Sorting

Announcements

- Quiz 4 will be handed back Wednesday
- Lab 8 is posted; due Saturday at midnight

Today’s plan

- Continue with run time analysis practice
- Describe task of sorting
- Exercise: design a sorting algorithm
- Exercise: Implement a sorting algorithm

- https://www.cs.swarthmore.edu/~mauskop/cs21/s17/practice/9F.html

Sorting

- Take a list of elements of the same type, which can be ordered.

- Rearrange the elements of the list so that all the original elements are there, but now in non-decreasing (or sorted) order.

- For now, we want to do this **in-place**, that is, without needing to use an extra list.

Sorting applications

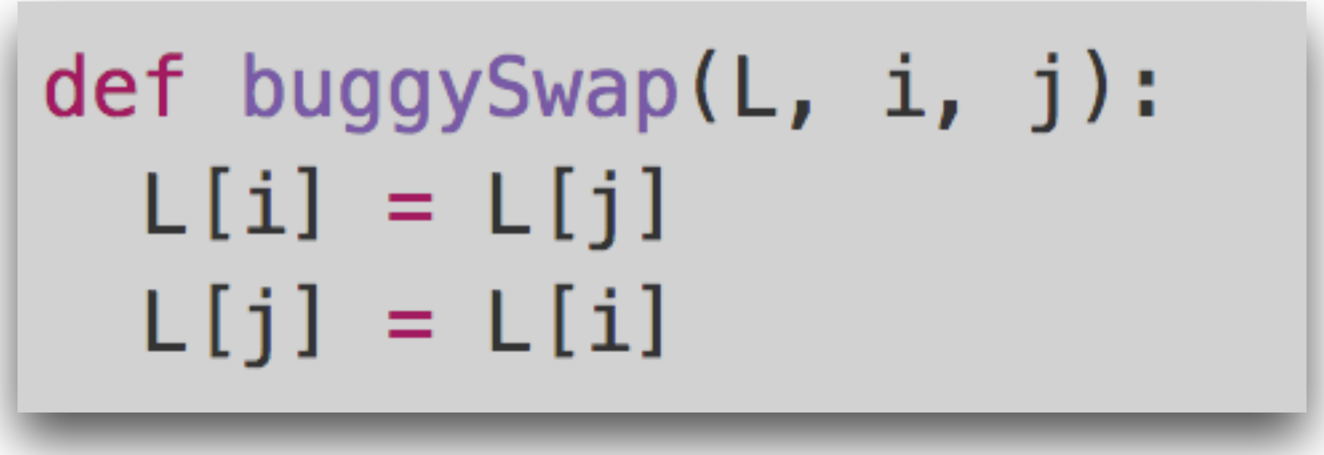
- Prepare a list for binary search
- Present information to a user in sorted order
- Gather stats like mode, median
- Do an equality check for two sets
- And many more…

Exercise: design sorting algorithm

In-place sorting

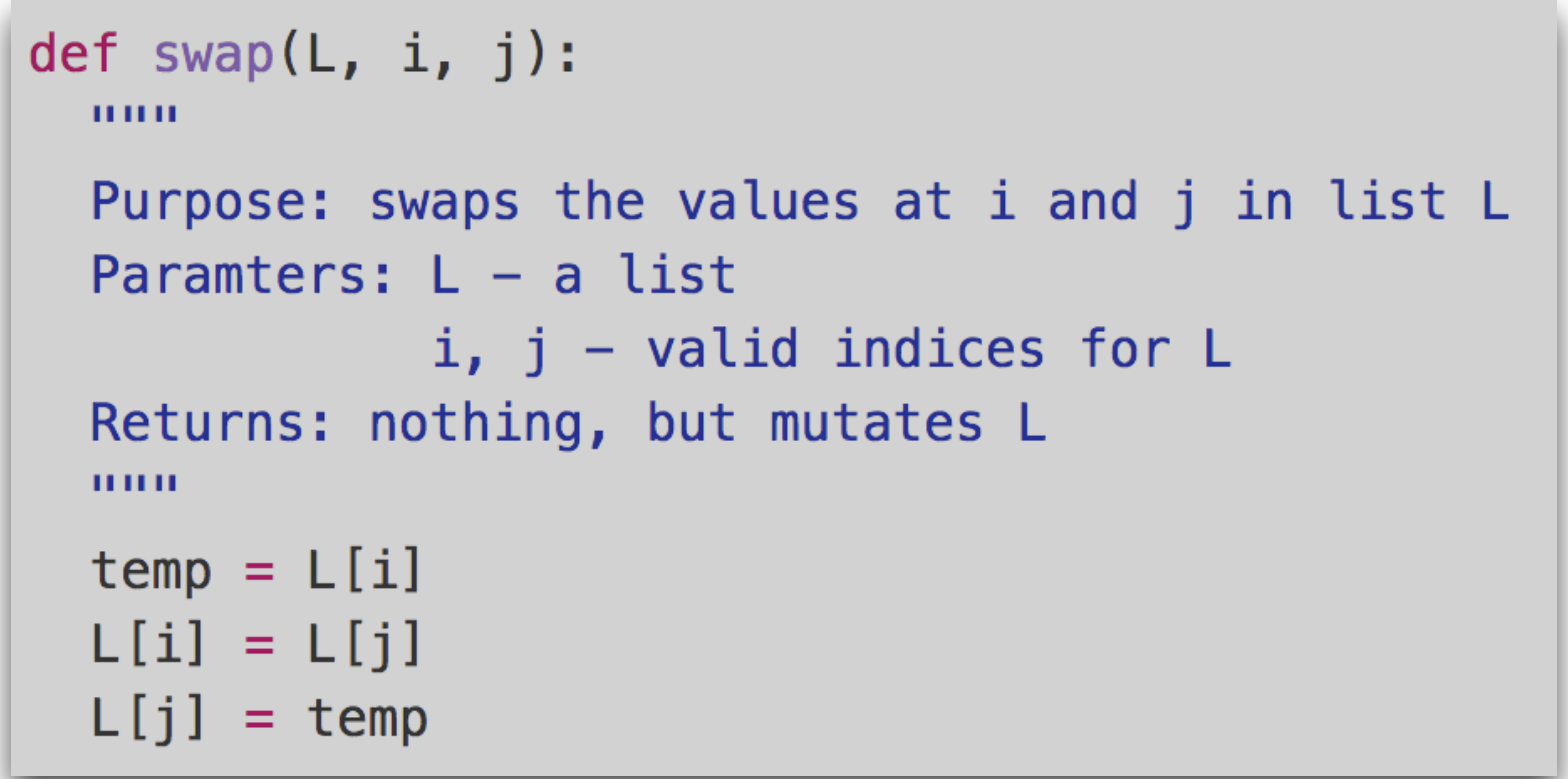
- Do the sort without using more than O(1) extra memory.
- Relies on the idea of swapping the values at two indices in a list.

Buggy swap



```
def buggySwap(L, i, j):
  L[i] = L[j]
  L[j] = L[i]
```

swap function



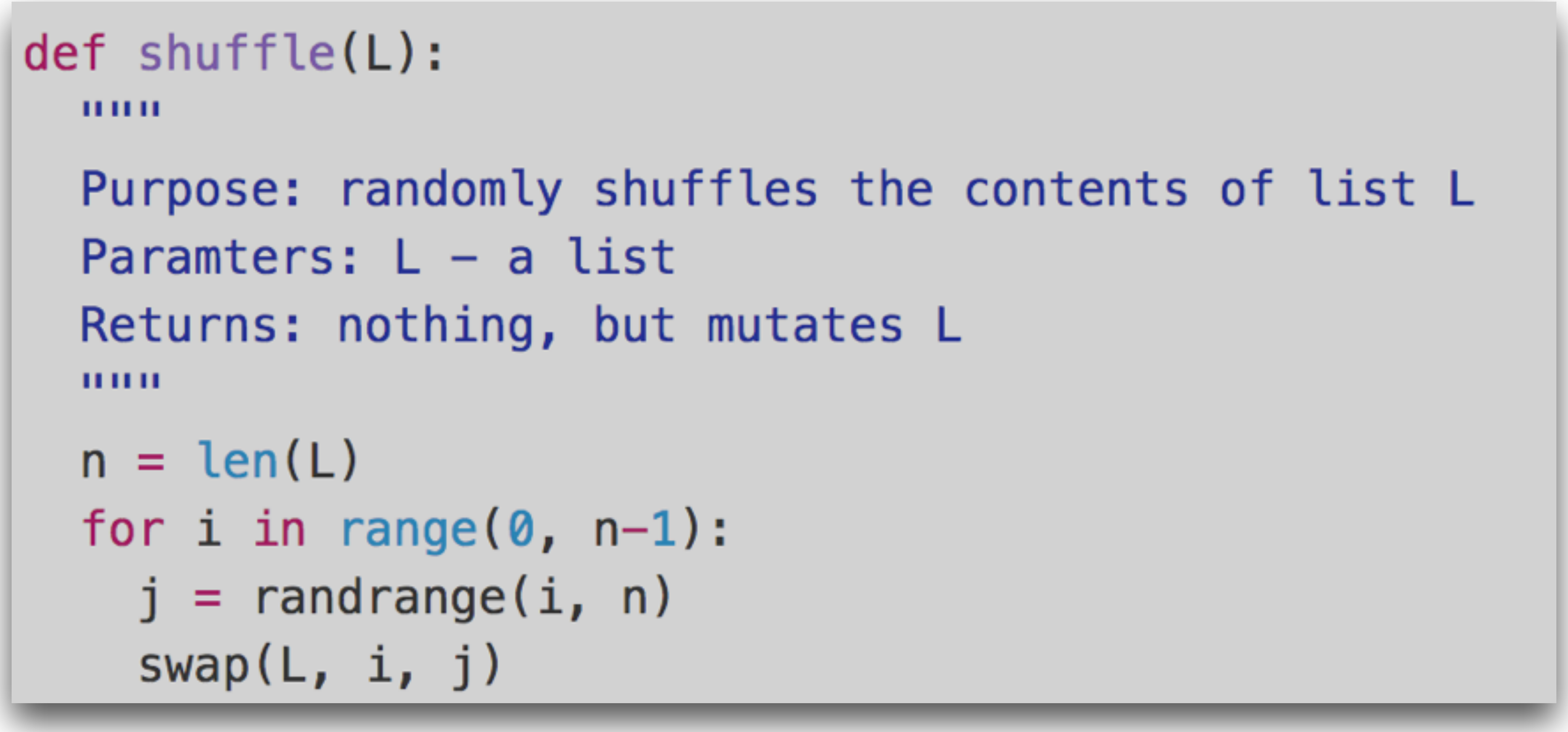
```python
def swap(L, i, j):
  """

  Purpose: swaps the values at i and j in list L
  Paramters: L - a list
             i, j - valid indices for L
  Returns: nothing, but mutates L
  """

  temp = L[i]
  L[i] = L[j]
  L[j] = temp
```

Aside: shuffling

- Once we know how to swap we can re-implement the shuffle function



```
def shuffle(L):
  """
  Purpose: randomly shuffles the contents of list L
  Paramters: L - a list
  Returns: nothing, but mutates L
  """
  n = len(L)
  for i in range(0, n-1):
    j = randrange(i, n)
    swap(L, i, j)
```

Exercise: implement sorting algorithm