Lists/Tuples

Example

- Write a program to keep track of all students' scores on exam 1.

- Need a *list* of everyone's score
- Use 14 doubles

- What about next semester?

Lists

- Ordered set of values

```
scores=[90.5, 73, 87]
```

- Each value accessed by using [ ] and index

```
scores[1] #would be 73
```

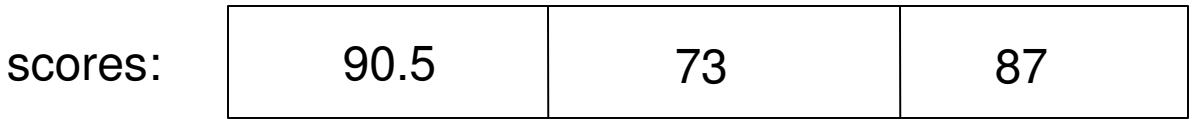
- A list can contain different types -- including other lists

```
scores=[90.5, 73, 87, "Mickey", [67, 89]]
```

- A list can be empty

```
scores=[]
```

Example




```
scores=[90.5, 73, 87]
```

Subscripts

- Subscript describes which box of the array you are dealing with
- List of size N has subscripts
  - 0, 1, 2, … (n-1)
  - list of size 3 – 0, 1, 2
- Subscript can be a variable or expression which produces an integer
  - scores[i]
  - scores[i+5]
- If subscript specified does not exist – runtime error

Range

- Lists of consecutive integers common
- Use range() to generate
  - `range(5) #0, 1, 2, 3, 4`
  - `range(1,5) #1, 2, 3, 4`
  - `range(1, 10, 2) #1, 3, 5, 7, 9`

Accessing List Elements

- Print all elements of the list *scores*
  - Use only one print statement

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- Print all elements of the list *scores*
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```
scores = [90.5, 73, 82]
i=0
while(i<3):
        print scores[i]
        i = i+1
```

Accessing List Elements

- Using 3 as length is error prone

```
scores = [90.5, 73, 82]
i=0
while(i<len(scores)):
        print scores[i]
        i = i+1
```

Accessing List Elements

- Another method -- short cut

```
scores = [90.5, 73, 82]
for i in scores:
        print i
```

- Membership

```
scores[90.5, 73, 82]
if 100 in scores:
   print “There is a perfect score!”
```

Operators -- A lot like strings

- Concatenation

```
first_scores=[90,56,87]
second_scores=[67,100,89]
all_scores = first_scores+second_scores
```

- Slices

```
all_scores[2:4] #yields [87,67]
more_scores=all_scores[:] #makes a copy of all_scores
```

Mutability

- Lists are mutable - they can be changed

```
scores[90.5, 73, 82]
scores[1] = 100 #scores is now [90.5, 100, 82]
```

- Lists can grow - using append function
  - append takes 1 argument

```
scores.append(12)
scores.append([56, 78, 34])
```

- Lists can shrink - using del function
  - del takes an element or slice

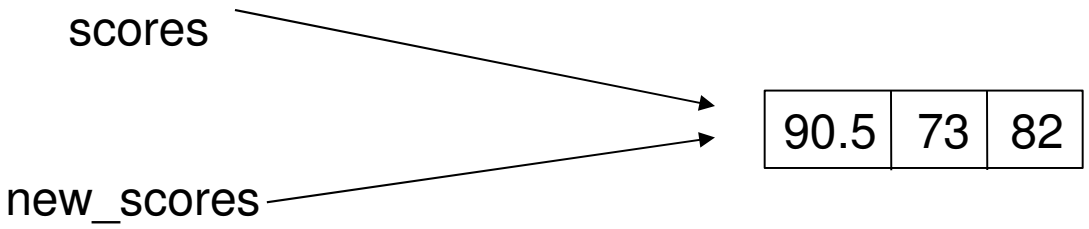
```
del scores[2]
del scores[1:3]
```

- Other functions - sort, reverse

Aliasing

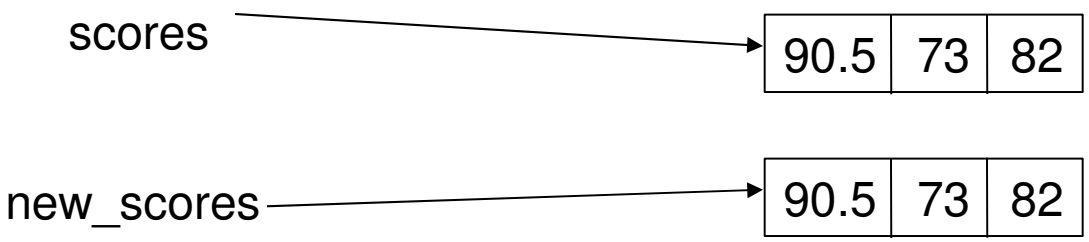
- Reference assignment

```
scores=[90.5, 73, 82]
new_scores = scores
scores[0] = 100 #new_scores[0] changes
```



Cloning

```
scores=[90.5, 73, 82]
new_scores = scores[:]
scores[0] = 100 #new_scores[0] DOES NOT change
```



Exercises

1. Use the interpreter to help you determine the outcome of each of the following statements. Why are the invalid statements invalid?

```
list1 = [1,2,3]
list2 = list1
print list2
list2 = list1[2]
print list2
list2.append(8)
print list2
list2 = list1
list2.append(8)
print list2
list1[9] = "hello"
print list2
list1[2] = "hello"
print list2
```

Exercises

1. Implement a program that prompts the user for a series of strings (using “quit” to end input) and stores them in a list. Then, for every string in the list, display it for the user and ask if he/she would like to delete it. Delete the appropriate strings and display the final list for the user.

List Elements as Parameters

- Write a function to add two elements of a list

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- Write a function to add two elements of a list
  - How is the function called?

```
def adder(num1, num2):
   return (num1 + num2)
```

List Elements as Parameters

- Write a function to add two elements of a list
  - How is the function called?

```
adder(scores[0], scores[1])
```

Passing Lists

- Would like to pass an entire list into a function
  - Sum all elements, prompt user for values

Example

```
sum(scores)

def sum(list):
   sum = 0
   for i in list:
       sum += i
   return sum
```

Nested Lists

```
exam_scores=[[90, 67, 34], [46, 99, 87], [89,78,67],[87,87,85]]
#could represent three scores for four students
```

- Access second score of third student

Nested Lists

```
exam_scores=[[90, 67, 34], [46, 99, 87], [89,78,67],[87,87,85]]
#could represent three scores for four students
```

- Access second score of third student

```
exam_scores[2, 2]
```

	0	1	2
0	90	67	34
1	46	99	87
2	89	78	67
3	87	87	85

Exercises

1. Implement a function that takes as input a list of integers and adds 5 to every element.
2. Implement a program that prints all elements in a matrix.

Tuples

- Very similar to lists, but immutable
  - You can copy, but you cannot modify (append, del, assign new values)
- Typically enclosed in ( )

```
scores=(90.5, 73, 87)
```

- An integer - `scores = (70)`
- A tuple of one element - `scores = (70,)`
- Convert a list to a tuple

```
tuple_scores = tuple(list_scores)
```

- Convert a tuple to a list -

```
list_scores = list(tuple_scores)
```

Swapping

- Typical swap requires a temp variable

```
tmp = b
b = a
a = tmp
```

- Tuple assignment

```
a, b = b, a
x, y, z = 4, 6, 8
```

Return Values

```
def getnums() :
     n1 = input(“Enter number 1:”)
     n2 = input(“Enter number 2:”)
     return n1, n2

x, y = getnums()
print x #prints first number entered
print y #prints second number entered
```

Exercises

1. Can you think of a way to write a function that takes as input a tuple of integers, adds 5 to every element, and returns a tuple?