CS 61BL   Lab 19

Summer 2019   August 6, 2019

Name:

SID:

Please complete this worksheet during your lab, and turn it in to your TA by the end
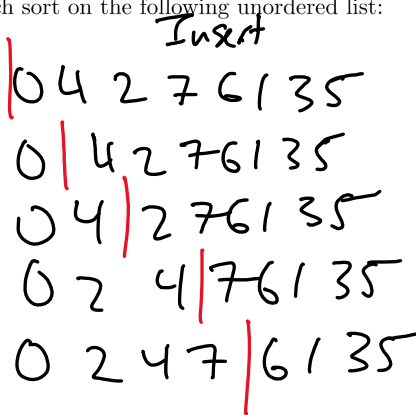of your section. You are encouraged to work with your neighbors collaboratively.

Section Number: (01) (02) (03) (04) (05) (06) (07) (08) (09) (10) (11) (12)
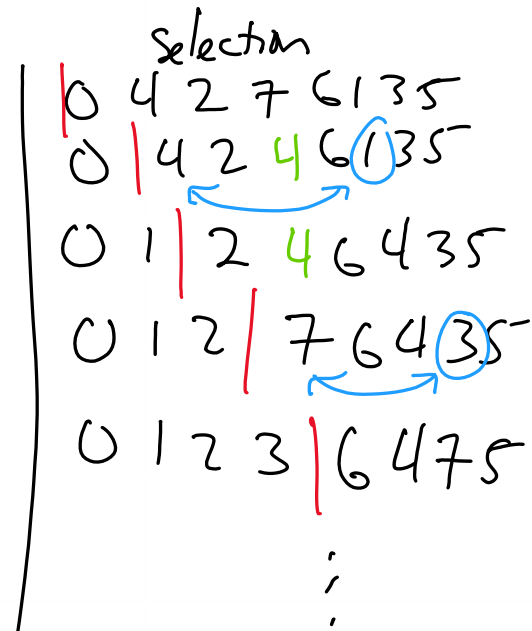
1   Sorting

1.1   Show the steps taken by each sort on the following unordered list:

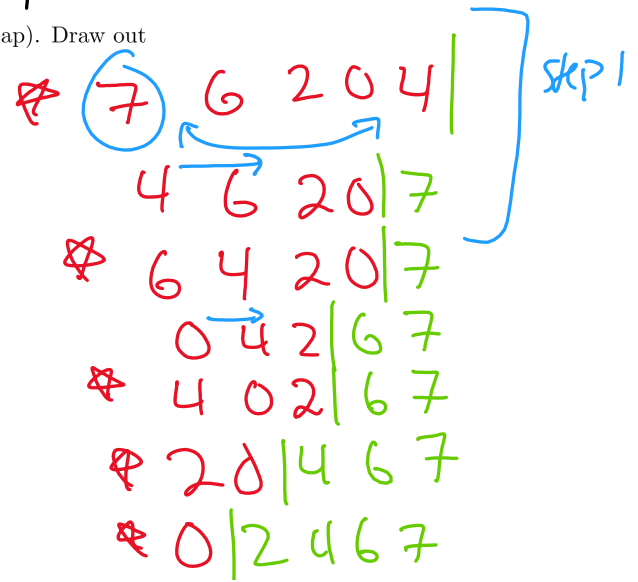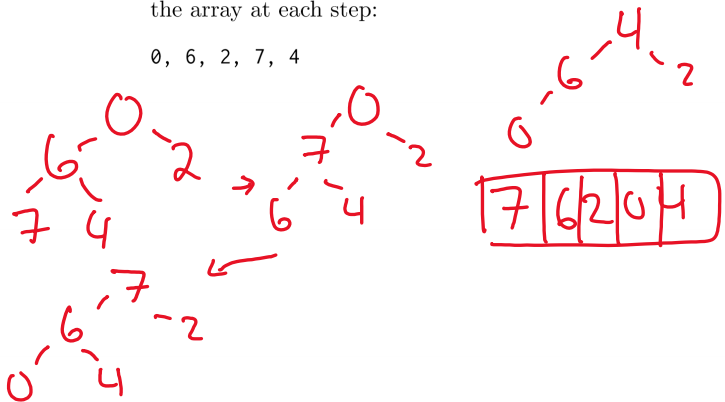0, 4, 2, 7, 6, 1, 3, 5

(a) Insertion sort

Insert

```
|0 4 2 7 6 1 3 5
0|4 2 7 6 1 3 5
0 4|2 7 6 1 3 5
0 2 4|7 6 1 3 5
0 2 4 7|6 1 3 5
```

(b) Selection sort

Selection

```
|0 4 2 7 6 1 3 5
0|4 2 4 6 1 3 5
0 1|2 4 6 4 3 5
0 1 2|7 6 4 3 5
0 1 2 3|6 4 7 5
      ⋮
```

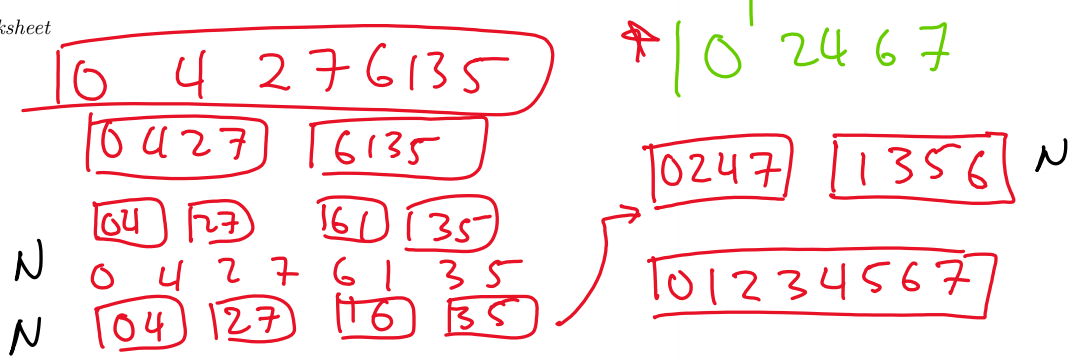(c) Use heapsort to sort the following array (hint: draw out the heap). Draw out
the array at each step:

0, 6, 2, 7, 4


```
|7|6|2|0|4|
```

Step 1
```
⚝ (7) 6 2 0 4|
   4 6 2 0|7
⚝ 6 4 2 0|7
   0 4 2|6 7
⚝ 4 0 2|6 7
⚝ 2 0|4 6 7
⚝ 0|2 4 6 7
```

(d) Merge sort

10 4 2 7 6 1 3 5

0 4 2 7   6 1 3 5

0 4   2 7   6 1   3 5

N   0 4 2 7   6 1   3 5

N   0 4   1 2 7   1 6   3 5

$\$10^1 2 4 6 7$

0 2 4 7   1 3 5 6   N
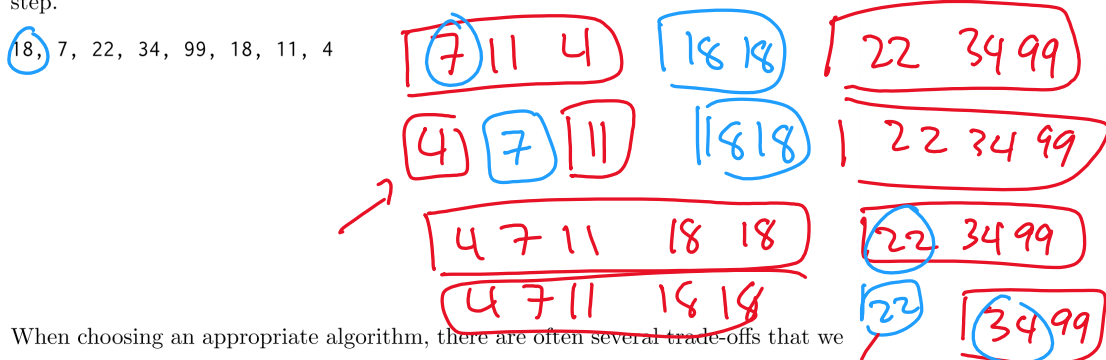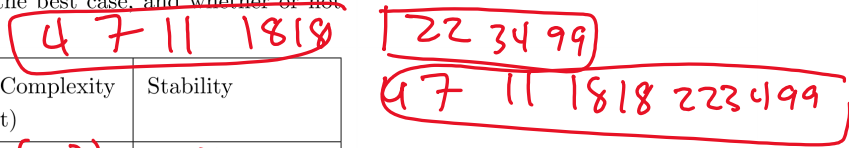
0 1 2 3 4 5 6 7

1.2 Sort the following unordered list using stable Quicksort. Assume that we always choose first element as the pivot and that we use the 3-way merge partitioning process described in lecture and lab. Show the steps taken at each partitioning step.

18, 7, 22, 34, 99, 18, 11, 4

7 11 4   18 18   22 34 99

4 7 11   18 18   22 34 99

4 7 11   18 18   22 34 99

4 7 11   18 18   22   34 99

4 7 11   18 18   22 34 99

4 7   11   18 18 22 34 99

1.3 When choosing an appropriate algorithm, there are often several trade-offs that we need to consider. Complete the chart for the following sorting algorithms: give the expected time complexity in the worst case, in the best case, and whether or not each sort is stable.

	Time Complexity (Best)	Time Complexity (Worst)	Stability
Selection Sort	$\Theta(n^2)$	$\Theta(n^2)$	No
Insertion Sort	$\Theta(n)$	$\Theta(n^2)$	Yes
Heapsort	$\Theta(n)$	$\Theta(n\log n)$	No
Merge sort	$\Theta(n\log n)$	$\Theta(n\log n)$	Yes
Quicksort (Three-way Partitioning)	$\Theta(n)$	$\Theta(n^2)$	Yes

$\Theta(n\log n)$