March 13, 2025

Announcements

- HW9 graded
- Talk uploaded

Goals

- Grab bag of accidents

Review

$S = \{(i,j) : 0 \le i < N \wedge 0 \le j < M\}$? $N=0 \Rightarrow S=\emptyset$

$\Pi_i \; S \; : \; \mathrm{sum}(i) = 0$

Arrays

Why are arrays the dominant data structure in high-performance code?

boxes!

Any comments on C's arrays?

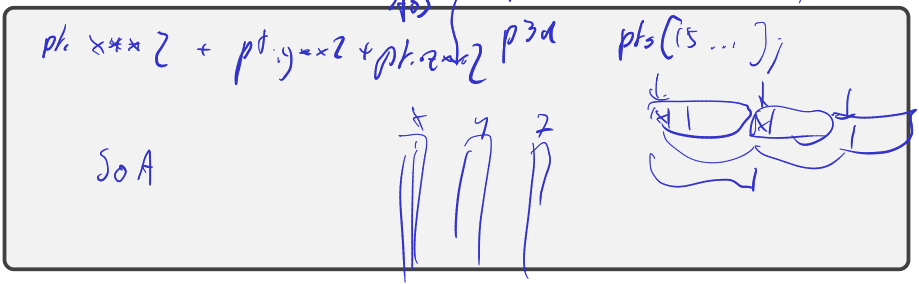
float s[ ][7];

real * s

s(M, N)

Arrays vs Abstraction

Arrays-of-Structures or Structures-of-Arrays? What's the difference? Give an example.



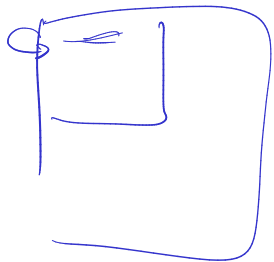
Language aspects of the distinction? Salient example?

C and Multi-Dimensional Arrays: A Saving Grace

```
// YES:
void f(int m, int n, double (*)[m][n]);

// NO:
struct ary {
  int m;
  int n;
  double (*array)[m][n];
};

// YES:
struct ary {
  int m;
  int n;
  double a[];
};
```



SIMD

Name language mechanisms for SIMD:

- intrinsics
- inline assembly
- ispc
- #pragma
- vector data types

Demo: machabstr/Ways to SIMD

Outer-Loop/inner-Loop Vectorization

Contrast *outer-loop* vs *inner-loop vectorization*.

Side q: Would you consider GPUs outer- or inner-loop-vectorizing?