

Video - (22)

Backtracking

Leetcode
- 679
~~Hard~~

> 50%



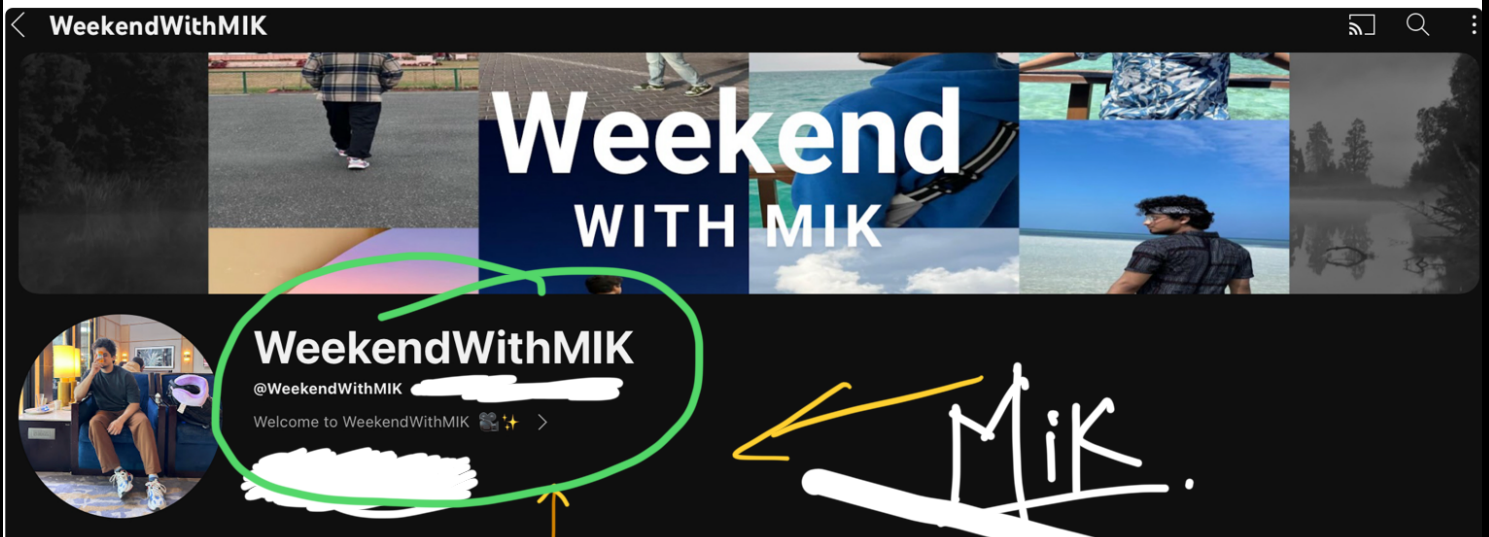
codestorywithmik



CSwithMIK



codestorywithMIK



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Motivation :-

When you feel like you are tired,
you don't feel like working hard.

Just take a pause, take a deep breathe.

think about how far you have come

and how much you will regret if

you quit after coming so far.

You will know how it feels.



MIK...

679. 24 Game

Hard

Topics

Companies

cards = {
value = 1 <= val <= 9

You are given an integer array `cards` of length `4`. You have four cards, each containing a number in the range `[1, 9]`. You should arrange the numbers on these cards in a mathematical expression using the operators `['+', '-', '*', '/']` and the parentheses `'('` and `)'` to get the value 24.

You are restricted with the following rules:

- ✓ The division operator `'/'` represents real division, not integer division.

- For example, `4 / (1 - 2 / 3) = 4 / (1 / 3) = 12`.

- ✓ Every operation done is between two numbers. In particular, we cannot use `'-'` as a unary operator.

- For example, if `cards = [1, 1, 1, 1]`, the expression `"-1 - 1 - 1 - 1"` is **not allowed**.

- You cannot concatenate numbers together

$$\frac{5}{2} = 2.5$$

- For example, if `cards = [1, 2, 1, 2]`, the expression `"12 + 12"` is not valid.

Return `true` if you can get such expression that evaluates to `24`, and `false` otherwise.

Example:- `cards = [4, 1, 8, 7]`

Output = True.

$\{ (8, 4), 7, 1 \}$
 $\{ 7, 1, 4 \}$
 $\{ (6, 4) \}$

`cards = [1, 2, 1, 2]` $\{ 6 \times 4 \} = \{ 24 \}$

Output = False.

Thought Process

$\begin{matrix} i & & j \\ \{ \underline{8}, 1, \underline{4}, 7 \} \end{matrix}$
 $\{ (8, 4), 1, 7 \}$
 $+$
 $\{ 1, 7, 12 \}$

Key points :-

\checkmark Any order \rightarrow options to pick two numbers at a time.

\rightarrow options $\rightarrow a, b$

\swarrow
 $\{ a+b, a-b, a \times b, a/b \}$

$$b-a, b/a \}$$

Constraint:-

$$\text{cards.length() == 4}$$



```
for ( i = 0 ; i < cards.length(); i++ ) {
```

```
    for ( j = 0 ; j < cards.length(); j++ ) {
```

```
        if ( i == j )
            continue;
```

} Exploring
all possible
selection
of 2 numbers
a, b

$$\Rightarrow \{1, 7\}$$

$$a = 8;$$

$$b = 4;$$

Possible = { a+b, a-b, b-a, a*b, a/b, b/a }

{1, 7, ~~8-4~~}

{1, 7, 8-4}

Recursion.

False

Recursion.

True.

Optimal = Recursion.

Options = Recursion (Backtracking)

Do
Explore
Undo

$\{1, 7\}$
 $\{1, 7, 12\} \xrightarrow{\text{Do}} \underline{\text{Explore}}$
 $\{1, 7\} \xleftarrow{\text{Undo}}$

$\{1, 7, 4\} \rightarrow \text{Explore}$
 $\{1, 7\}$

$$\{ \overset{0}{\underset{a}{\textcircled{8}}}, \overset{1}{1}, \overset{2}{\underset{b}{\textcircled{4}}}, \overset{3}{7} \}$$

$$P_{\text{arr}} = \{ 12, \underset{\cdot}{\textcircled{4}}, -4, 32, 2, 0.5 \}$$

$$\text{remain} = \{ 1, 7, \underset{\uparrow}{4} \}$$

$$\downarrow \begin{matrix} i & j \\ \{ 1, 7, \underset{\cdot}{4} \} \end{matrix}$$

$$P_{\text{arr}} = \{ 8, -6, 6, 7, 0, \dots, 7 \}$$

$$\begin{matrix} i & j \\ \{ 4, 6 \} \end{matrix}$$

$$P_{\text{arr}} = \{ \textcircled{10}, -2, 2, \textcircled{24}, 4/6, 6/4 \}$$

$$\{ \textcircled{24} \}$$

$$\text{Cards}[k] == 1$$

if

$$\{ \text{Cards}[0] == 24 \}$$

return true;

$\swarrow \searrow O(6)$

$$a+b \checkmark$$

$$a-b \checkmark$$

$$b-a \checkmark$$

$$a \times b \checkmark$$

$$a/b \checkmark$$

$$b/a \checkmark$$

real
division

can't set false

Floating point Errors and the Role of Epsilon :-

double

$$\{(8, 3) \ 3\}$$

$$\{(8/3), (3)\}$$

→

$$\{(8/3) \ 3\}$$

$$\frac{8}{3} * 3 = 8$$

$$\{2.666, 3\}$$

↳

7.9999...

$$(7.999 == 8) \times$$

"Epsilon" (EPS)
↳ x

(8 - 7.9999)

target = 24

abs(cards[0] - target) <= epsilon

epsilon = 0.1 ; // 0.01, 0.001, 0.0000001

if (cards.size() == 1) {

return abs(cards[0] - 24.0) <= epsilon;

}

