CS218 - Data Structures
FAST NUCES Peshawar Campus
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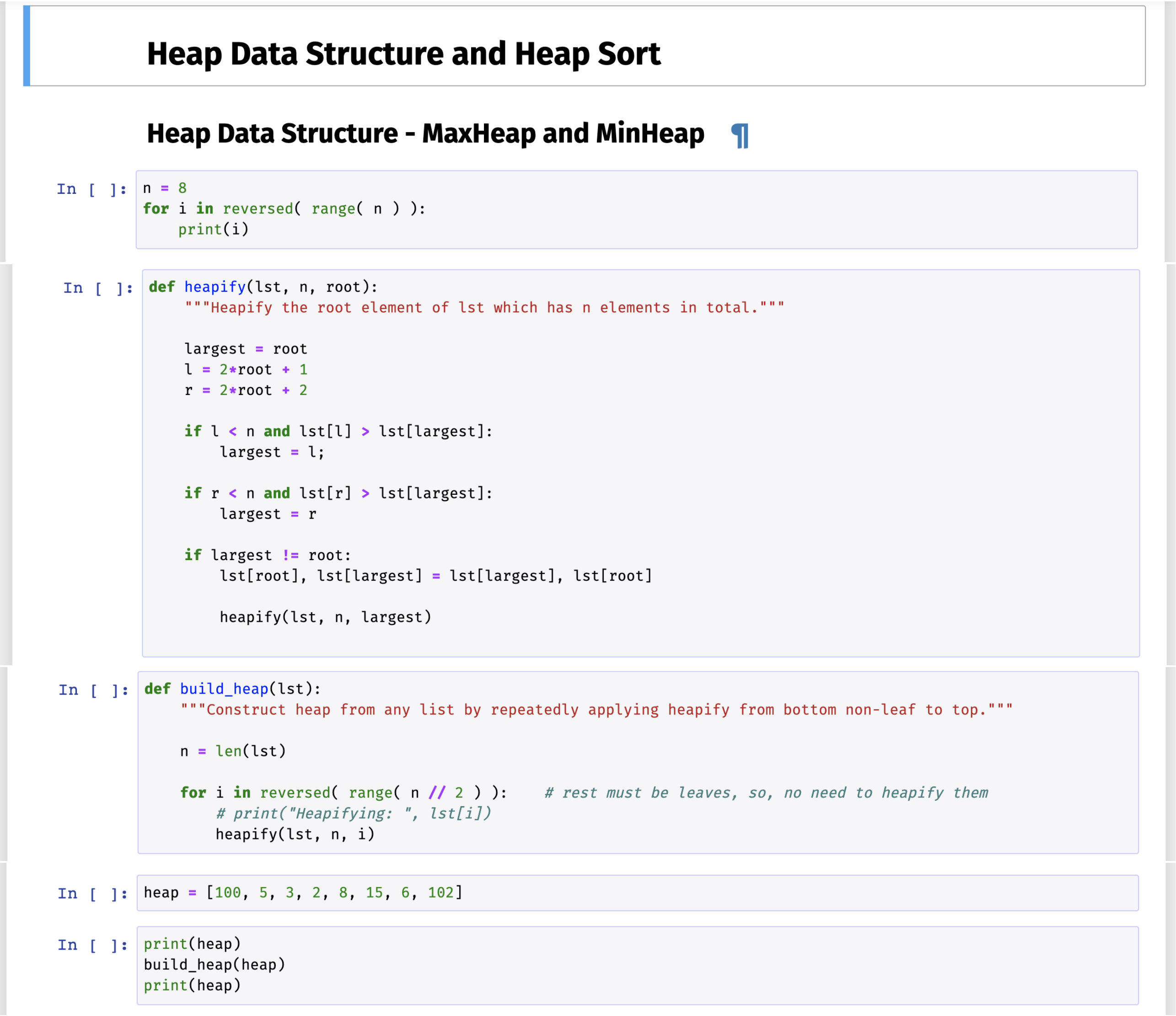
October 8, 2019

1 Trees

Raster images of the notebook 14-heap.



Heap Data Structure and Heap Sort

Heap Data Structure - MaxHeap and MinHeap ¶

In [ ]:

```
n = 8
for i in reversed( range( n ) ):
    print(i)
```

In [ ]:

```
def heapify(lst, n, root):
    """Heapify the root element of lst which has n elements in total."""

    largest = root
    l = 2*root + 1
    r = 2*root + 2

    if l < n and lst[l] > lst[largest]:
        largest = l;

    if r < n and lst[r] > lst[largest]:
        largest = r

    if largest != root:
        lst[root], lst[largest] = lst[largest], lst[root]

        heapify(lst, n, largest)
```

In [ ]:

```
def build_heap(lst):
    """Construct heap from any list by repeatedly applying heapify from bottom non-leaf to top."""

    n = len(lst)

    for i in reversed( range( n // 2 ) ):    # rest must be leaves, so, no need to heapify them
        # print("Heapifying: ", lst[i])
        heapify(lst, n, i)
```

In [ ]:

```
heap = [100, 5, 3, 2, 8, 15, 6, 102]
```

In [ ]:

```
print(heap)
build_heap(heap)
print(heap)
```

Heap Sort

In [ ]:

```
def heap_sort(lst):
    """Perform Heap Sort by building a Max Heap from the list and then repeatedly retrieving the max and heapify
    n = len(lst)

    # Build max heap
    build_heap(heap)


    for i in reversed(range(n)):
        # swap
        lst[i], lst[0] = lst[0], lst[i]

        #heapify root element again but only until the ith element
        heapify(lst, i, 0)
```

In [ ]:

```
heap = [100, 5, 3, 2, 8, 15, 6, 102]
print(heap)
heap_sort(heap)
print(heap)
```