

Problem Set 3

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Collaborators: None

Problem 3-1.

- (a)
- 0 : [36, 92]
 - 1 :
 - 2 :
 - 3 :
 - 4 : [56]
 - 5 : [47, 61, 33]
 - 6 : [52]

(b) $c = 13$

Problem 3-2.

- (a) guarantee: $k_1 = 1, k_2 = n + 1$
- (b) guarantee: choose k_1, k_2 small enough so that $k_i n / u = 0$
- (c) the highest probability is $\frac{1}{n}$

Problem 3-3.

- (a) word can be upper bounded by $128^{16 \log n * 8} < n^{33}$, so radix sort.
- (b) direct access array of size 10^5
- (c) Multiplying by n^3 , so they are in $[0, 4n^3]$, using radix sort.
- (d) merge sort using only comparisons, so $O(n \log n)$.

Problem 3-4.

- (a) build a hash table H , insert b_i into H mapped to i , for every b_i , check if $r - b_i$ exists in H in expected $O(1)$ time, then check whether it is close.
- (b) Replace each b_i with tuple (b_i, i) , scan the B and remove all (b_i, i) that $b_i > r$, then use radix sort to an array A .
 use two-pointer algorithm, initialize $i = 0, j = |A| - 1$,
 if $A[i][0] + A[j][0] < r$, then $i++$;
 if $A[i][0] + A[j][0] > r$, then $j--$;
 if $A[i][0] + A[j][0] = r$, then return True.

Problem 3-5.

(a)

(b)

(c) code in .python file