

THE BRANCHING ALGORITHM

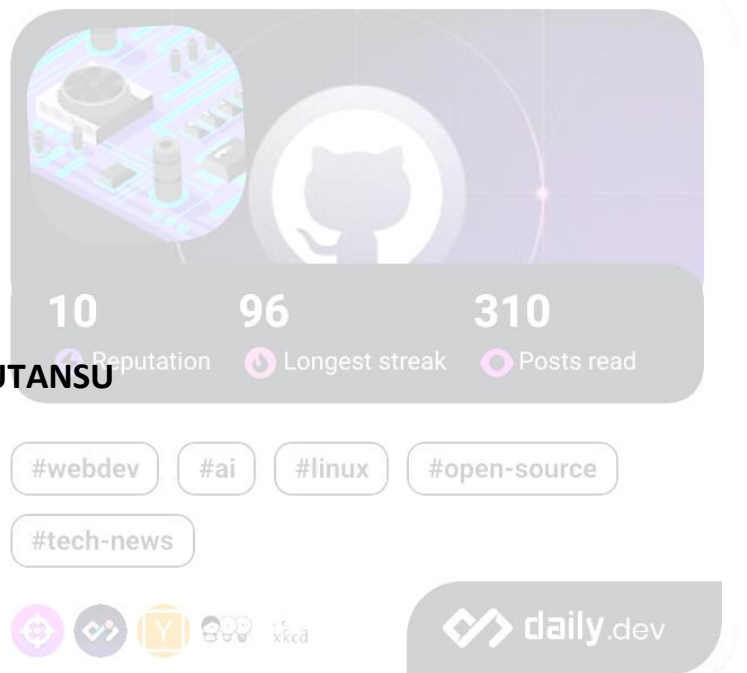
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GITHUB:



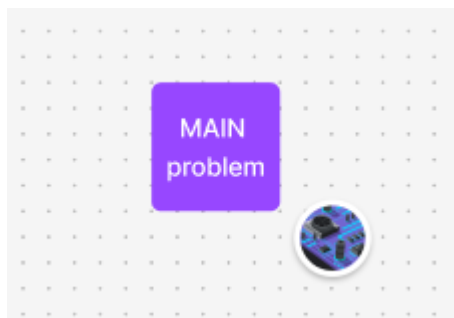
INTRODUCTION

In places like India the government need to work on various sectors, ex: education, agriculture, law, defence, etc. but the government alone cannot do this but what it does next is what related to this algorithm. So to prevent overloading of work they create minor governments for different work ex: defence sector, RBI, agriculture and tax department etc. But now let's see the same in maths.

LET'S SAY: -

We have the problem: 12×4

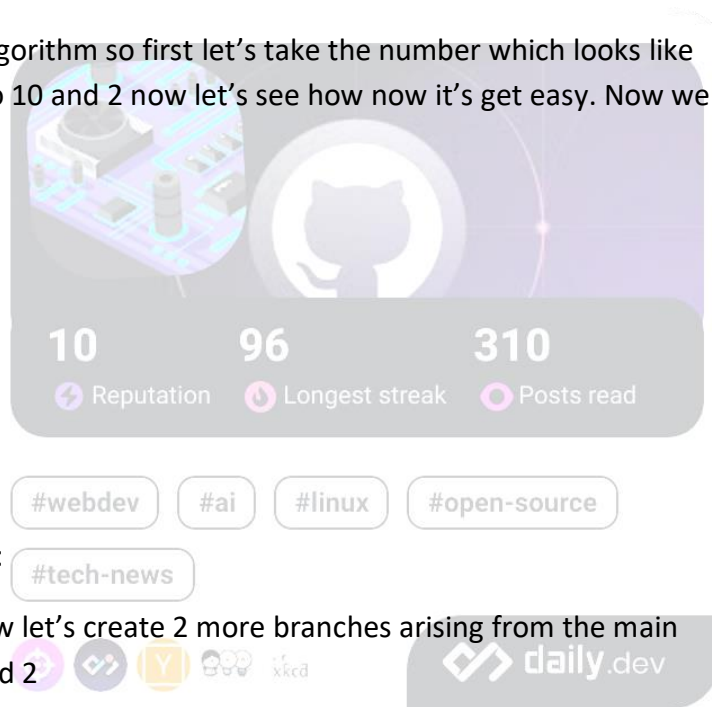
Looks easy its 48 but let's now solve it using our algorithm so first let's take the number which looks like that it can be divided into more numbers like 12 to 10 and 2 now let's see how now it's get easy. Now we create the main branch.

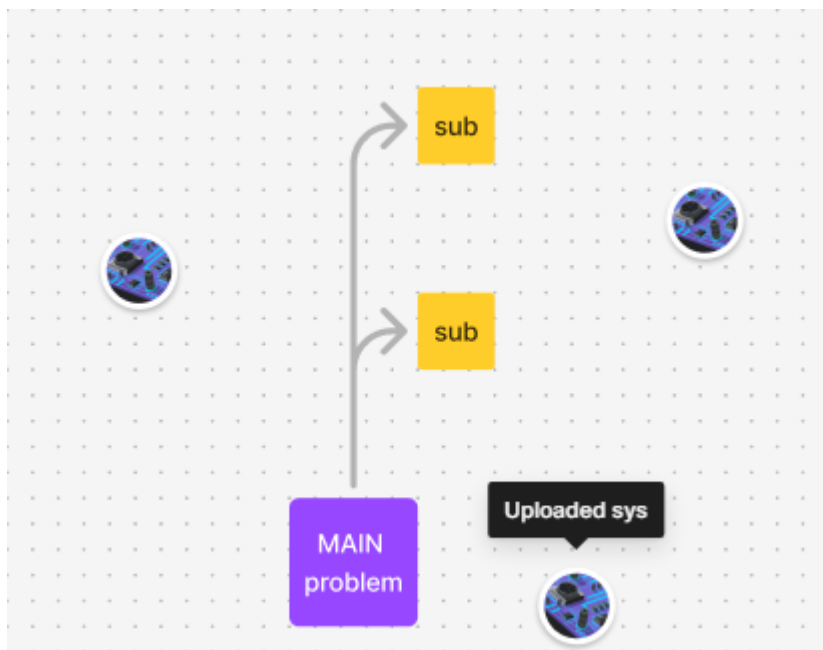


TEAM MEMBER OF UPLOADED SYS

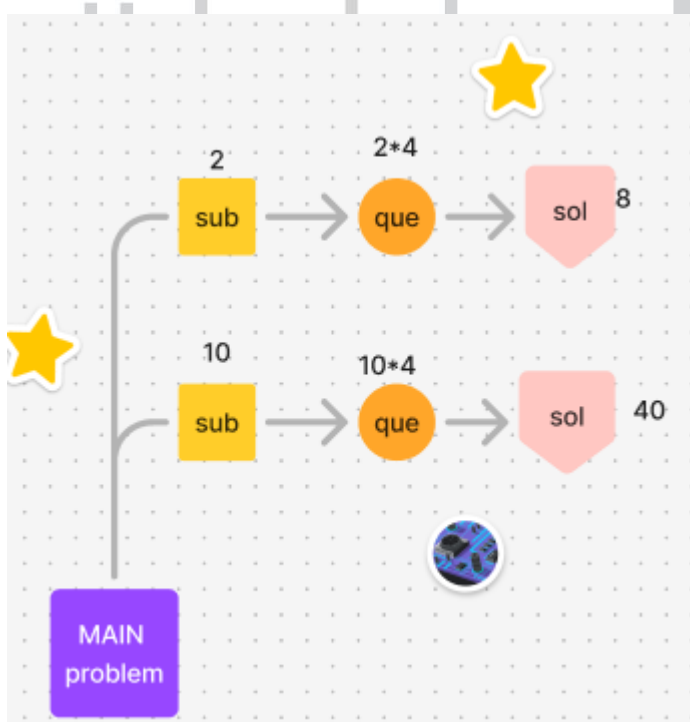
Now the **main branch contains the main problem**:

Now as we did earlier we divide 12 to 10 and 2 now let's create 2 more branches arising from the main main problem these two **sub-branches** have 10 and 2





Now as we know $12 \times 4 = 48$. Now as we have divided 12 to 10 and 2 now we are individually multiplying 10 with 4 and 2×4 and adding them. First let's multiply we now need to create a **quest** which returns a **solution** like $10 \times 4 = 40$.



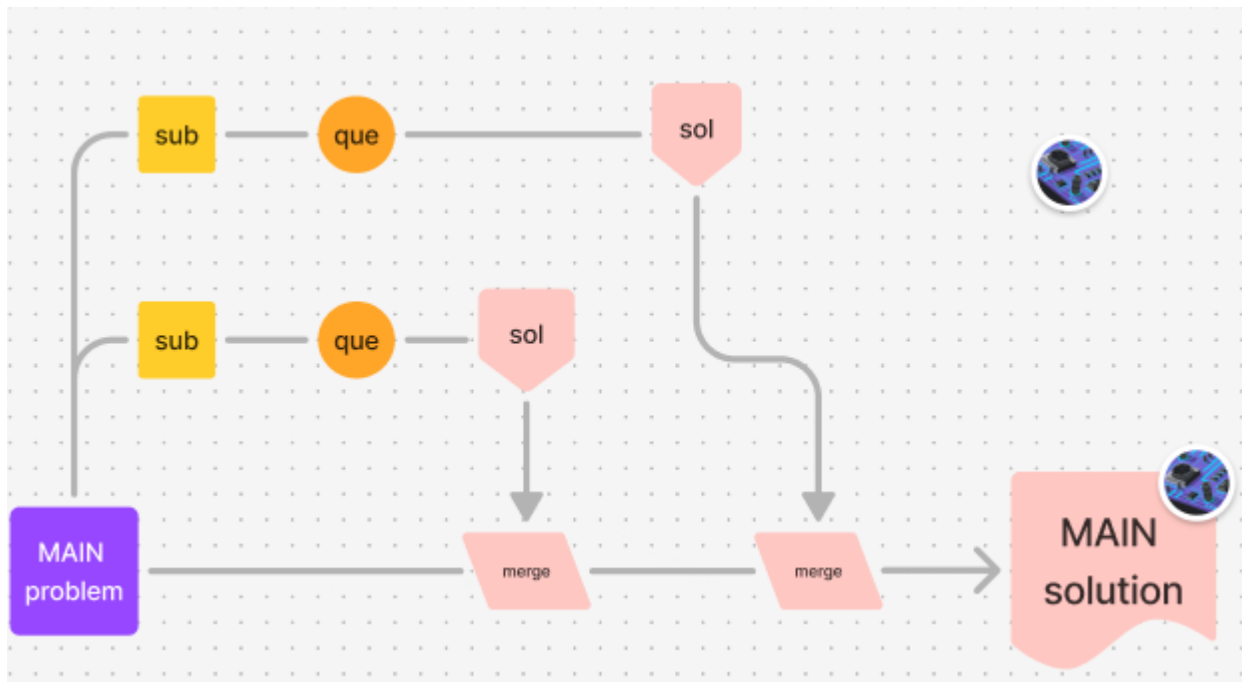
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Now we just need to add it we get $40 + 8 = 48$ well in this algorithm we call it a **merge**



Now we see it much easier to multiply 4 with 10 and 2 rather than 12 but this was too easy

Let's see another problem

NOTE: WE DON'T ALWAYS NEED TO VISUALISE IT ON A PHYSICAL SURFACE WE CAN USE OUR BRAIN IT WOULD BE 4X FASTER.

QUESTION: 49×7

Answer: now let's divide 49 to 40 and 9 now we individually multiply 40 and 9 with 7

$$40 \times 7 = 280 \quad | \quad 9 \times 7 = 63$$

Now let's add 280 and 63 if you are still stuck to add you can divide 63 to 40, 20, and 3

Now let's see:

1st: add(280+20)

= 300

2nd: add(300+40)

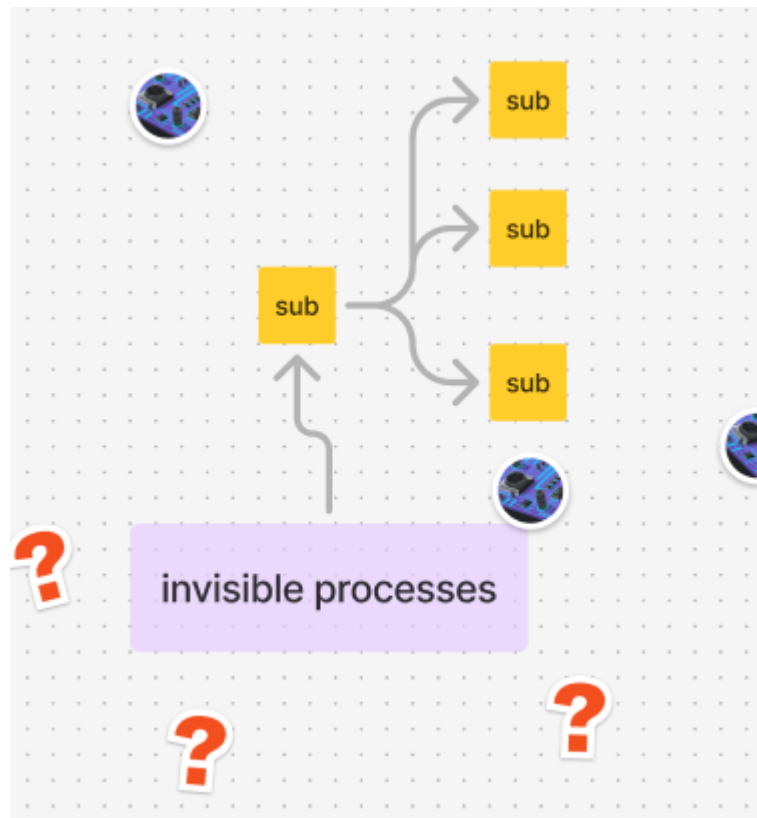
=340

3rd: add(340+3)

=343

Looks like we got our answer so, $49 \times 7 = 343$

NOTE: YOU CAN CREATE A SUB-BRANCH FOR A SUB-BRANCH



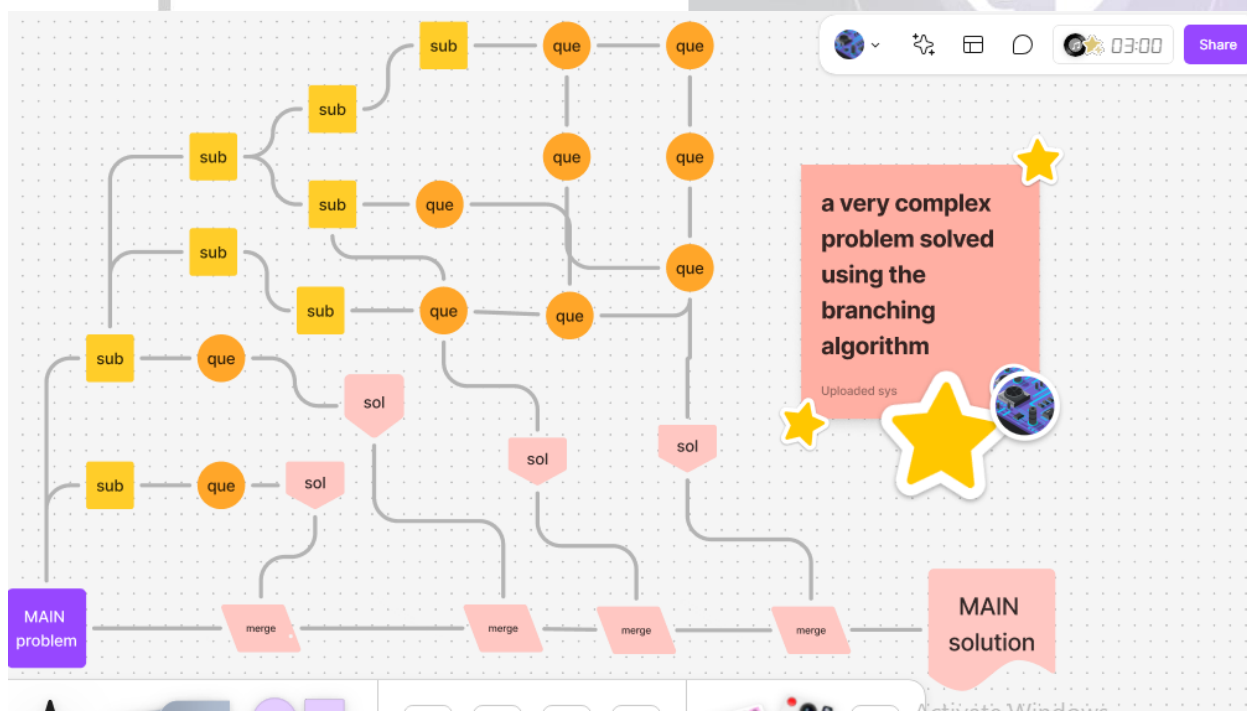
EX: we a sub-branch 63 then we created 3 more sub-branches containing 40, 20, 3

so in the introduction I keep some notes:

BRANCHING METHOD ADVANTAGES:

- It divides the problem into simpler tasks
- Once the simpler task is complete the solutions can be merged to get the final solution
- Less interruptions while calculating
- Less mistakes
- Less processes
- It can be represented visually

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A VERY COMPLEX PROBLEM SOLVED USING BRANCHING METHOD

ADVANCED FORMULAS

BRANCHING ALGORITHM FOR MULTIPLICATION:

FOR QUESTION $X * F = Y$ | let F be and X be any number

$$F(X-M)+F(X-N) = Y$$

REMEMBER YOU CAN ONLY DIVIDE X TO TWO NUMBER AT ONCE BUT DOING MORE IS OK BUT IT WILL NOT SATISFY THE RULE $M+N == X$: IT IS MANDATORY

BUT YOU CAN THEN DO IT AGAIN WITH THE RULE

$$\text{EX: } F(((X-M)-K)+((X-M)-L))+F(X-N) = Y$$

WELL I TOOK K AND L BECAUSE I AM SUBTRACTING A DIFFERENT NUMBER

Let's verify the formulas using python:

Let X be 12 and F be 4:

```

apple.py - C:/Users/dell/Desktop/apple.py (3.8.10)
File Edit Format Run Options Window Help
x = 12
f = 4
m = 2
n = 10
k = 5
l = 5
print('m+n:', m+n)
print('F(X-M)+F(X-N):', (f*(x-m)) + (f*(x-n)))
print('F(((X-M)-K)+((X-M)-L))+F(X-N):', f*((x-m)-k) + ((x-m)-l) + (f*(x-n)))

```

Code: [above]

```

IDLE Shell 3.8.10
File Edit Shell Debug Options Window Help
Python 3.8.10 (tags/v3.8.10:3d8993a, May 3 2021, 11:48:03) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: C:/Users/dell/Desktop/apple.py =====
m+n: 12
F(X-M)+F(X-N): 48
F(((X-M)-K)+((X-M)-L))+F(X-N): 48
>>>

```

Now division:

FOR QUESTION $X * F = Y$ | let F be and X be any number

$$(X-M)/F - (X-N)/F = Y$$

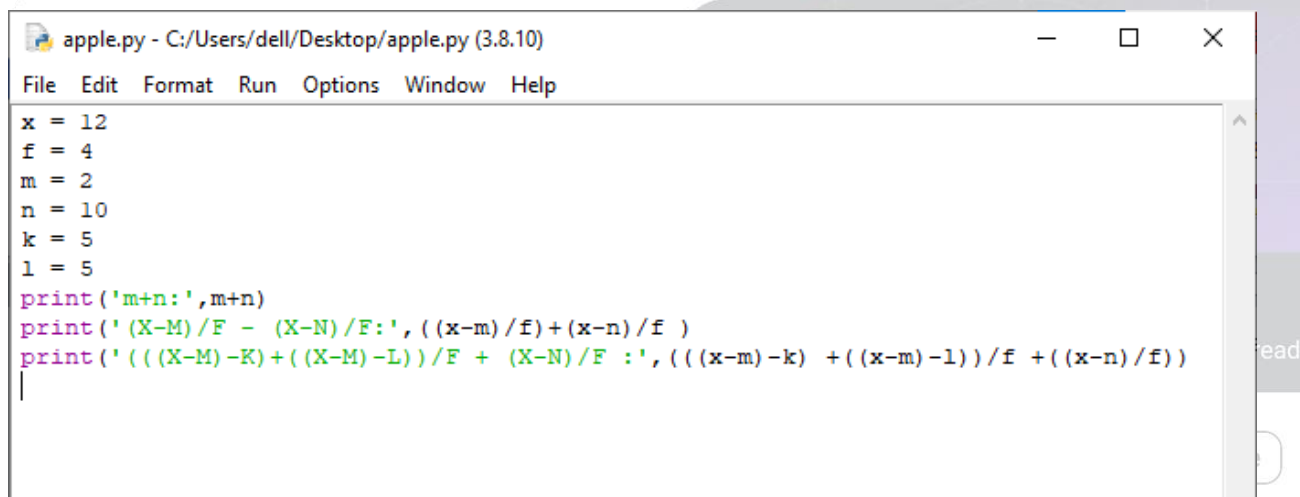
REMEMBER YOU CAN ONLY DIVIDE X TO TWO NUMBER AT ONCE BUT DOING MORE IS OK BUT IT WILL NOT SATISFY THE RULE $M+N == X$: IT IS MANDATORY

BUT YOU CAN THEN DO IT AGAIN WITH THE RULE

$$\text{EX: } (((X-M)-K)+((X-M)-L))/F + (X-N)/F = Y$$

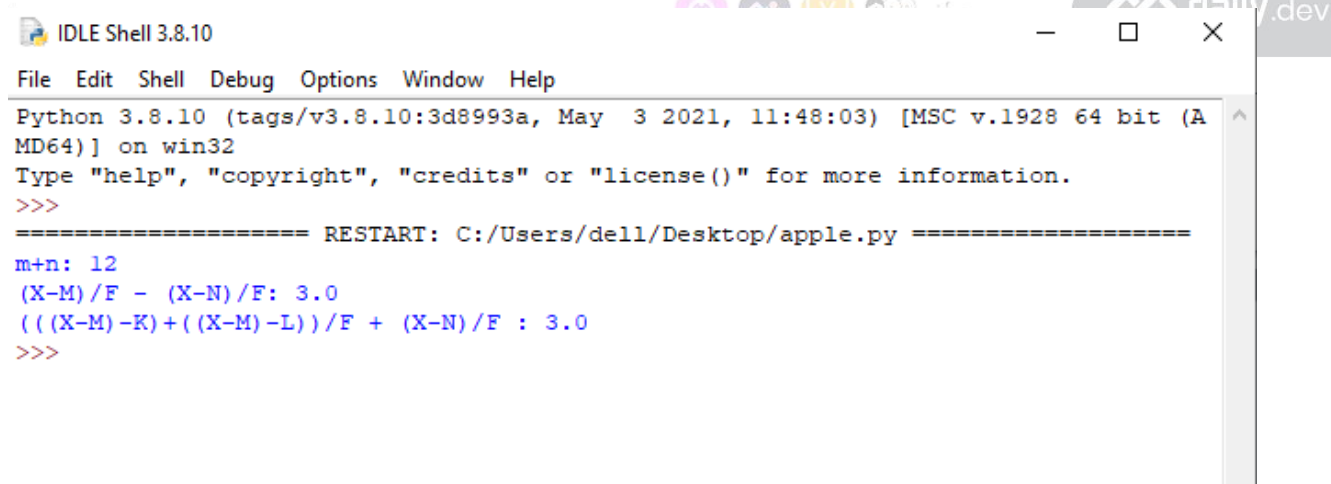
Let's verify the formulas using python:

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apple.py - C:/Users/dell/Desktop/apple.py (3.8.10)
File Edit Format Run Options Window Help
x = 12
f = 4
m = 2
n = 10
k = 5
l = 5
print('m+n:',m+n)
print(' (X-M)/F - (X-N)/F:', ((x-m)/f)+(x-n)/f )
print(' ( ((X-M)-K)+((X-M)-L) )/F + (X-N)/F :', (((x-m)-k) + ((x-m)-l))/f + ((x-n)/f))
```

Code:[above]



```
IDLE Shell 3.8.10
File Edit Shell Debug Options Window Help
Python 3.8.10 (tags/v3.8.10:3d8993a, May 3 2021, 11:48:03) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: C:/Users/dell/Desktop/apple.py =====
m+n: 12
(X-M)/F - (X-N)/F: 3.0
(((X-M)-K)+((X-M)-L))/F + (X-N)/F : 3.0
>>>
```

Now as we have learned to use this in multiplication and division now let's move on

Well during multiplication and division we simply divided the number into two numbers multiply the other number to both and add them. But in addition we can divide the number into 2 numbers but we will add or subtract from only one of the numbers and add them

Now addition:

So the formula for addition is:

$(x-m)+((x-n)+f)$ | let x and m be any number even decimal(floating point integers)

Or

$((x-m)+f)+(x-n)$ | does the same

What is Floating point arithmetic?

Floating-point arithmetic is a method used in computing to represent real numbers. It involves an integer with a fixed precision, known as the significant, which is scaled by an integer exponent of a fixed base. This allows for the representation of a wide range of values, both very large and very small.

For example, the number 12.345 in base ten with five digits of precision is a floating-point number. However, if more precision is needed, such as 12.3456, it would require six digits of precision. The nearest floating-point number with only five digits would be 12.346.

Floating-point arithmetic is essential for scientific calculations, graphics, and many other applications where precision and range are crucial. It enables computers to handle a vast range of real numbers efficiently, making it a cornerstone of modern computing.

For subtraction:

So the formula for subtraction is:

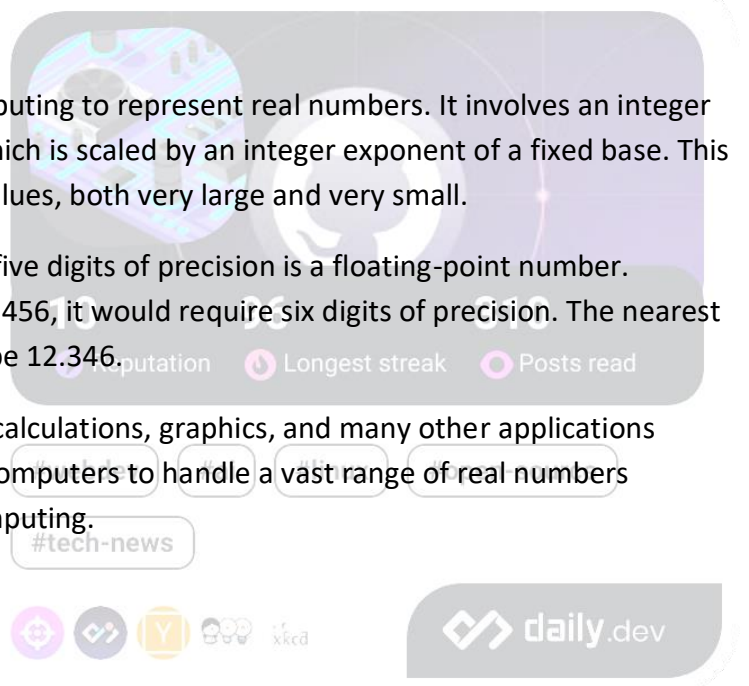
$(x-m)+((x-n)-f)$ | let x and m be any number even decimal(floating point integers)

Or

$((x-m)-f)+(x-n)$ | does the same

Well now you can use these formulas to do **addition, subtraction, division, multiplication.**

Well you can prefer the cheat sheet at the last page.



Maximize YOUR BRAIN POWER WITH THESE PROBLEMS

- 34×12
- 15×76
- 112×76
- 198×8
- 54×7
- 49×7
- 16807×7
- $7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7$ or 7^7
- $12/4$
- $49/7$
- $90/45$
- $1234/4$
- $54564/4$
- $65/5$
- $2012/2$
- 2×55
- $1223+222$
- $2213+443$
- $44+333$
- $74646+77838$
- $24484+3783$
- $909+1$
- $4567-987$
- $826729-82728$
- $1234321-1234321$
- $94375-97865$
- $123-321$
- $7654646-7546671$
- $12433-975$
- $(12343+65434) \times (123+321) / (1000000-1000)$
- A farmer has 123 apple trees in one orchard and 45 apple trees in another orchard. How many apple trees does the farmer have in total?
- A bookstore sold 234 books on Monday and 56 books on Tuesday. How many books did they sell in total?
- A factory produces 1,234 widgets in a day. How many widgets will it produce in 3 days?
- A gardener planted 345 flowers in one garden and 78 flowers in another garden. How many flowers did the gardener plant in total?



- A farmer has 1,234 apples and wants to distribute them equally among 12 baskets. How many apples will each basket contain?
- A company has 5,678 units of a product and needs to ship them in boxes that can hold 25 units each. How many boxes will they need?
- A factory produces 9,876 widgets and needs to package them in crates that hold 50 widgets each. How many crates will they need?
- A baker has 3,456 cookies and wants to pack them into boxes that can hold 30 cookies each. How many boxes will they need?
- A library has 1,234 fiction books and 567 non-fiction books. How many books does the library have in total?
- A farmer harvested 2,345 apples and 1,234 oranges. How many fruits did the farmer harvest in total?
- A school has 789 students in the primary section and 456 students in the secondary section. How many students are there in total?
- A factory produced 3,456 units of product A and 2,345 units of product B. How many units did the factory produce in total?
- A library had 1,234 books, but 567 were borrowed. How many books are left in the library?
- A farmer harvested 2,345 apples but sold 1,234 of them. How many apples does the farmer have left?
- A school had 789 students, but 456 graduated. How many students are still at the school?
- A factory produced 3,456 units of product A but shipped out 2,345 units. How many units are left in the factory?
- A baker had 1,234 loaves of bread but sold 567. How many loaves are left?
- A company hired 678 employees in the first quarter but 345 left. How many employees are still with the company?
- A factory produces 123 widgets per hour. If the factory operates for 8 hours a day, how many widgets does it produce in a day? If the factory operates for 5 days, how many widgets does it produce in total?
- A gardener plants 45 flowers in each of 12 rows. How many flowers are there in total? If the gardener plants an additional 78 flowers, how many flowers are there now?
- A bookstore sells 234 books each day. How many books does it sell in 7 days? If the bookstore sells an additional 56 books on the 8th day, how many books does it sell in total?
- A school has 567 students in the morning session and 89 students in the afternoon session. If each student has 3 classes, how many classes are there in total?
- A company produces 1,234 units of product A and 567 units of product B. If each unit of product A costs \$5 and each unit of product B costs \$3, what is the total cost of all the products?
- A baker makes 789 loaves of bread each week. How many loaves does the baker make in 4 weeks? If the baker makes an additional 123 loaves in the 5th week, how many loaves does the baker make in total?

THIS AMMOUNT OF PROBLEMS SHOULD BE ENOUGH FOR YOU TO GET PERFECT AT BRANCHING ALGORITHM

Cheat sheet:

BRANCHING ALGORITHM FOR MULTIPLICATION:

FOR QUESTION $X * F = Y$ | let F be and X be any number

$$F(X-M) + F(X-N) = Y$$

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division:

FOR QUESTION $X * F = Y$ | let F be and X be any number

$$(X-M)/F - (X-N)/F = Y$$

REMEMBER YOU CAN ONLY DIVIDE X TO TWO NUMBER AT ONCE BUT DOING MORE IS OK BUT IT WILL NOT SATISFY THE RULE $M+N == X$: IT IS MANDATORY

Now addition:

So the formula for addition is:

$$(x-m) + ((x-n)+f) \quad | \text{ let x and m be any number even decimal(floating point integers)}$$

Or

$$((x-m)+f) + (x-n) \quad | \text{ does the same}$$

For subtraction:

So the formula for subtraction is:

$$(x-m) + ((x-n)-f) \quad | \text{ let x and m be any number even decimal(floating point integers)}$$

Or

$$((x-m)-f) + (x-n) \quad | \text{ does the same}$$

This algorithm works best during multiplication and division.

