CS107
Introduction to Computer Science

Lecture 5, 6
An Introduction to Algorithms:
List variables

Exercise
Write an algorithm that asks the user for 10 temperature measurings, and prints out the temperatures entered and their average. For example:

Enter 10 temperatures: 21, 32, 34, 56, 67, 89, 21, 45, 67, 54
The recorded temperatures are: 21, 32, 34, 56, 67, 89, 21, 45, 67, 54. The average is: ...

Exercise
• Change your previous program so that it handles
  – 20 temperatures
  – 50 temperatures
  – 100 temperatures
  – 1000 temperatures

List variables
• How to represent inputs of arbitrary size?
• Suppose that we need to read 100 numbers from the user, or 1000, or...
  – we could give each variable a different name…tedious!!
• Use a list variable:
  – Variable: list a of size n
  – This means that a is a list of n elements: a1, a2, a3,...,an
  – To read the list from the user use a loop to read each element
  – To print the list use use a loop to print each element
  – We can treat each element in the list as a normal variable
    • Set a3 to 5
    • Set a4 to a3 +2
    • If (a4 == a3) then print "equal"

List examples
• Reading a list of 100 elements from the user

Variables: i, n, list a of size 100
Print “Enter 100 elements: ”
n = 100
i = 1
while (i <= n)
  print “enter next element”
  get ai
  i = i+1
Print “Great, thanks.”
**List examples**

- Printing a list to the user
  
  ```python
  Variables: i, n, list a of size 100
  n = 100
  i = 1
  Print "The list is: 
  while (i <= n)
  print a_i
  i = i+1
  Print "Done"
  ```

- What does the following code do?
  ```python
  n = 10
  i = 1
  while (i <= n)
  a_i = i
  i = i+1
  x = 0
  ```

- What does the following code do?
  ```python
  i = 1
  while (i <= n)
  x = x + a_i
  i = i+1
  print x
  ```

**Example**

- What does the following do?
  ```python
  n = 10
  print "Enter n numbers:"
  i = 1
  while (i <= n)
  get a_i
  i = i+1
  x = 0
  i = 1
  while (i<= n)
  x = x + a_i
  i = i+1
  print x
  ```

**Searching**

- Problem: Write an algorithm that reads from the user a list of 100 numbers and a target value, and searches to see if any element in the list is equal to the target value. If not, prints “target not found”. If yes, prints “target found”.

**Searching, variations**

- Modify your search algorithm so that:
  - It prints the location (i.e. index in the list) where it finds the target
  - It finds only the first occurrence of target
  - It finds all occurrences of target (and prints their locations)
  - It counts the number of occurrences of target in the list
  - It counts how many elements in the list are larger than target

**More exercises**

- Write an algorithm that reads a list of 100 numbers from the user and
  - prints out the average of all numbers in the list.
  - prints out the largest element in the list
  - prints out the smallest element in the list