# COSI 10A Recitation #7

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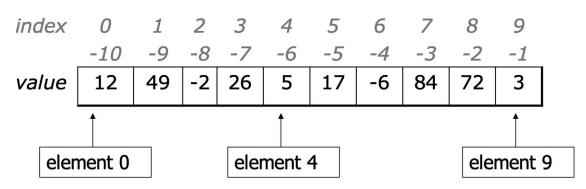
Agenda: Lists

#### Lists

object that stores a list of values

element: One value in a list.

index: A 0-based integer to access an element from a list.



### **List initialization**

```
name = [value, value, ... value]

numbers = [12, 49, -2, 26, 5, 17, -6]

index 0 1 2 3 4 5 6

value 12 49 -2 26 5 17 -6
```

# **Accessing list elements**

```
numbers = [0] * 8
numbers[0] = 3
numbers[1] = 99
numbers[2] = 6
numbers index 0 1 2 3 4 5 6 7
value 3 99 6 42 0 0 11 0
```

```
x = numbers[0]
numbers[x] = 42
numbers[numbers[2]] = 11 # use numbers[2] as index
```

## Lists and for loops

It is common to use for loops to access list elements

```
for i in range(0, 8):
    print(str(numbers[i]) + " ", end='')
print() # output: 0 4 11 0 44 0 0 2
```

Sometimes we assign each element a value in a loop.

```
for i in range(0, 8):

numbers[i] = 2 * i

index 0 1 2 3 4 5 6 7

value 0 2 4 6 8 10 12 14
```

# Can a list have a list as an element?

```
YES!!
```

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

```
data = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
print(data[1][1])
print()

for i in range(len(data)):
    for j in range(len(data[i])):
        print(data[i][j], end=" ")
        print()
```

```
5
1 2 3
4 5 6
7 8 9
```

#### **Problem 1**

P1. Write a function <code>calcDet</code> that calculates the determinant of a 2x2 matrix. The <code>calcDet</code> function needs to accept the 2x2 matrix and return the determinant of the given matrix. You may assume that 2x2 matrix always given to <code>calcDet</code> function.

$$|A| = \begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc$$

Example Input: Example Output:

Matrix:

Determinant: 10

[4 7]

[2 6]

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P1. Write a function calcDet that calculates the determinant of a 2x2 matrix. The calcDet function needs to accept the 2x2 matrix and return the determinant of the given matrix. You may assume that 2x2 matrix always given to calcDet function.

$$|A| = \begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc$$

```
def calcDet(matrix):
    # Calculate the determinant of a 2x2 matrix
    a, b = matrix[0][0], matrix[0][1]
    c, d = matrix[1][0], matrix[1][1]
    return a * d - b * c
def main():
    # Example 2x2 matrix
   matrix = [
        [4, 7],
        [2, 6]
    # Calculate determinant
    det = calcDet(matrix)
    print(f"Determinant: {det}")
# Run the main function
main()
```

#### Problem 2

P2. Write a program that calculates the inverse of the given matrix. Your program should have at least three functions, main, calcDet, and inverse. You can use the calcDet from P1. The inverse function needs to accept the 2x2 matrix and return the inverse of the given matrix. You may assume that 2x2 matrix always given to inverse function.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d - b \\ -c & a \end{bmatrix}$$

Example Input: Example Output:

Matrix: Inverse Matrix:

[4 7] [0.6, -0.7]

[2 6] [-0.2, 0.4]

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P2. Write a program that calculates the inverse of the given matrix. Your program should have at least three functions, main, calcDet, and inverse. You can use the calcDet from P1. The inverse function needs to accept the 2x2 matrix and return the inverse of the given matrix. You may assume that 2x2 matrix always given to inverse function.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d - b \\ -c & a \end{bmatrix}$$

```
def inverse(matrix):
    # Calculate the inverse of a 2x2 matrix using calcDet
    det = calcDet(matrix)
    a, b = matrix[0][0], matrix[0][1]
    c, d = matrix[1][0], matrix[1][1]
    # The inverse matrix formula
    inverse matrix = [
        [d / det, -b / det],
        [-c / det, a / det]
    return inverse_matrix
def main():
    # Example 2x2 matrix
    matrix = [
        [4, 7],
        [2, 6]
    # Calculate inverse
    inv_matrix = inverse(matrix)
    print("Inverse Matrix:")
    for row in inv_matrix:
        print(row)
# Run the main function
main()
```

# Questions?