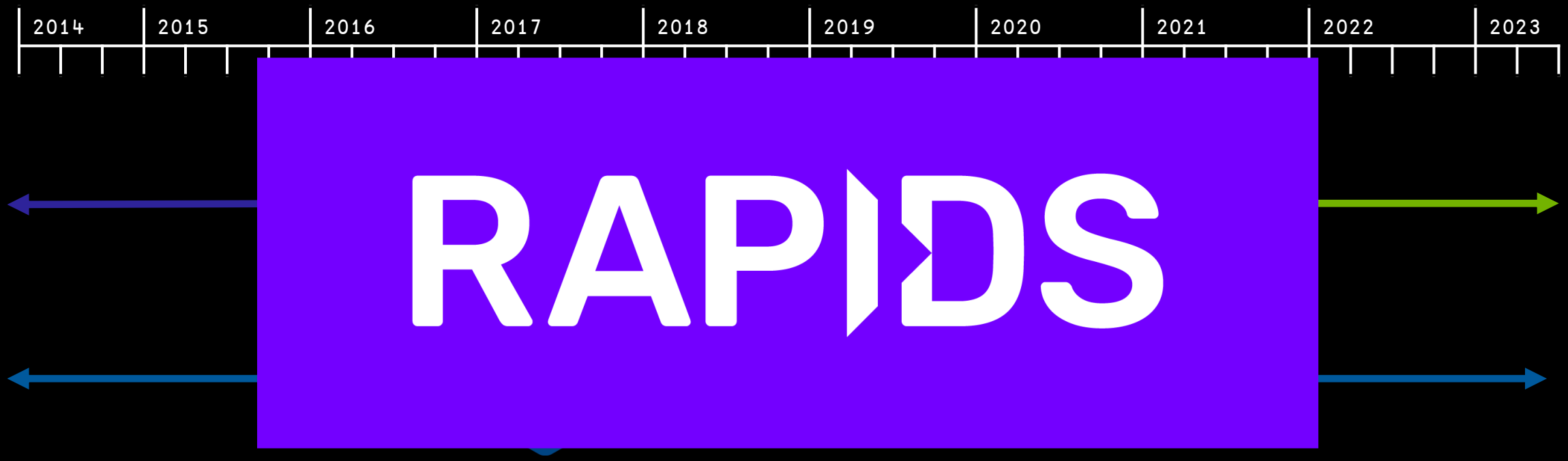
Algorithms in q

Conor Hoekstra

code_report



About Me

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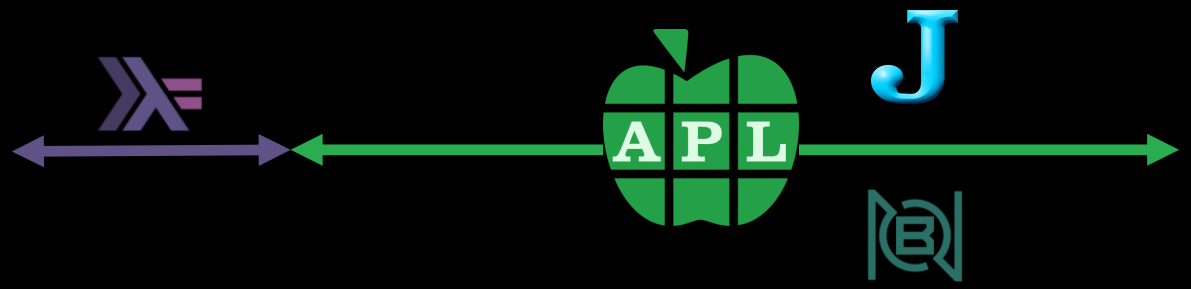

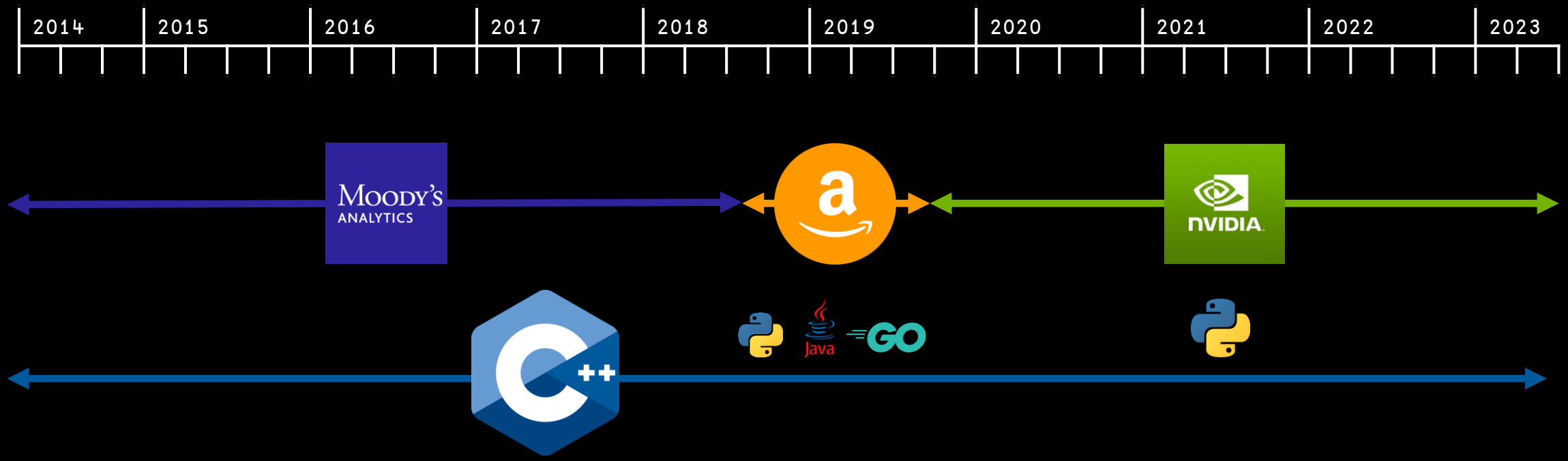

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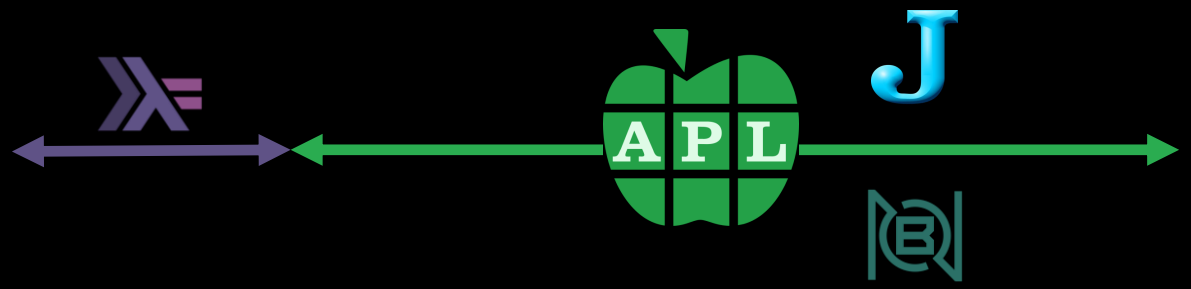
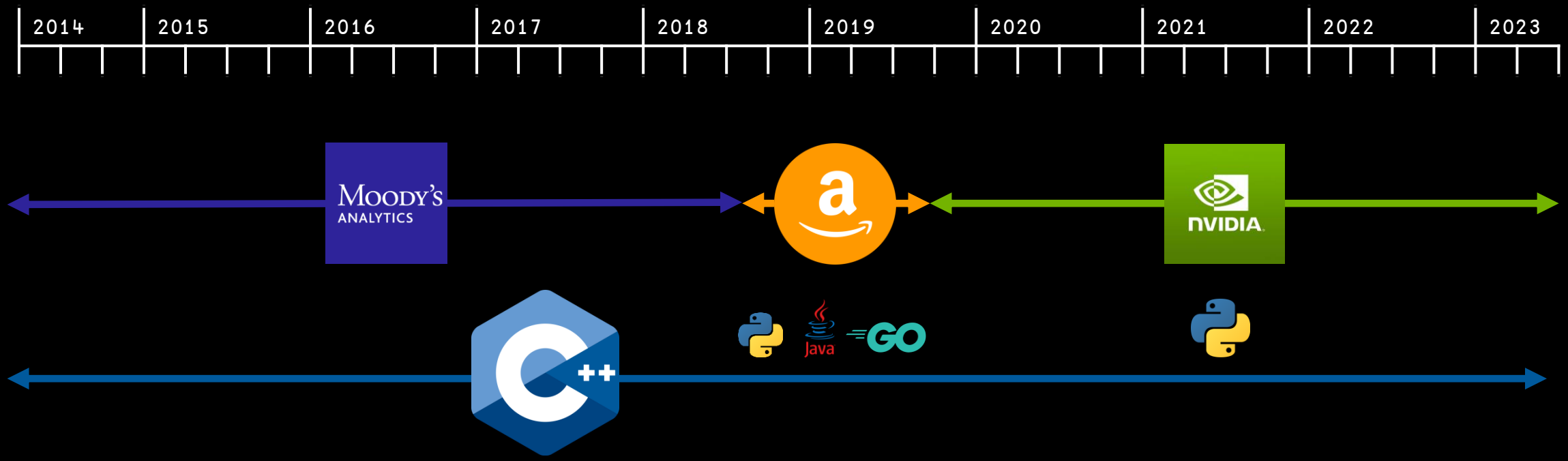


J

APL

NB



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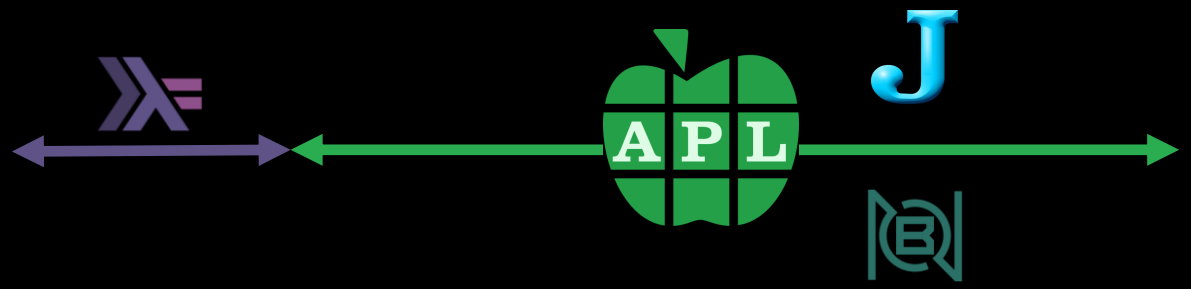

Algorithms + Data Structures = Programs

RUN FOR THE FUN OF IT!

2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023

MOODY'S ANALYTICS

NVIDIA

Java GO

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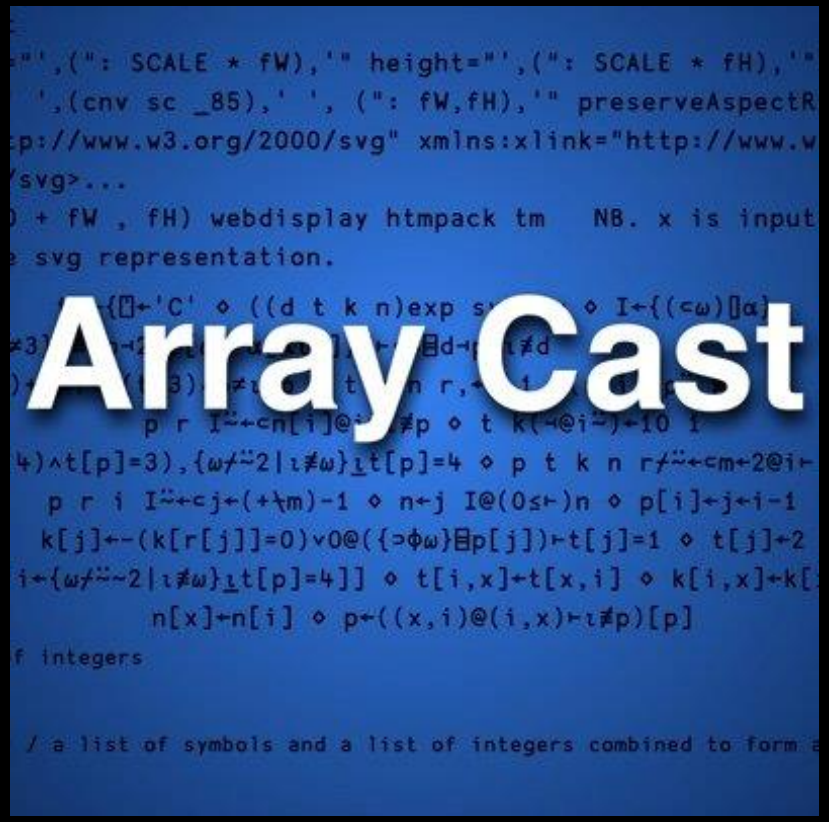
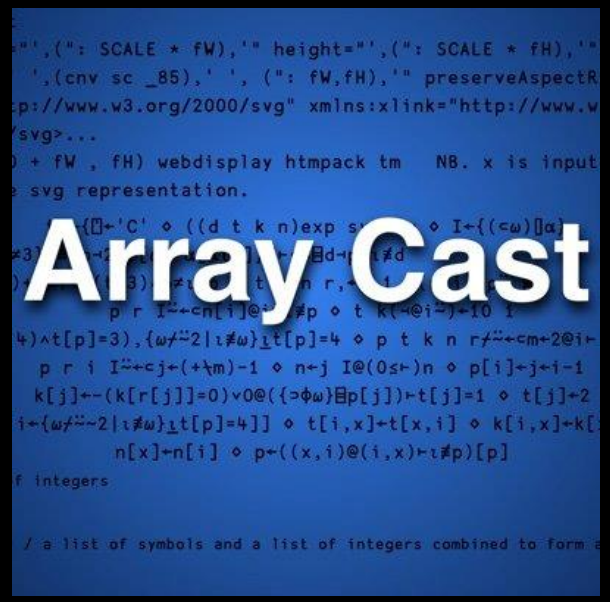
Algorithms + Data Structures = Programs



318 Videos

31 (20) Talks

Algorithms + Data Structures = Programs



RUN 👟 FOR THE FUN 🙂 OF IT!

131 Episodes
@adspthepodcast

52 Episodes
@arraycast

8 Episodes
@conorhoekstra

https://github.com/codereport/Content

https://github.com/interregna/arraylanguage-companies

Companies

Name	Language	Location	Sector	Source	Remote OK?
1010Data	K3	New York	analytics	Reddit	yes
4xtra	APL	UK	consulting	company	
APL Borealis	APL	Ontario, Canada	consulting	company	
Aplensia	APL	Sweden	consulting	Dyalog	
Appian	K	global	apps	company	yes
Data Intellect (formally AquaQ)	Kx	Belfast, UK + Jersey City, US	consulting	Reddit	
Aviva	APL	London, UK	finance	Optima systems	
Barclays	K	global	finance	tsdb	
Bank of America - Merrill Lynch	K	global	finance	tsdb	
BCA Research	APL	Canada	finance	APL Wiki	
BIG	APL	USA	Retail consulting	APL Wiki	only
Carlisle Group	APL	Pennsylvania	financial software	GitHub	yes
Citi Bank	K	global	finance	tsdb	

Viewers can expect to learn the utility and importance of the fundamental built-in functions that come with q such as **scans**, **reductions**, **where**, **cut**, **prior** and **more**.

- scans
- reductions
- where
- cut
- prior
- more

https://github.com/codereport/top10

	Problem	Solution
1	Rain Water	`rainWater: { sum abs x - (reverse maxs reverse x) & maxs x }`
2	MCO	1) `mco: { max sum each chunk x }` 2) `mco: { max { y * y + x } scan x }`
3	LCIS	1) `lcis: { 1 + max { y * y + x } scan (>) prior x }` 2) `lcis: { 1 + max sum each chunk 1 _ (>) prior x }`
4	Kadanes	`kadanes: { max { y | y + x } scan x }`
5	SF2	`sf2: { 2 * max (&) prior count each chunk x }`
6	Max Gap	`maxgap: { max 1 _ deltas asc x }`
7	Max Gap Count	`maxgapcount: { sum { x = max x } 1 _ deltas asc x }`
8	TCO	`tco: { 3 <= max sum each chunk x mod 2 }`
9	Skyscraper	`skyscraper: { count distinct maxs x }`
10	OceanView	`oceanview: { where reverse differ maxs reverse x }`

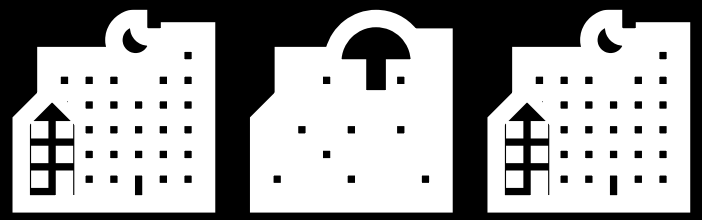
Problems:

5. Sushi for Two
6. Max Gap
9. Skyline

Problems:

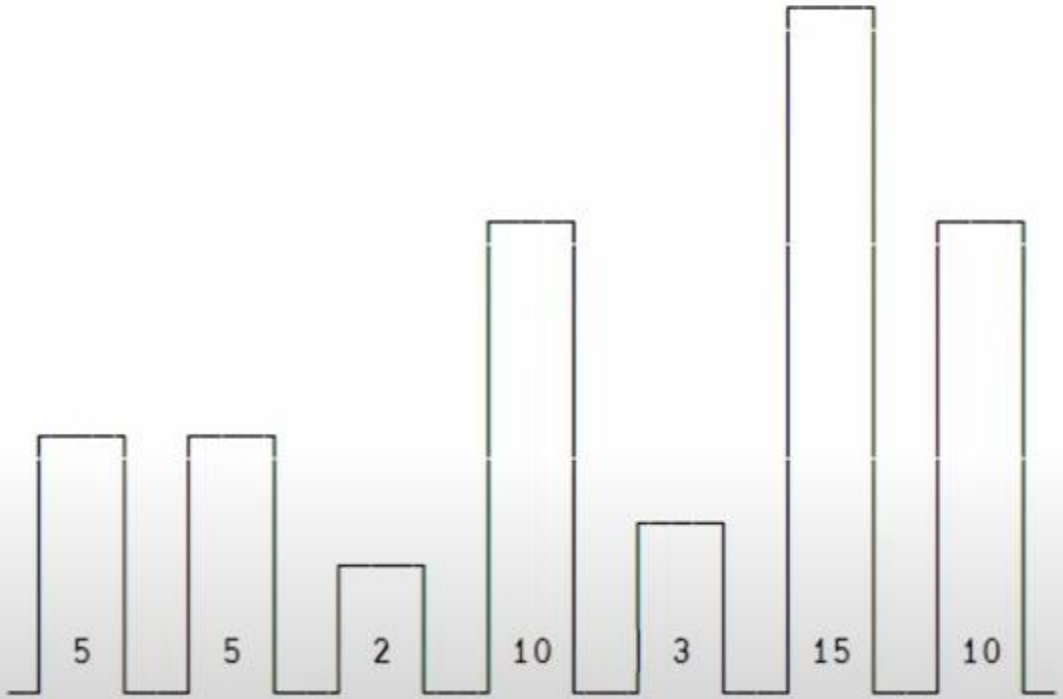
9. Skyline
6. Max Gap
5. Sushi for Two

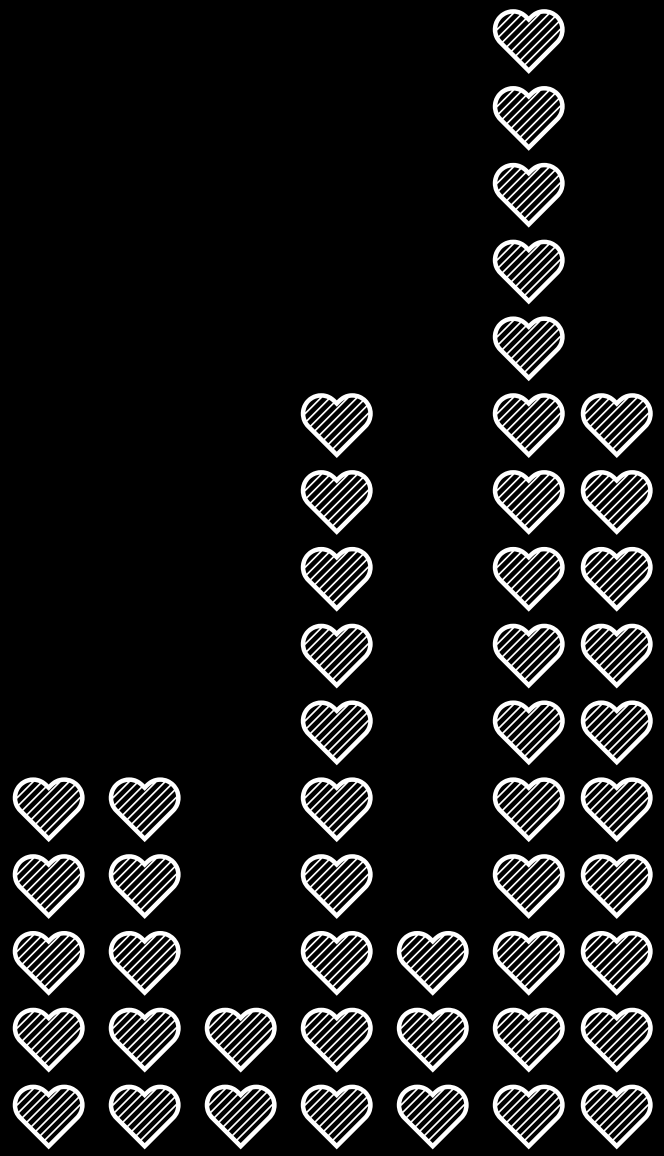
Skyline

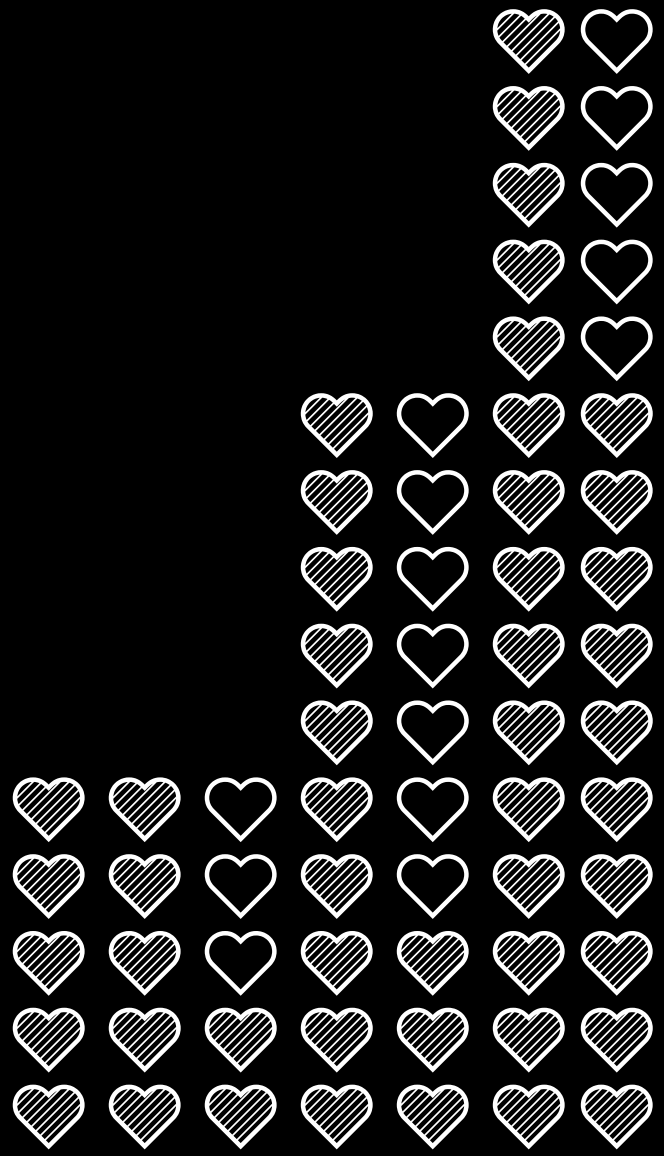


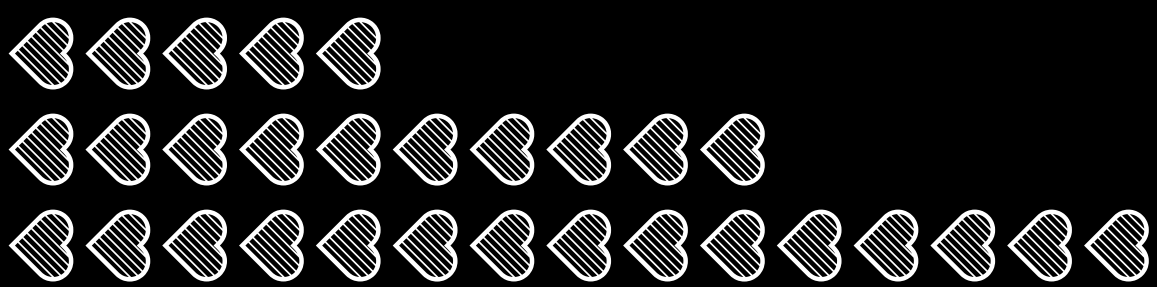
https://youtu.be/6AWSPC6qQB4?t=560

APL Practice Problem









[5, 5, 2, 10, 3, 15, 10]

skyline: { x }

[5, 5, 2, 10, 3, 15, 10]

```
skyline: { (|) scan x }

[5, 5, 5, 10, 10, 15, 15]
```

```
skyline: { maxs x }

[5, 5, 5, 10, 10, 15, 15]
```

```
skyline: { distinct maxs x }

[5, 10, 15]
```

```
skyline: { count distinct maxs x }
```

3

```
skyline: count distinct maxs ::
```

```
Skyline ← {≢∪⌈\ω}
```

```
skyline: { count distinct maxs x }
```

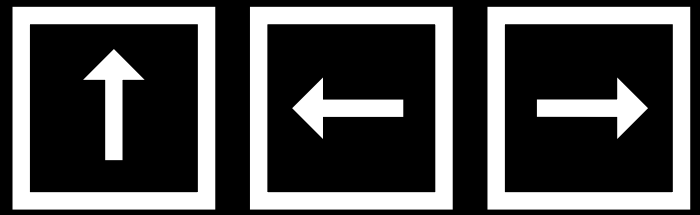
```
Skyline ← {≢∪⌈\⍵}
```

```
skyline: { count distinct maxs x }
Skyline← {  ≢      ∪      ⌈\ ω }
```

- scans
- reductions
- where
- cut
- prior
- more

- ✓ scans
- ☐ reductions
- ☐ where
- ☐ cut
- ☐ prior
- ✓ more (count, distinct)

Max Gap



https://leetcode.com/problems/maximum-gap/

[8, 4, 1, 3, 10]

[1, 3, 4, 8, 10]

[1, 3, 4, 8, 10]
[2, 1, 4, 2]

[1, 3, 4, 8, 10]

[2, 1, **4**, 2]

maxgap: { x }

[8, 4, 1, 3, 10]

```
maxgap: { asc x }

[1, 3, 4, 8, 10]
```

```
maxgap: { deltas asc x }

[1, 2, 1, 4, 2]
```

```
maxgap: { max deltas asc x }
```

4

```
maxgap: max deltas asc ::
```

```
maxgap: { deltas asc x }

[1, 2, 1, 4, 2]
```

```
maxgap: { deltas asc x }

[10, 2, 1, 4, 2]
```

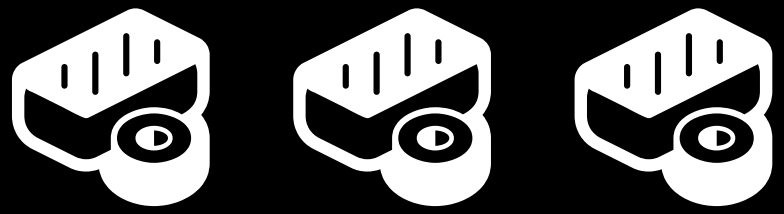
```
maxgap: { 1 _ deltas asc x }

[2, 1, 4, 2]
```

```
maxgap: max 1 _ deltas asc ::
```

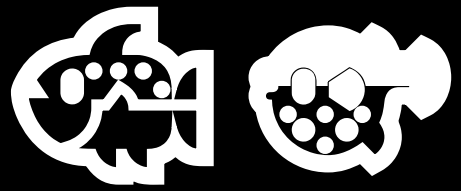
- ✓ scans
- ☐ reductions
- ☐ where
- ☐ cut
- ☐ prior
- ✓ more (count, distinct)

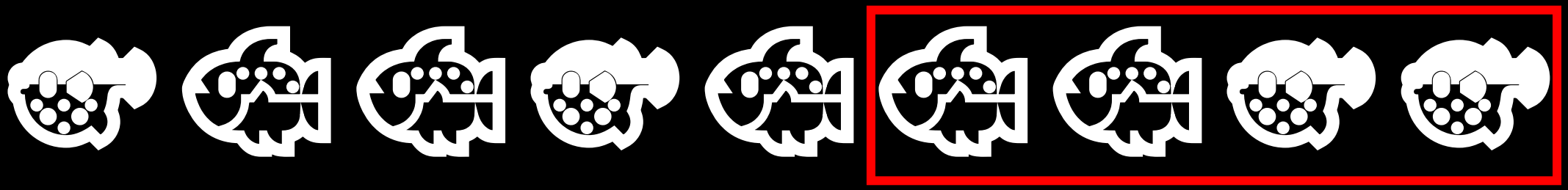
- ✓ scans
- ✓ reductions
- ▣ where
- ▣ cut
- ◈ prior (deltas)
- ✓ more (count, distinct, _, asc)

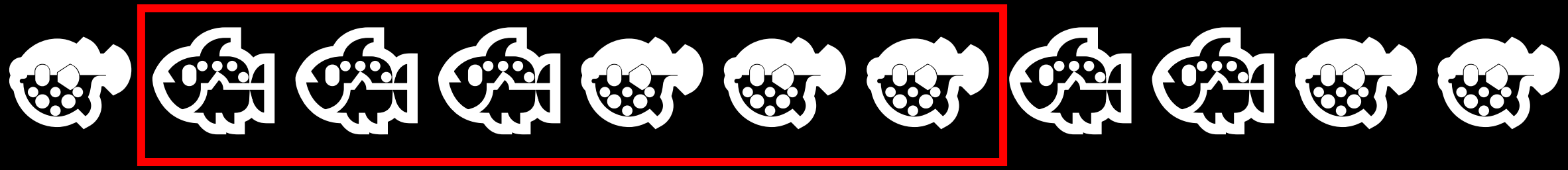
Sushi for Two



https://codeforces.com/contest/1138/problem/A







```
sf2: { x }

[1, 2, 2, 1, 2, 2, 2, 1, 1]
```

```
sf2: { x }
chunk: { (where differ x) cut x }
```

```
[1, 2, 2, 1, 2, 2, 2, 1, 1]
```

```
chunk: { x }

[1, 2, 2, 1, 2, 2, 2, 1, 1]
```

```
chunk: { differ x }

[1, 1, 0, 1, 1, 0, 0, 1, 0]
```

```
chunk: { where differ x }

[0, 1, 3, 4, 7]
```

```
chunk: { (where differ x) cut x }
```

```
[[1], [2, 2], [1], [2, 2, 2], [1, 1]]
```

```
sf2: { chunk x }
chunk: { (where differ x) cut x }

[[1], [2, 2], [1], [2, 2, 2], [1, 1]]
```

```
sf2: { count each chunk x }
chunk: { (where differ x) cut x }
```

```
[1, 2, 1, 3, 2]
```

```
sf2: { (&) prior count each chunk x }
      chunk: { (where differ x) cut x }
```

```
[1, 1, 1, 1, 2]
```

Hoogle Translate

prior

CUDA	adjacent_difference	Thrust	Doc
C++	adjacent_difference	<numeric>	Doc
APL	/ (n-wise reduce)	-	Doc
Haskell	mapAdjacent	Data.List.HT	Doc
Kotlin	zipWithNext	collections	Doc
q	prior	-	Doc
C++	adjacent_transform	<ranges>	Doc

```
sf2: { (&) prior count each chunk x }
      chunk: { (where differ x) cut x }
```

```
[1, 1, 1, 1, 2]
```

```
sf2: { 1 _ (&) prior count each chunk x }
chunk: { (where differ x) cut x }
```

```
[1, 1, 1, 2]
```

```
sf2: { max 1 _ (&) prior count each chunk x }
chunk: { (where differ x) cut x }
```

2

```
sf2: { 2 * max 1 _ (&) prior count each chunk x }
chunk: { (where differ x) cut x }
```

2

```
sf2: { 2 * max 1 _ (&) prior count each chunk x }
chunk: { (where differ x) cut x }
```

4

```
sf2: 2 * max 1 _ (&) prior count each chunk ::
        chunk: { (where differ x) cut x }
```

```cpp
template <int N>
constexpr auto sushi_for_two(std::array<int, N> sushi) {
    int current_sushi = 0;
    int sushi_in_a_row = 0;
    int prev_sushi_in_a_row = 0;
    int max_of_mins = 0;
    for (auto const s : sushi) {
        if (current_sushi != s) {
            current_sushi = s;
            if (prev_sushi_in_a_row == 0) {
                prev_sushi_in_a_row = sushi_in_a_row;
                sushi_in_a_row = 1;
            } else {
                auto const min = std::min(sushi_in_a_row, prev_sushi_in_a_row);
                max_of_mins = std::max(max_of_mins, min);
                prev_sushi_in_a_row = sushi_in_a_row;
                sushi_in_a_row = 1;
            }
        } else {
            sushi_in_a_row += 1;
        }
    }
    auto const min = std::min(sushi_in_a_row, prev_sushi_in_a_row);
    max_of_mins = std::max(max_of_mins, min);
    return max_of_mins * 2;
}
```

- ✓ scans
- ✓ reductions
- ▣ where
- ▣ cut
- ◈ prior (deltas)
- ✓ more (count, distinct, _, asc)

- ✓ scans
- ✓ reductions
- ✓ where
- ✓ cut
- ✓ prior (deltas, differ)
- ✓ more (count, distinct, _, asc, each)

Thank You

https://github.com/codereport/Content/Talks

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Questions?

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