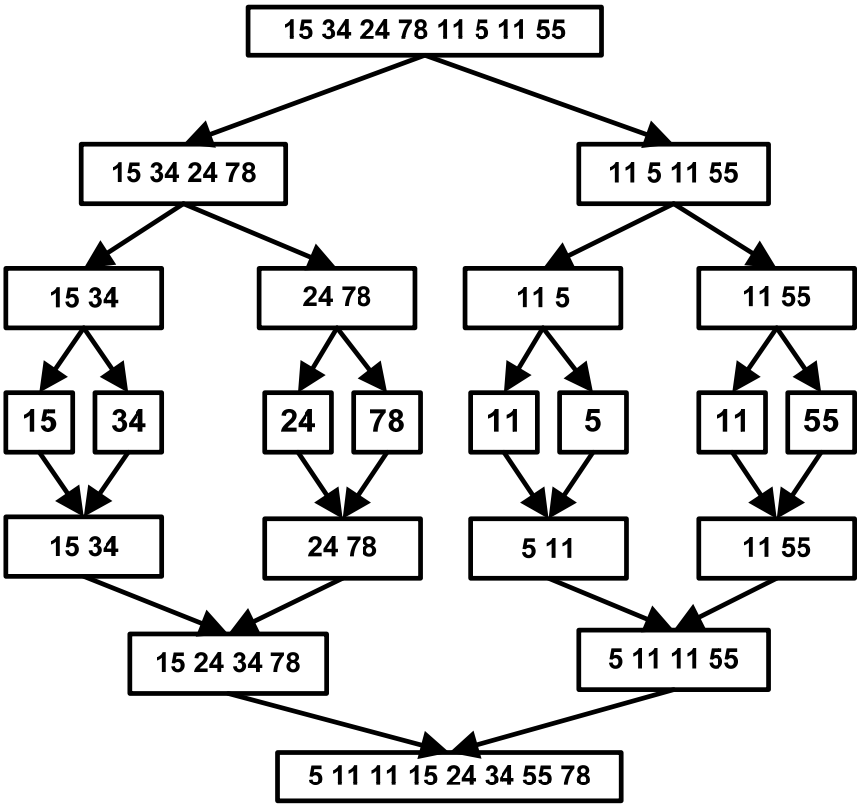
Review Activity 17 Solutions

Sorting Algorithms

1) Consider the following random and unordered sequence: 15, 34, 24, 78, 11, 5, 11, 55. Apply the Merge Sort algorithm that was discussed in class to sort the numbers in ascending order. For each merge iteration, clearly indicate how two collections are merged together.



2) Consider the following random and unordered sequence of letters: K, C, B, Z, E, R, D, F
Apply the Quick Sort algorithm that was discussed in class to sort the letters in descending alphabetical order (e.g., D should be listed before C). As the pivot, always select the last element from each collection (e.g., select F as the first pivot). Do not move the pivot once selected. For each collection, mark the pivot, indicate where the swaps are performed, and show low and high pointers before swaps.

Iteration 1:

```
K   C   B   Z   E   R   D   F
^ High                  ^ Low ^ Pivot
K   C   B   Z   E   R   D   F
    ^ High              ^ Low     ^ Pivot
K   R   B   Z   E   C   D   F
    ^ High              ^ Low     ^ Pivot
K   R   B   Z   E   C   D   F
        ^ High ^ Low              ^ Pivot
K   R   Z   B   E   C   D   F
        ^ High ^ Low              ^ Pivot
K   R   Z   B   E   C   D   F
```

```
                    ^ Low  ^ High                    ^ Pivot
          K      R      Z      F      E      C      D      B
                                ^ Sorted
Iteration 2:
          K      R      Z             E      C      D      B
          ^ High ^ Low  ^ Pivot              ^ High        ^ Low  ^ Pivot
          K      R      Z             E      C      D      B
   ^ Low  ^ High        ^ Pivot                           ^ Low  ^ Pivot / High
          Z      R      K             E      C      D      B
          ^ Sorted                                              ^ Sorted

Iteration 3:
          R             K             E      C      D
          ^ High / Low  ^ Pivot              ^ High ^ Low  ^ Pivot
          R             K             E      C      D
          ^ Low         ^ Pivot / High       ^ Low  ^ High ^ Pivot
          R             K             E      D      C
          ^ Sorted             ^ Sorted             ^ Sorted      ^ Sorted      ^ Sorted

Solution:
          Z      R      K      F      E      D      C      B
```

3) Consider the following random and unordered sequence: 16, 35, 25, 79, 12, 6, 12, 56
Apply the Quick Sort algorithm that was discussed in class to sort the numbers in descending alphabetical order. As the pivot, always select the second element from each collection (e.g., select 35 as the first pivot).

For each collection, mark the pivot, indicate where the swaps are performed, and show low and high pointers before swaps. You need to perform an in-place sort without using additional data structures.

```
Iteration 1:
        16      56      25      79      12      6       12      35
        ^ High                                          ^ Low   ^ Pivot
        16      56      25      79      12      6       12      35
        ^ High                  ^ Low                           ^ Pivot
        79      56      25      16      12      6       12      35
        ^ High                  ^ Low                           ^ Pivot
        79      56      25      16      12      6       12      35
                ^ Low   ^ High                                  ^ Pivot
        79      56      35      16      12      6       12      25
                        ^ Sorted

Iteration 2:
        79      56
                ^ Pivot
        79      56
        ^ Low   ^ Pivot / High
        79       56
        ^ Sorted ^ Sorted

        16      12      6       12      25
```

```
                ^ Pivot
        16      25      6       12      12
                        ^ High  ^ Low   ^ Pivot
        16      25      12       6      12
                        ^ High  ^ Low   ^ Pivot
        16      25      12       6      12
                        ^ Low    ^ High  ^ Pivot
        16      25      12       12       6
                                 ^ Sorted  ^ Sorted

Iteration 3:
        16      25      12
                ^ Pivot
        16      12      25
        ^ High  ^ Low   ^ Pivot
        16      12      25
  ^ Low ^ High          ^ Pivot

        25      12      16
        ^ Sorted

Iteration 4:
                12           16
                ^ High/Low   ^ Pivot
                12      16
          ^ Low ^ High  ^ Pivot
                16       12
                ^ Sorted  ^ Sorted

Solution:
          79    56    35    25    16    12    12    6
```