Problem: We will be provided with 4 integers. By using plus, minus, multiply and divide, we need to manipulate these 4 integers to obtain a final result – 24.

Firstly, we need to find out all possible permutations of these 4 integers. For 4 different integers, we will get $A_4^4 = 24$ possible answers. And we also need to consider about the arrangements of brackets. In this situation, we have only 5 possible ways to arrange the brackets:

$$((A \cdot B) \cdot C) \cdot D$$

$$(A \cdot (B \cdot C)) \cdot D$$

$$A \cdot ((B \cdot C) \cdot D)$$

$$A \cdot (B \cdot (C \cdot D))$$

$$(A \cdot B) \cdot (C \cdot D)$$

And since we have 4 operations $(+, -, \times, \div)$, we will get in total $24 \times 5 \times 4 \times 4 \times 4 = 7680$ possible results. Then we only need to check out whether the result equals to 24.

Input: 4 integers num1, num2, num3, num4

Output: A way to manipulate 4 integers to obtain 24

1. *numbers* ← {*num1*, *num2*, *num3*, *num4*}
2. *ops* ← {+, -, *, /}
3. *perm* ← {*numbers*}
4. **For** i ← 1 to 24 **Do**
5. *perm* ← Next_permutation(*numbers*) ∪ *perm*

/* Next_permutation( ) is a function to get next permutation of *numbers* */

6. **End**
7. **For every** {*num1*, *num2*, *num3*, *num4*} ∈ *perm*

/**perm* is a set of all possible permutations, for each permutation in this set…*/

8. **For every** i ∈ *ops* **Do**
9. **For every** j ∈ *ops* **Do**
10. **For every** k ∈ *ops* **Do**

/*i, j, k means a kind of operation – plus, minus, multiply or divide*/

11. **If** (((*num1* i *num2*) j *num3*) k *num4*) == 24
12. **Then Return** (((*num1* i *num2*) j *num3*) k *num4*)
13. **Elseif** ((*num1* i (*num2* j *num3*)) k *num4*) == 24
14. **Then Return** ((*num1* i (*num2* j *num3*)) k *num4*)
15. **Elseif** (*num1* i ((*num2* j *num3*) k *num4*)) == 24
16. **Then Return** (*num1* i ((*num2* j *num3*) k *num4*))
17. **Elseif** (*num1* i (*num2* j (*num3* k *num4*))) == 24

18. **Then Return** (*num1* i (*num2* j (*num3* k *num4*)))

19. **Elseif** ((*num1* i *num2*) j (*num3* k *num4*)) == 24

20. **Then Return** ((*num1* i *num2*) j (*num3* k *num4*))

/*5 possible ways to arrange the brackets*/

21. **Else**

22. **Then** Print(‘No solution.’)

23. **End**

24. **End**

25. **End**

26. **End**

27.**End**

```
Please input 4 numbers:
1,2,3,4
        1         2         3         4  : ((        1 +       2 )+       3 )*       4
```

```
Please input 4 numbers:
1,4,5,8
        1         5         8         4  : (        1 +       5 )*(       8 -       4 )
```

```
Please input 4 numbers:
5,9,8,3
        3         9         5         8  : ((        3 *       9 )+       5 )-       8
```

```
Please input 4 numbers:
1,3,4,6
        6         1         3         4  :        6 /(       1 -(       3 /       4 ))
```

```
Please input 4 numbers:
1,5,4,6
        6         5         4         1  :        6 /((       5 /       4 )-       1 )
```

num1	num2	num3	num4	Result
1	2	3	4	$\big((1+2)+3\big)*4$
1	4	5	8	$(1+5)*(8-4)$
5	9	8	3	$\big((3*9)+5\big)-8$
1	3	4	6	$6/(1-(3/4))$
1	5	4	6	$6/((5/4)-1)$