

Problem Set 2

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Collaborators: None

Problem 2-1.

- (a) $O(n^2)$
- (b) $O(n^4), \Omega(n^{2lg^3})$
- (c) $\Theta(n \log^2 n)$
- (d) $\Theta(n^2)$

Problem 2-2.

- (a) selection sort, cause its fewer *set* operations($O(n)$)
- (b) merge sort, cause it has fewer *compare* operations($O(n \log n)$)
- (c) insertion sort, cause it decrease a inversions each inner loop iteration. So its $O(n + k)$

Problem 2-3. tell card to teleport to 2^i and $n-2^i$, until Datum is found or have not been passed, then $j = i$, which means $2^{j-1} < k < 2^j$, then do binary search in the $[2^{j-1}, 2^j]$ range. All above take $O(j)$ time.

Problem 2-4.

1. doubly linked list L containing all undeleted messages in order.
2. a sorted array V containing the pair (v_i, p_i) , where v_i is the ID and p_i is the pointer to a linked list L_v of a sequence of pointers p_v to the ordered messages with ID v_i .

$\text{build}(V): L$ in $O(1)$ time, V in $O(n \log n)$ time.

$\text{send}(v, m):$ insert m into a node x at the front of L in $O(1)$. find v in V in $O(\log n)$ time, then insert p_v pointing to x at the end of L_v in $O(1)$.

$\text{recent}(k):$ traverse the first k nodes of L in $O(k)$ time.

$\text{ban}(v):$ find v in V in $O(\log n)$ time, then for each pointer p_v in L_v , delete the node pointed by p_v in L in $O(1)$ time, set p_v point to None .

Problem 2-5.

(a)

(b)

(c) code in .python file