

Exercise 2.4.23 Multiway heaps. Considering the cost of compares only, and assuming that it takes t compares to find the largest of t items, find the value of t that minimizes the coefficient of $N \lg N$ in the compare count when a t -ary heap is used in heapsort. First, assume a straightforward generalization of $\text{sink}()$; then, assume that Floyd's method can save one compare in the inner loop.

Solution:

Q.4) Exercise 2.4.23 (Without Floyd's method)

Multiway heaps: - Consider cost of compares only, assuming that it takes t compares to find largest of t -items, find val of t that minimizes coeff of $N \lg N$ in compare count when a t -ary heap used in heapsort.

t -ary heaps use $O(\log_b n)$ comparisons in $\text{swim}()$ & $O(b \log_b n)$ in $\text{sink}()$.

- So base-2 heap would have $\log_2 n$ comparisons in swim with $2 \cdot \log_2 n$ comparisons in $\text{sink}()$.
- Recall it takes $N/2$ $\text{sink}()$ operations to build heap & N operations in sortdown.
- \therefore Heapsort makes $1.5 N \lg (b \cdot \log_b N)$
- OR $1.5 N \cdot ((b \log_b N) - 1)$ for Floyd's method

• So without Floyd's method, this comes to coefficient of 3 as it results in minimal coefficient.

Let $N = 500$

Heap Base	$1.5 N \lg (b \log_b N)$	$1.5 N \lg (b \log_b N) - 1.5 N$	Value
2	1515.0	1344	1344
3	75	1345	1345
4		1448	1448
5			

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