

# CPE/csc 101

## Today

- List of Lists

- Revisit algorithmic complexity

# List of Lists



grid  
2d-matrix  
2d-list

uniform

[ [ [ [ ] ] ] , —  
[ [ [ [ ] ] ] , —  
[ [ [ [ ] ] ] , —  
[ [ [ [ ] ] ] , —      rows

irregular  
jagged  
matrices

list = [ [1, 2, 3], [4, 5, 6], [7, 8, 9] ]

0                  1                  2

list [   
   ↑    ] [   
      ↑    ]  
 row        col  
  
   ↑                   ↑  
 outer       nested  
 list        list

1	2	3
4	5	6
7	8	9

list[ 1 ][ 1 ]

1	2	3
4	5	6
7	8	9

⋮ ⋮ ⋮

list [row][col]

row

col

Expression that adds values from each  
"neighbor":

$$\text{list}[row][col-1] + \text{list}[row][col+1] \\ + \text{list}[row-1][col] + \text{list}[row+1][col]$$

```
def sum(nums: List[List[int]]) → int:  
    total = 0  
    for sublist in nums:  
        for value in sublist:  
            total += value  
    return total
```

Sum from  
before

---

list = [ [1, 2, 3], [4, 5, 6], [7, 8, 9] ]

nums      + + +    + + +  
            ↓ ↓ ↓    ↓ ↓ ↓  
total: 0    1 3 6    10 15 21    - - -

```
def sum(nums: List[List[int]]) → int:  
    total = 0  
    for sublist in nums:  
        total += sum-single-list(sublist)  
  
    return total
```

```
def find (nums : List[List[int]], n: int)
```

→ Optional[Tuple[int, int]]:

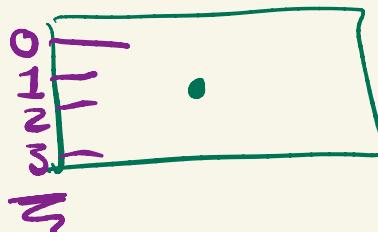
```
for row in range(len(nums)):
```

```
    for col in range(len(nums[row])):
```

if n == nums[row][col]:

```
            return (row, col)
```

return None



row = 7

~~range(len(7))~~

```
def find (nums : List[List[int]], n: int)
         → Optional[Tuple[int, int]]:
    for row in range(len(nums)):
        col = search (nums[row], n)
        if col:
            return (row, col)
    return None
```

# Algorithmic Complexity

```
result = find_intersection_points
```

$$\text{spheres} = [ \quad , \quad ]$$

$$T - T = 2T$$

$$\text{spheres} = \lfloor 60,000 \text{ T} \rfloor$$

call sphere\_intersection\_pt  
- quadratic eq.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

# cast-ray

Find :  $2T$   $60,000T$

~~Find:  $2T$   $60000 T$~~

~~Find:  $2T$   $60,000T$~~

time : T