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: a_1, a_2, a_3,...,a_n
  - 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 variable
    - Set a_3 to 5
    - Set a_4 to a_3 +2
    - If (a_4 == a_5) then print "equal"

List variables

- We used to write
  - Variable: a, b, c, sum, avg, i etc
- If we want to use a list we'll write
  - Variable: list a of size 100
  - This tells the "computer" that a is a list variable which can hold 100 items
  - Now we can access any item in the list as a normal variable, by specifying its index
    - Set a_2 to a_9
    - Set i = 10
    - Set a_i to a_3 +2

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 a_i
   i = i+1
Print "Great, thanks."
```

List examples

- Printing a list to the user

```
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"
```

List examples

- What does the following code do?

```
n = 10
i = 1
while (i <= n)
          a_i = i
          i = i+1
x = 0
```

- What does the following code do?

```
i =1
while (i<= n)
         x = x + a_i
         i = i+1
print x
```

Example

- What does the following do?

```
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 occurence of target
  - It finds all occurences of target (and prints their locations)
  - It counts the number of occurences 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