CSci 127: Introduction to Computer Science

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Today's Topics

- Indefinite Loops
- Searching Data
- Random Numbers

Indefinite Loops

```
dist = int(input('Enter distance: '))
while dist < 0:
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
```

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

- Indefinite loops repeat as long as the condition is true.
- Could execute the body of the loop zero times, 10 times, infinite number of times.
- The condition determines how many times.
- Very useful for checking input, simulations, and games.

Indefinite Loops

```
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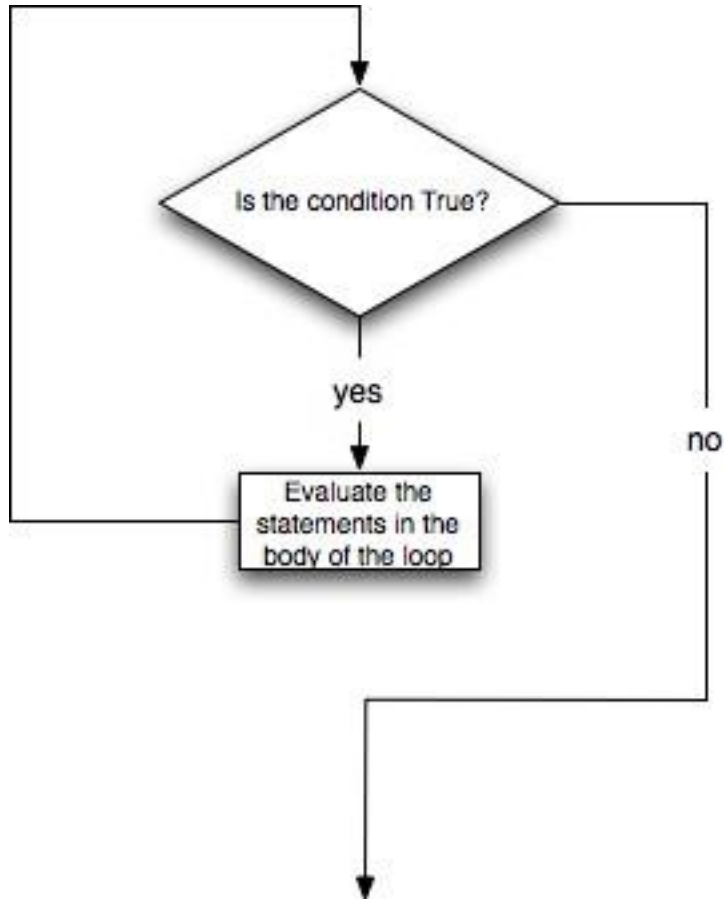
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
```



In Pairs or Triples:

Predict what the code will do:

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while dist < 0:
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
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    i=i+1

print(nums)
```

Python Tutor

```
dist = int(input('Enter distance: '))
while dist < 0:
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
```

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

(Demo with pythonTutor)

Problem Solving

- When we are presented with a problem, we immediately want to write code!
  - We call this the “code and pray” approach.
- The phases of problem solving:
  - **Phase 1:** Understand the problem!
  - **Phase 2:** Get an idea of how an algorithm might solve the problem.
  - **Phase 3:** Formulate the algorithm and code it as a computer program.
  - **Phase 4:** Evaluate the program for accuracy and correctness!

In Pairs or Triples (Pandas):

Design a program that:

1. Takes a CSV file that contains one column 'FirstName' (you can fill in the columns with anything that you like, not sorted)
2. Read the file using Pandas
3. Sort the Dataframe
4. Print:
   - Whose name comes first alphabetically?
   - Whose name comes last alphabetically?

Design Question: Find first alphabetically

- In Pandas, lovely built-in functions:
  - `df.sort_values('FirstName')`

Searching

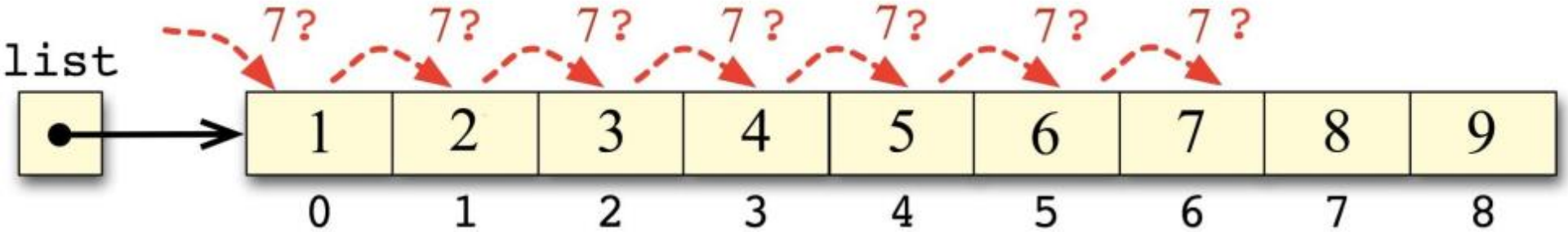
- **Problem**: Given a list of numbers, how can we find out whether or not a particular number is in that list?
- Given a list of numbers:

1	2	3	4	5	6	7	8	9	10

- How can we find out if the number **7** is in the list?
- Any ideas?

Linear Search

- **Goal**: find the desired number by checking each list element one by one from start to finish.



- The algorithm:
  1. For every element in the list, starting from the first element and ending at the last element.
  2. Check if the current element is the desired number.
  3. If this is true, then we've found it! Stop looking.
  4. Otherwise, repeat steps 2 and 3 until we hit the end of the list!

In Pairs or Triples:

- *Predict what the code will do:*

```
def search(nums, locate):
    found = False
    i = 0
    while not found and i < len(nums):
        print(nums[i])
        if locate == nums[i]:
            found = True
        else:
            i = i+1
    return(found)

nums= [1,4,10,6,5,42,9,8,12]
if search(nums,6):
    print('Found it! 6 is in the list!')
else:
    print('Did not find 6 in the list.')
```

Max Design Pattern

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- Set a variable to the smallest value.
- Loop through the list,
- If the current number is larger, update your variable.
- Print/return the largest number found.
- Must look at entire list to determine max is found
- Similar idea works for finding the minimum value.

Python Tutor

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

```
def search(nums, locate):
    found = False
    i = 0
    while not found and i < len(nums):
        print(nums[i])
        if locate == nums[i]:
            found = True
        else:
            i = i+1
    return(found)

nums= [1,4,10,6,5,42,9,8,12]
if search(nums,6):
    print('Found it! 6 is in the list!')
else:
    print('Did not find 6 in the list.')
```

(Demo with pythonTutor)

In Pairs or Triples: (5 min)

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():



    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0



    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0
    while num <= 2000 or num >= 2018:



    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0
    while num <= 2000 or num >= 2018:
        num = int(input('Enter a number > 2000 &< 2018'))

    return(num)
```

Python's random package

```
import turtle
import random

trey = turtle.Turtle()
trey.speed(10)

for i in range(100):
  trey.forward(10)
  a = random.randrange(0,360,90)
  trey.right(a)
```

- Python has a built-in package for generating pseudo-random numbers.
- To use:

  `import random`

- Useful command to generate whole numbers:

  `random.randrange(start,stop,step)`

  which gives a number chosen randomly from the specified range.
- Useful command to generate real numbers:

  `random.random()`

  which gives a number chosen (uniformly) at random from [0.0,1.0).
- Very useful for simulations, games, and testing.

Turtle

```
import turtle
import random

trey = turtle.Turtle()
trey.speed(10)

for i in range(100):
  trey.forward(10)
  a = random.randrange(0,360,90)
  trey.right(a)
```

(Demo turtle random walk)

Recap: Indefinite Loops & Random Numbers

- Indefinite (while) loops allow you to repeat a block of code as long as a condition holds.
- Very useful for checking user input for correctness.
- Python's built-in random package has useful methods for generating random whole numbers and real numbers.
- To use, must include: `import random`.