

DYALOG

Glasgow 2024

Problem Solving with APL



Adám Brudzewsky



Rich Park



Stefan Kruger

Format: For each problem...

- ◆ Problem statement (ask if unclear)
- ◆ Solve the problem (bonus task if you're fast)
- ◆ We collect and show solutions (be brave)
- ◆ Discussion (learning opportunity)

It Is All Right

Write a dfn that takes the length of the legs of a triangle as its left argument, and the length of the hypotenuse as its right argument and returns 1 if the triangle is a right triangle, 0 otherwise.

```
1      3 4 YourFunction 5
0      2 3 YourFunction 4
```

Hint: In a right triangle, the square of the hypotenuse equals the sum of squares of the legs.

Being Whole is Overrated

Write a function which selects the non-integer numbers from a numeric vector.

```
YourFunction 14.2 9 3 3.1 0 -1.1  
14.2 3.1 -1.1
```

```
YourFunction 1 3 5
```

```
YourFunction 3.1415 2.71828  
3.1415 2.71828
```

Bonus task:
Keep integers
instead

Zero Nulls

Write a function replaces all `⊖NULL`s with 0s in a simple array.

```
    YourFunction 1 2 ⊖NULL 4 5 6
1 2 0 4 5 6
```

```
    YourFunction 2 2 2ρ'A' ⊖NULL 'B'
A 0
B A
```

```
0 B
A 0
```

Bonus task: Handle nested arrays

Move to the Front

Write a function that, given vector arguments, reorders the right argument so elements in the left argument come first.

```
'rb' YourFunction 'abracadabra'  
brbraacadaa  
42 YourFunction 0  
3 YourFunction ,1  
1
```

Bonus task:
Use the order of
the left argument:
rrbbaacadaa

What Is In a Word

Write a function which returns the number of words in the given character vector. For simplicity's sake, you can consider the space character ' ' to be the only word separator.

```
YourFunction 'Testing one, two, three'
4
YourFunction 'many blanks'
2
YourFunction ''
0
```

Bonus task:
Multiple word
separators as
left argument

Like an Arrow

Write a function that takes a size and creates a corresponding Boolean matrix with the top triangle being 1s.

YourFunction 4

```
1 1 1 1
0 1 1 0
0 0 0 0
0 0 0 0
```

YourFunction 5

```
1 1 1 1 1
0 1 1 1 0
0 0 1 0 0
0 0 0 0 0
0 0 0 0 0
```

Bonus task:
Left argument
(0–3) is arrow
direction

Longest Streak

Write a function that takes a non-empty numeric vector and returns the length of the longest streak of positive growth.

YourFunction 1 2 3 4 5 6 7 8 9 → 8

YourFunction 9 5 4 3 2 6 7 8 → 3

Bonus task: Length of longest streak of consistent growth/stagnation/fall

You're Unique, Just Like Everyone Else

Write a function that takes a vector as its right argument and returns elements that occur only once in the vector.

```
YourFunction 1 2 3 4 5 4 3 2 1 2
5
```

```
YourFunction 'bye' 'bye' 'hello' 'world'
hello world
```

Bonus task: Sort by ascending frequency

See (Through) Me

Write a replacement for $\underline{\epsilon}$ on simple vectors where the left argument is a pair: what to search for and a Boolean mask vector indicating which elements must match.

```
w ← 5 2 18 5 3 5 4 5 2 18 5
(5 6 5)(1 0 1) YourFunction w
0 0 0 1 0 1 0 0 0 0 0
w ← 'mississippi'
'issixxi' (1 1 1 1 0 0 1) YourFunction w
0 1 0 0 1 0 0 0 0 0 0
```

Bonus task:
Handle
higher ranks

Separation Anxiety

Write a function that takes a right argument character vector and a left argument character scalar separator character. It should then insert the separator after every group of 3 characters from the right, but not at the far left.

```
      ', ' YourFunction '123456789'  
123,456,789  
      ' ' YourFunction 'abcde'  
ab cde
```

Bonus task:
Do it fast!

Chop Chop

A gene has 3xn characters and ends with TAG, TAA, or TGA.

Chop the given character vector into genes.

```
s ← 'TAG' 'TAA' 'TGA'
⊞RL ← 4
⊞ ← g ← ε { ω ≥ 4 : 'ACTG' [ ? 3 ρ 4 ] ⋄ ω = s } `` ? 10 ρ 8
GTCCTAACCTAATTATGATAACGGCCGTAA
YourFunction g
GTCCTAACCTAA TTATGA TAA CGGCCGTAA
```

Keeping Things In Balance

Write a function which returns a 1 if the opening and closing parentheses in a character vector are balanced, or a zero otherwise.

YourFunction	'((2×3)+4)'	→	1
YourFunction	''	→	1
YourFunction	'hello world!'	→	1
YourFunction	')(2×3)+/4('	→	0
YourFunction	'(())'	→	0

**Bonus
task:**
Handle
[] too!

Thank you for playing!

Want more? Visit apl.quest →



The screenshot shows a web browser window with a dark theme. On the left is a vertical navigation menu with links for Home, Help, and years from 2023 down to 2013. The main content area is titled "APL Quest" and contains the following text: "This site automatically validates APL solutions for practice problems sourced from The APL Problem Solving Competition's phase 1." To the right of this text is a green apple logo with "APL" and a question mark inside. Below this is a paragraph: "Each problem starts with a task description; some also include a hint suggesting one or more APL primitives. These may be helpful in solving the problem, but you are under no obligation to use them. Clicking on a primitive in the hint opens the Dyalog documentation page for that primitive." This is followed by another paragraph: "Each problem ends with some example cases. You can use these as a basis for implementing your solution." Then: "Notice something wrong? Report a bug." Next: "Every problem has one or more solutions explained fully in the APL Quest video series." Below this is a section titled "Sample Problem: Counting Vowels" with the text: "Write an APL function to count the number of vowels in an array consisting of upper and lower case letters." At the bottom, a "Hint" icon is visible.