intro to mathematics in software engineering

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objectives

scary looking functions

math related software engineering concepts

translate math to programming

fundamentals of mathematical and function notation

$$f(x) = x^2$$

fundamentals of mathematical and function notation

$a \cdot f(x)$

$f(x/b)$

$f(x - c)$

$f(x) + d$

fundamentals of mathematical and function notation

$a \cdot f(x) \Rightarrow$ multiplies the y-value by a

$f(x/b) \Rightarrow$ multiplies the x-value by b

$f(x - c) \Rightarrow$ shifts graph c units to the right

$f(x) + d \Rightarrow$ shifts graph d units upward

breaking down a scary looking function

$$g(x) = \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{\sin(2\pi(2n-1)ft)}{2n-1}$$

(where $t = \texttt{time}$, $f = \texttt{frequency}$, $n = \texttt{iterations}$)

breaking down a scary looking function

$$g(x) = \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{\sin(2\pi(2n-1)ft)}{2n-1}$$

we are dealing with a function built from multiple smaller functions added together

breaking down a scary looking function

$$g(x) = \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{\sin\left(2\pi(2n-1)ft\right)}{2n-1}$$

the sin on the inside suggests we are dealing with waves or oscillations

breaking down a scary looking function

$$g(x) = \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{\sin(2\pi(2n-1)ft)}{2n-1}$$

denominator $2n-1$ hints that terms get smaller as n increases - later terms have less influence

breaking down a scary looking function

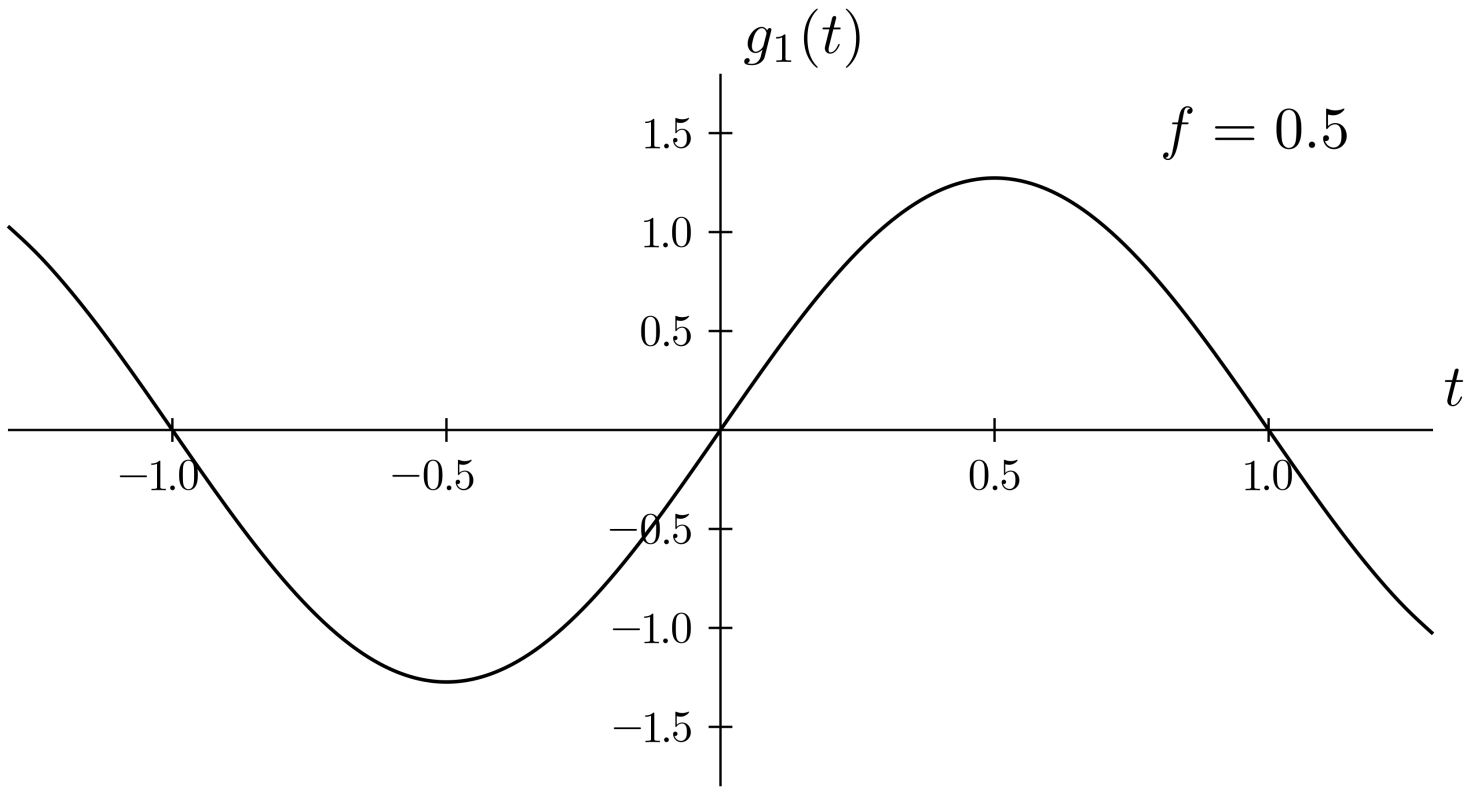
$$g_1(t) = \frac{4}{\pi} \cdot \frac{\sin(2\pi(2(1)-1)ft)}{2(1)-1}$$

$$= \frac{4}{\pi} \cdot \frac{\sin(2\pi(1)ft)}{1}$$

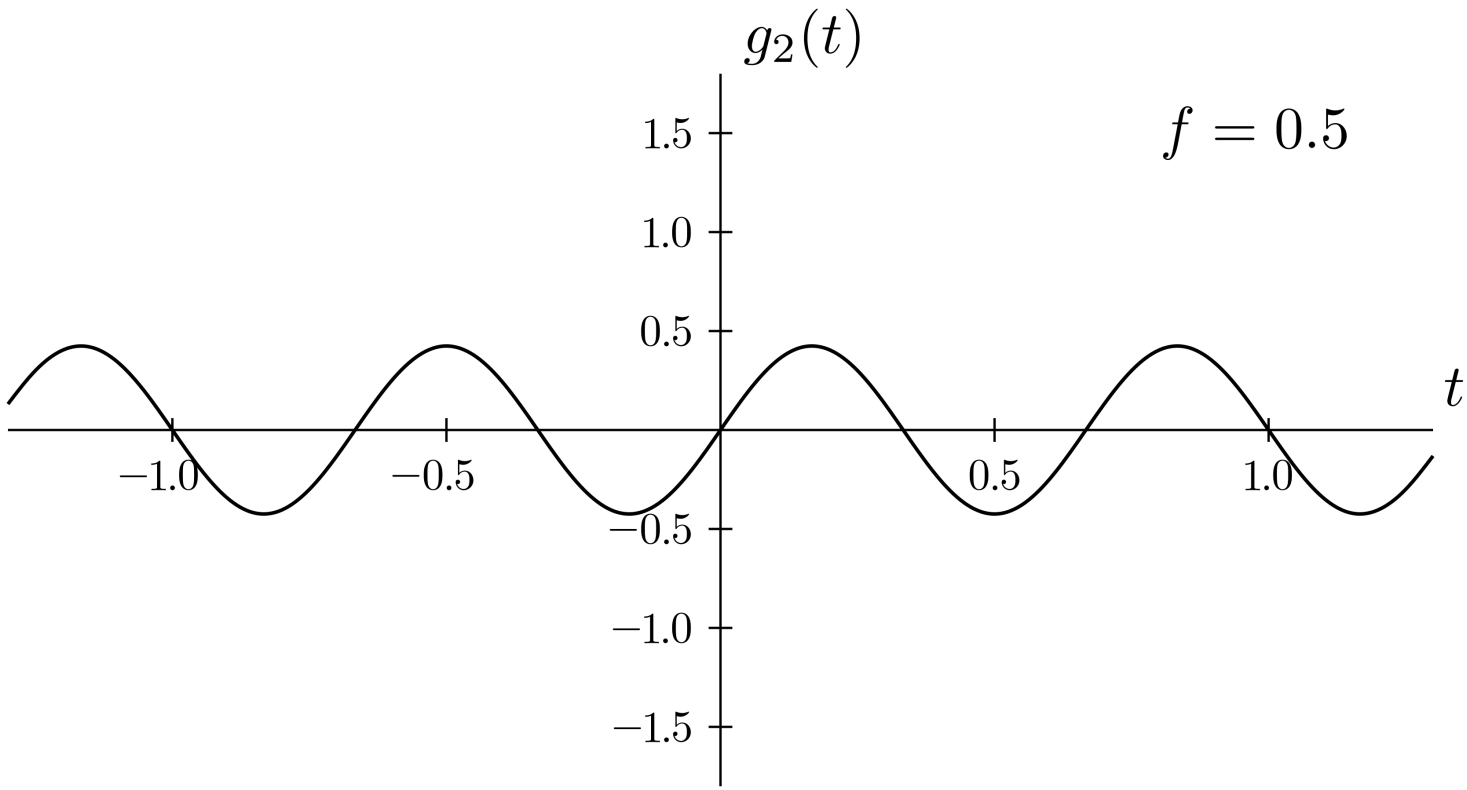
$$= \frac{4}{\pi} \cdot \sin(2\pi ft)$$

$$g_1(t) = \frac{4}{\pi} \sin(2\pi ft)$$

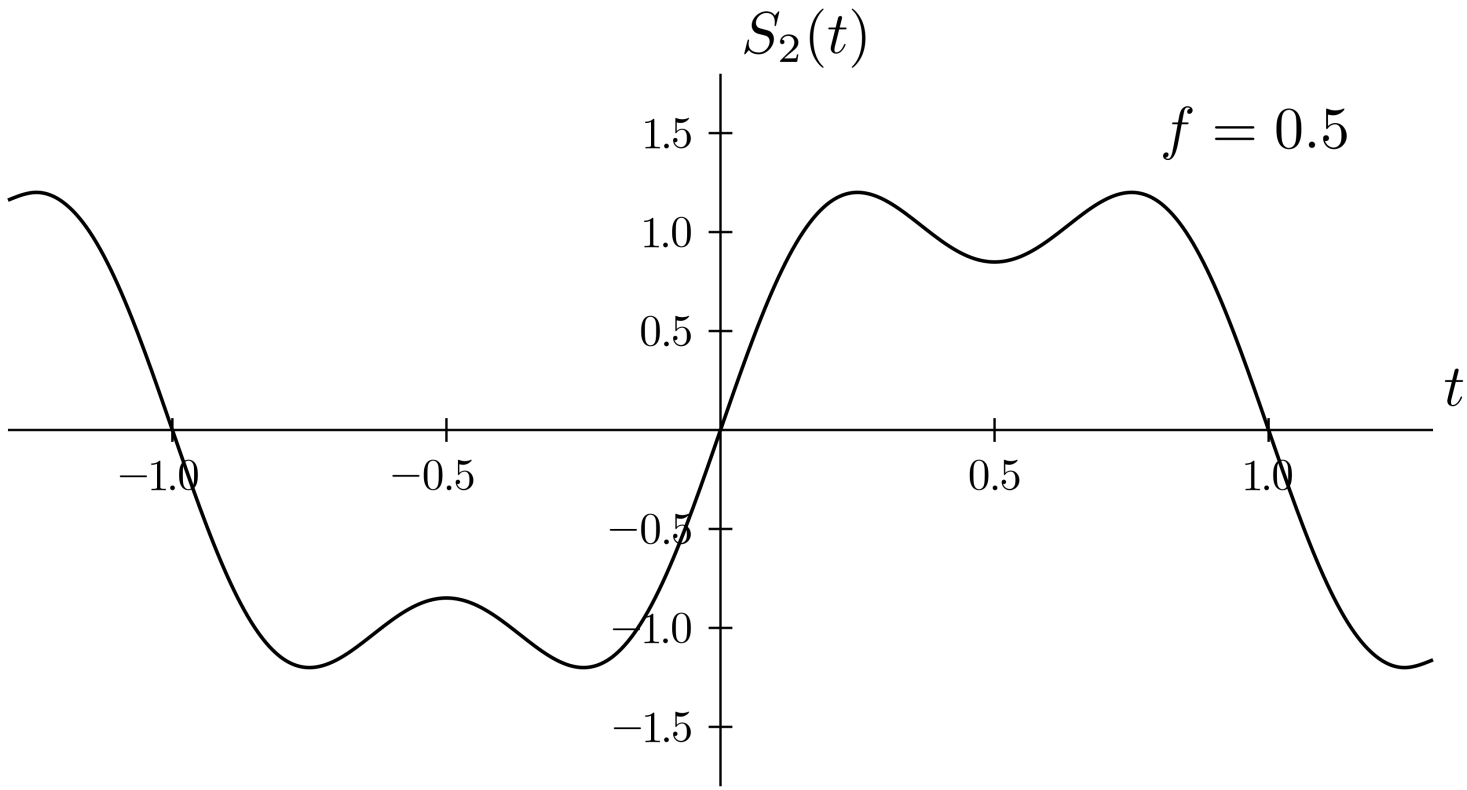
breaking down a scary looking function



breaking down a scary looking function



breaking down a scary looking function



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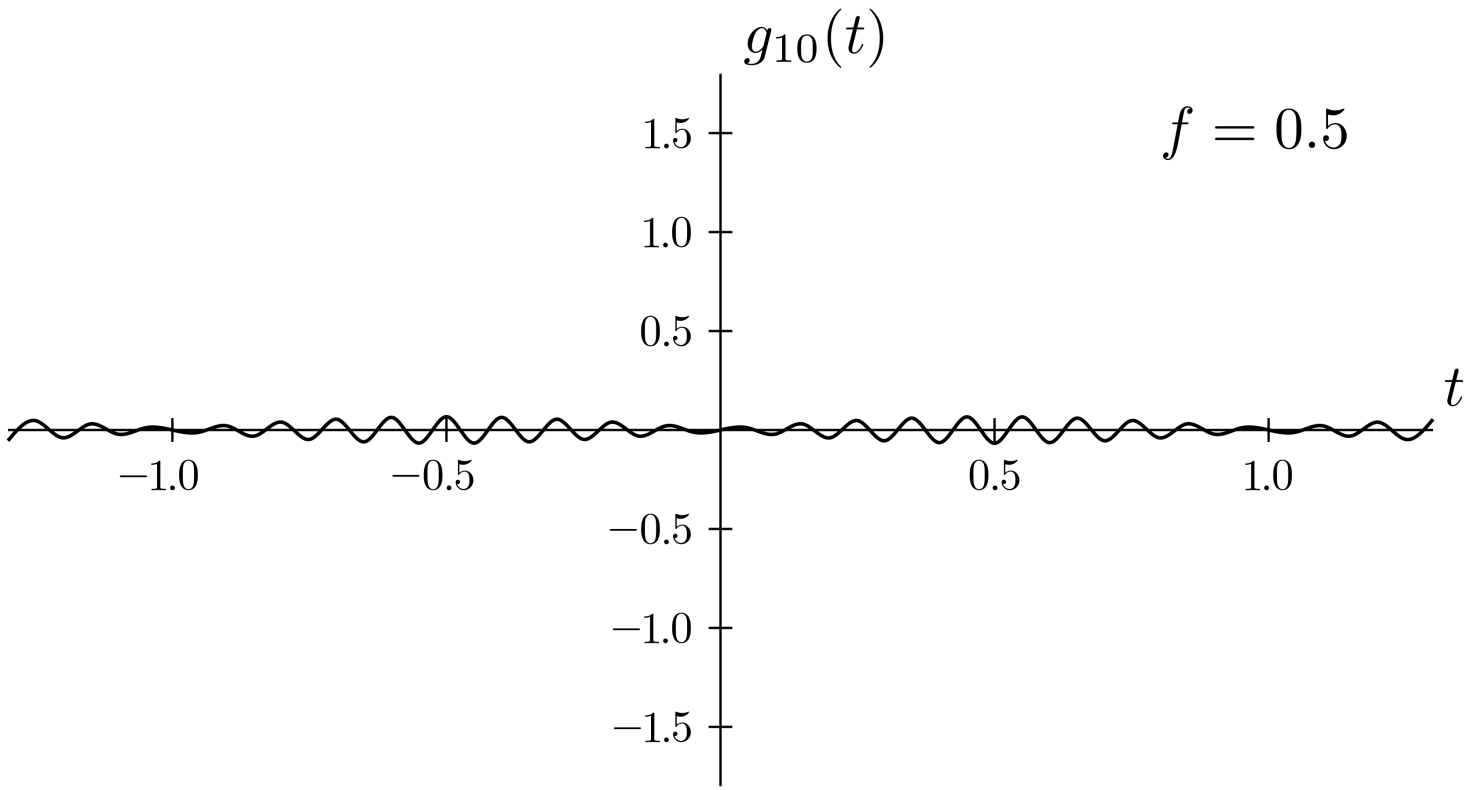
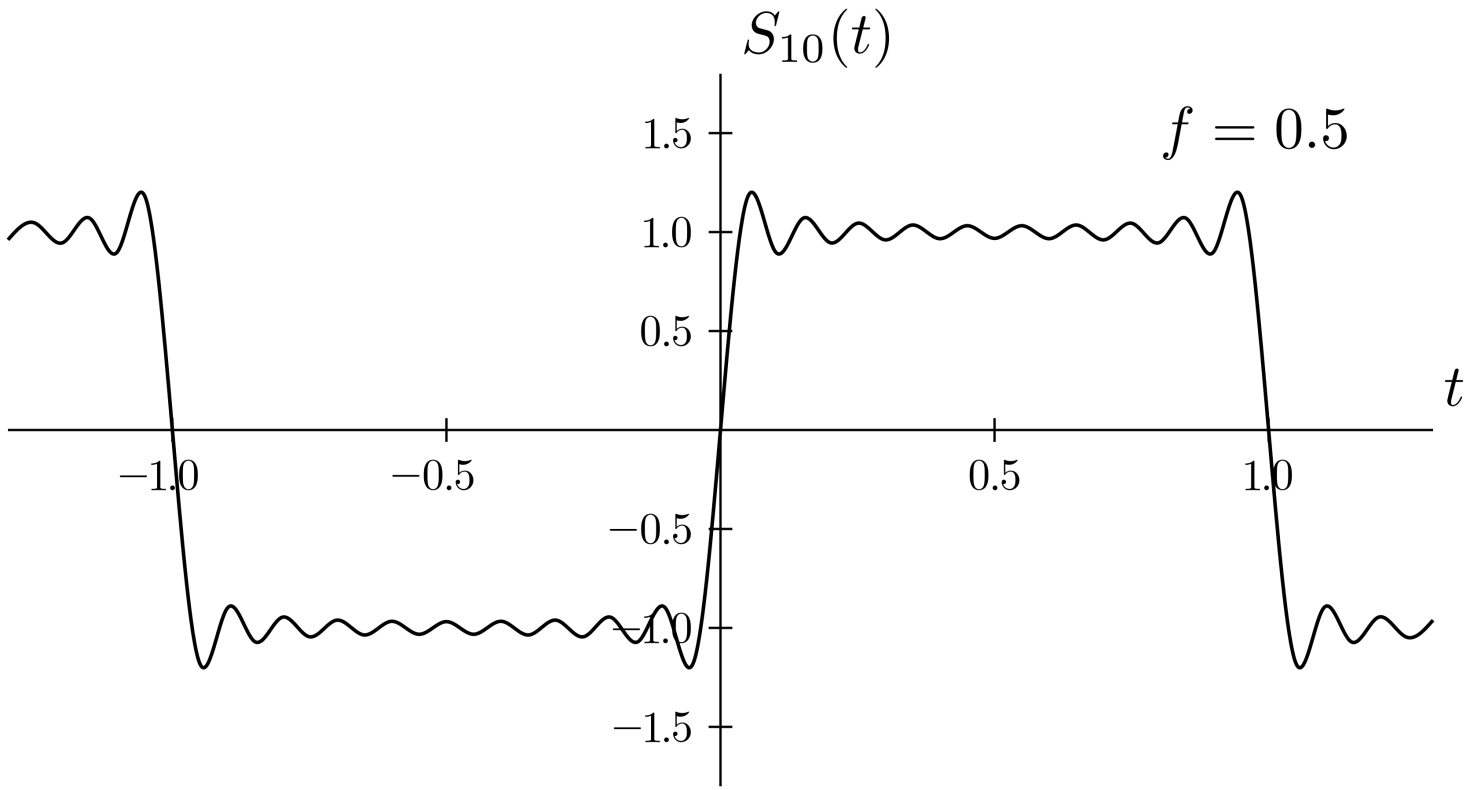


breaking down a scary looking function



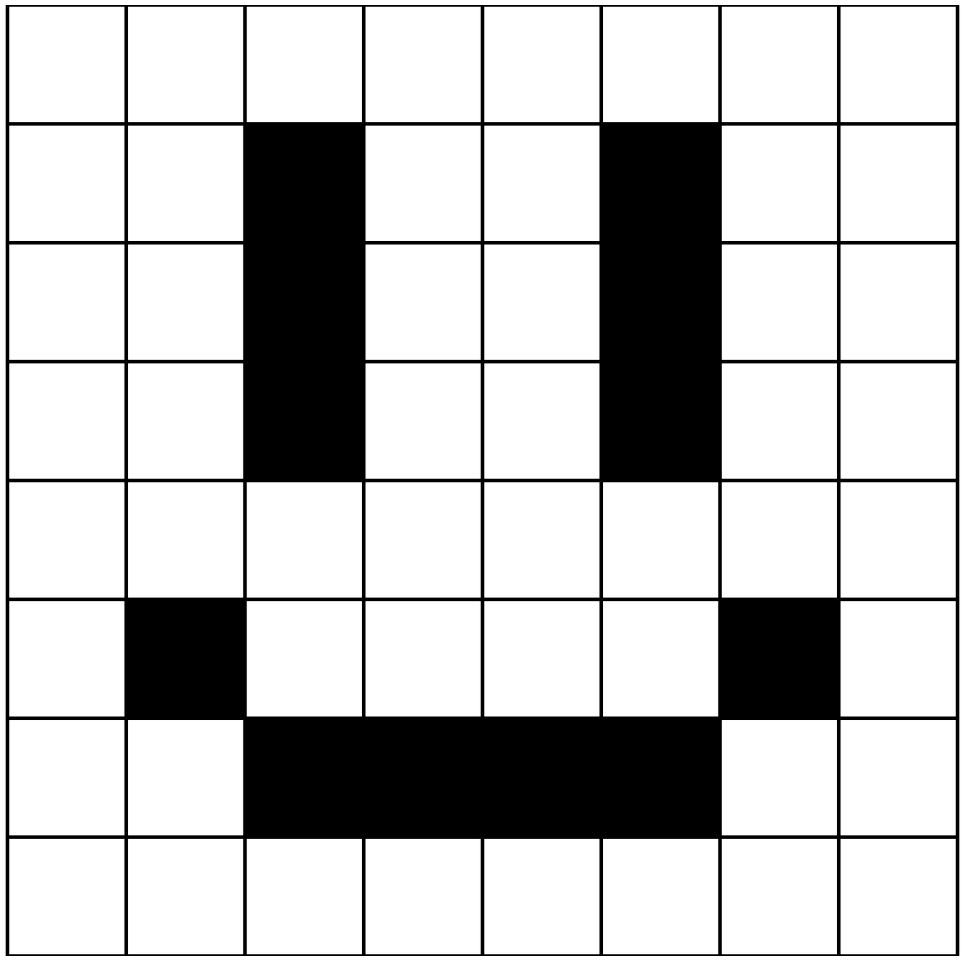
vectors (not the math kind), i.e. arrays

- set of pairs $\Rightarrow$ index and value
- elements (pairs) are conventionally of same memory size

vectors (not the math kind), i.e. arrays

```
one_d_array = [0, 0, 1, 0, 1, 0, 1, 1]
```

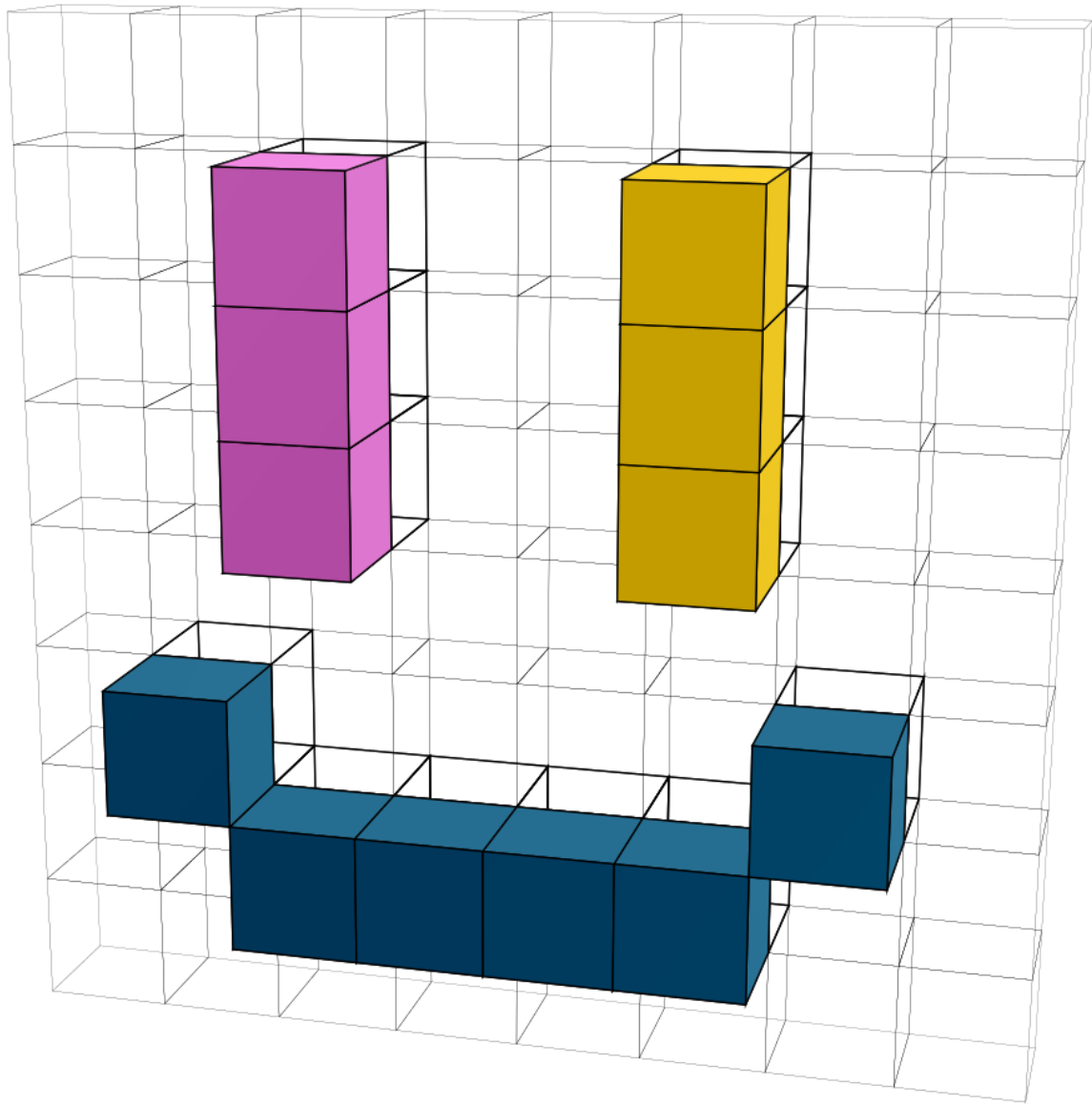
vectors (not the math kind), i.e. arrays



vectors (not the math kind), i.e. arrays

```
two_d_array = [
[0, 0, 0, 0, 0, 0, 0, 0],
[0, 0, 1, 0, 0, 1, 0, 0],
[0, 0, 1, 0, 0, 1, 0, 0],
[0, 0, 1, 0, 0, 1, 0, 0],
[0, 0, 0, 0, 0, 0, 0, 0],
[0, 1, 0, 0, 0, 0, 1, 0],
[0, 0, 1, 1, 1, 1, 0, 0],
[0, 0, 0, 0, 0, 0, 0, 0]
]
```

vectors (not the math kind), i.e. arrays



binary tree

data structure expressed as a figurative tree

one root node

nodes can only have one parent node and at most two children nodes (left and right)

foundation for more complex data structures