

## 1 Potpourri

- 1.1 Each of the following sequences represent an array being sorted at some intermediate step. Match each sample with one of the sorting algorithms: **insertion sort**, **selection sort**, **heapsort**, **merge sort**, **quicksort**. The original array is below.

5103 9914 0608 3715 6035 2261 9797 7188 1163 4411

- (a) 5103 9914 0608 3715 2261 6035 7188 9797 1163 4411  
0608 2261 3715 5103 6035 7188 9797 9914 1163 4411
- (b) 0608 1163 5103 3715 6035 2261 9797 7188 9914 4411  
0608 1163 2261 3715 6035 5103 9797 7188 9914 4411
- (c) 9797 7188 5103 4411 6035 2261 0608 3715 1163 9914  
4411 3715 2261 0608 1163 5103 6035 7188 9797 9914
- (d) 5103 0608 3715 2261 1163 4411 6035 9914 9797 7188  
0608 2261 1163 3715 5103 4411 6035 9914 9797 7188
- (e) 0608 5103 9914 3715 6035 2261 9797 7188 1163 4411  
0608 2261 3715 5103 6035 9914 9797 7188 1163 4411

## 2 Final Review

- 1.2 Give the *amortized runtime analysis* for push and pop for the priority queue below.

```
class TwinListPriorityQueue<E implements Comparable> {
    ArrayList<E> L1, L2;
    void push(E item) {
        L1.push(item);
        if (L1.size() >= Math.log(L2.size())) {
            L2.addAll(L1);
            mergeSort(L2);
            L1.clear();
        }
    }
    E pop() {
        E min1 = getMin(L1);
        E min2 = L2.poll();
        if (min1.compareTo(min2) < 0) {
            L1.remove(min1);
            return min1;
        } else {
            L2.remove(min2);
            return min2;
        }
    }
}
```

- 1.3 You have been hired by Alan to help design a priority queue implementation for *Kelp*, the new seafood review startup, ordered on the timestamp of each Review.

Describe a data structure that supports the following operations.

- `insert(Review r)` a Review in  $O(\log N)$ .
- `edit(int id, String body)` any one Review in  $\Theta(1)$ .
- `sixtyOne()`: return the sixty-first latest Review in  $\Theta(1)$ .
- `pollSixtyOne()`: remove and return the sixty-first latest Review in  $O(\log N)$ .

- 1.4 Find the Huffman encoding for the following alphabet and set of frequencies.

$\{(a, 0.12), (b, 0.38), (c, 0.1), (e, 0.25), (f, 0.06), (d, 0.05), (g, 0.01), (h, 0.03)\}$

When you build up your Huffman tree, you should place the branch of lower weight on the left. A left or right branch should respectively correspond to a 0 or 1 in the codeword.