

IDSA: SP10 Range Minimum Query

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Part a)

Performance analysis of algorithm: Hybrid approach one

Algorithm:

Preprocess:

1. Divide the input array into blocks
2. Block size $b = \log(n)$.
3. Compute the block level minimum and store it in an array
4. Construct sparse table over block minima

Query:

1. Based on index i and j , query sparse table
2. Iterate individual blocks if index is not in the border of the blocks
3. Return the minimum value from step 1 and 2

Performance:

Theoretical Time Complexity:

Preprocess: $O(n)$

Query: $O(\log n)$

Performance of preprocessing and query was evaluated for different input size and query range. For each input size, 1 million queries were executed, and average value was recorded.

Input Size	Preprocessing time in msec	Average Query Time in msec	Memory
128M	25994	9.9E-4	1032 MB / 1595 MB
256M	30182	0.001	2161 MB / 2926 MB
512M	73868	0.08016	4184 MB / 5388 MB

Preprocessing time did not increase significantly when input size was increased to 256M from 128M. When the input size is increased to 512M there was a significant rise in the pre-processing time.

This indicates that when the number of blocks increases beyond certain value time required to pre-process the data grows faster.

From the above observed metrics, it can be concluded that values approximately agree with the theoretical complexity of the algorithm.