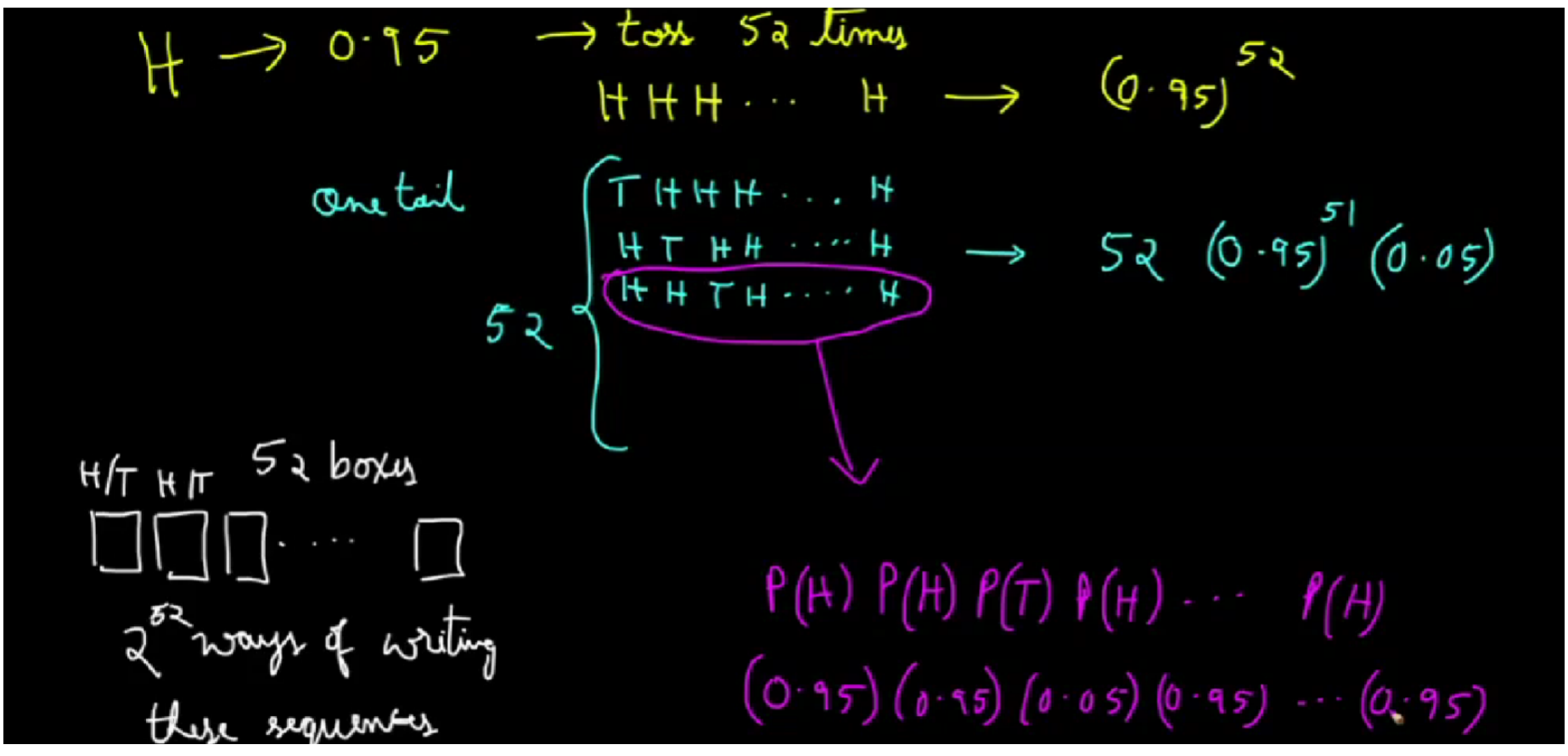
In [88]:
```
math.comb(52,1) * ((0.05)**1) * ((1-0.05)**(52-1)) # P[51 show up]
```

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 [ ]:

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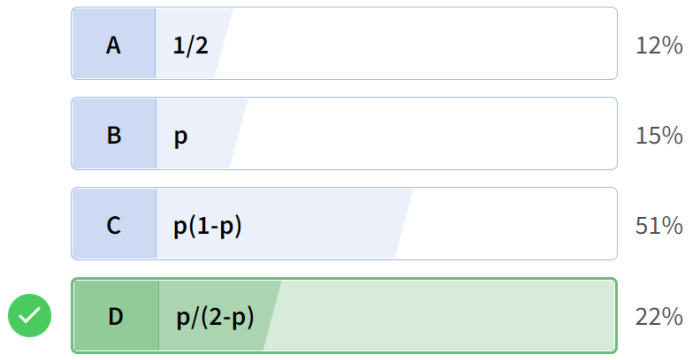
A and B toss a coin alternatively till one of them gets a heads. The probability of heads is "p". Game starts with A tossing first. What is the probability that A wins the game?

59 users have participated




```
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 [ ]:
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