ENG 346
Data Structures and Algorithms for Artificial Intelligence
Lists Tuples Maps

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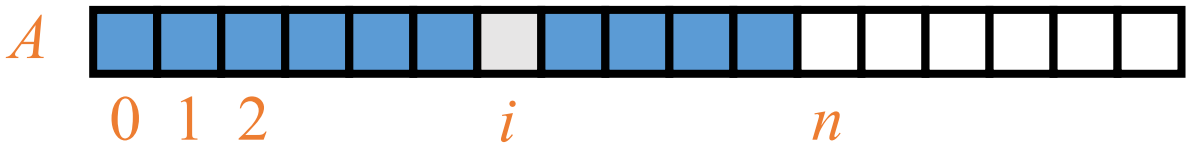
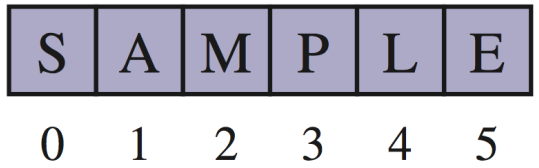
Sequences

- Built-in types: list, tuple, and str
- Sequence supports indexing, e.g. A[i]
- These types uses an *array* to represent the sequence.
  - An array is a set of memory locations that can be addressed using consecutive indices
  - Indices start with 0.

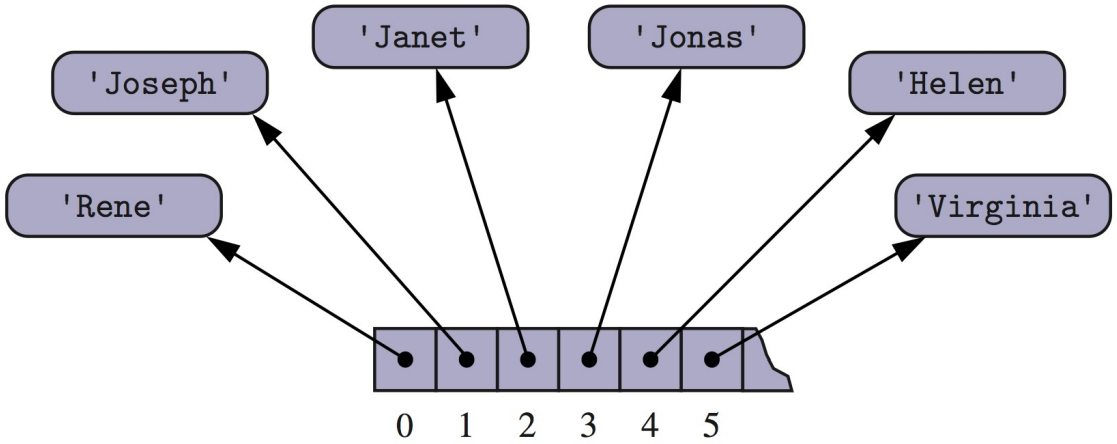


Arrays as Memory Cells

- An array can store primitive elements, such as characters, giving us a compact array.



- An array can also store references to objects.



Compact Arrays

- Defined in “array” module.
- Provides compact storage for arrays of *primitive data types*.
- Example:

```
primes = array('i', [2, 3, 5, 7, 11, 13, 17, 19])
```

Code	C Data Type	Typical Number of Bytes
'b'	signed char	1
'B'	unsigned char	1
'u'	Unicode char	2 or 4
'h'	signed short int	2
'H'	unsigned short int	2
'i'	signed int	2 or 4
'I'	unsigned int	2 or 4
'l'	signed long int	4
'L'	unsigned long int	4
'f'	float	4
'd'	float	8

Array Operations

- array.insert(i, x): add x to index i ⎵ O(n)
- array.append(x): add x to end of array.
- array.remove(x): remove first occurrence of x ⎵ O(n)
- array.pop(i=-1): remove and return ith element.
- array.index(x): search and return element x in the array.
- array.tolist(): return array content in Python List Class.
- …

Lists

- Built-in list Class
- Denoted with []
- Allow duplicate values
- Allow mixed types
- Index starts with 0

Lists – continued

- Let A = ["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]

- A[0] ⎵ "apple"
- A[1] ⎵ "banana"
- A[-1]: last item in the list ⎵ "mango"
- A[1:]: new list which starts at index 1
- A[:2]: first two items ⎵ ["apple", "banana "]
- …

Lists – continued

- A.append(x): Add x to the end of the list.
- A.extend(B): Add items in list B to the end of list A.
- A.append(B): Add list B to the end of the list A.
- A.remove(x): Remove first occurrence of item x.
- A.pop(i=-1): Remove and return ith element.
- del A[i]: remove ith element.

List Comprehension

- Let A = list(range(10))

- B = []
- for x in A:
  - B.append(x**2)

versus

- B = [x**2 for x in A]

List Comprehension – continued

```
fruits = ["apple", "banana", "cherry", "kiwi", "mango"]

newlist = [x for x in fruits if "a" in x]

# newlist = ["apple", "banana", "mango"]
```

Tuples

- Built-in list Class
- Cannot be changed
- Denoted with ()
- Allow duplicate values
- Allow mixed types
- Index starts with 0

Tuples – continued

- Let B = (1, 5, 7, 9, 3)

- Content cannot be changed
- B[0] ␣ 1

- C = ("A",) # tuple with one item

Tuples – continued

- Function returning tuples:

```
def stats(data):
        return max(data), min(data)

stats([1, 3, 5, 7, 9]) # returns tuple
(9, 1)
```

Dictionary

- Built-in list Class
- Denoted with { }
- Allow mixed types
- Key-value pairs
- Unordered
- Dynamic sizing
- Accessed by keys
- Allow dictionary comprehensions

Examples

```
# Iterating through key-value pairs
for key, value in somedict.items():
        print(key, ":", value)
```

Sets

- Built-in list Class
- Denoted with { }
- Allow mixed types
- Unordered
- Dynamic sizing
- Allow set comprehensions
- Common set operations, e.g. union, intersection, etc.