CAB302 - Assignment 2

Luke Josh, Jason Queen

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1 Summary

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2 Description of the Algorithms

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2.1 Brute Force

Words

2.1.1 The Algorithm

Algorithm 1 Brute Force Median

1: **function** BRUTEFORCEMEDIAN($A[0..n-1]$)
2:     $k \leftarrow \|n/2\|$
3:     **for** $i \leftarrow 1$ **to** $n-1$ **do**
4:         $numsmaller \leftarrow 0$
5:         $numeqal \leftarrow 0$
6:         **for** $j \leftarrow 0$ **to** $n-1$ **do**
7:             **if** $A[j] < A[i]$ **then**
8:                 $numsmaller \leftarrow numsmaller + 1$
9:             **else**
10:                 **if** $A[j] = A[i]$ **then**
11:                     $numequal \leftarrow numequal + 1$
12:                 **end if**
13:             **end if**
14:         **end for**
15:         **if** $numsmaller < k$ **and** $k \leq (numsmaller + numequal)$ **then**
16:             **return** $A[i]$
17:         **end if**
18:     **end for**
19: **end function**

2.2 Johnsonbaugh and Schaefers Algorithm

Words

2.2.1 The Algorithm

Algorithm 2 Selecion Median

1: **function** MEDIAN($A[0..n-1]$)
2:     **if** $n = 1$ **then**
3:         **return** $A[0]$
4:     **else**
5:         Select($A, 0, \lfloor n/2 \rfloor, n-1$)
6:     **end if**
7: **end function**
8:
9: **function** SELECT($A[0..n-1], l, m, h$)
10:     $pos \leftarrow$ Partition(A, l, h)
11:     **if** $pos = m$ **then**
12:         **return** $A[pos]$
13:     **end if**
14:     **if** $pos > m$ **then**
15:         **return** **Select**($A, l, m, pos - 1$)
16:     **end if**
17:     **if** $pos < m$ **then**
18:         **return** **Select**($A, pos + 1, m, h$)
19:     **end if**
20: **end function**
21:
22: **function** PARTITION($A[0..n-1], l, h$)
23:     $pivotval \leftarrow A[l]$
24:     $pivotloc \leftarrow l$
25:     **for** $j \leftarrow l + 1$ **to** h **do**
26:         **if** $A[j] < pivotval$ **then**
27:             $pivotloc \leftarrow pivotloc + 1$
28:             **swap**($A[pivotloc], A[j]$)
29:         **end if**
30:         **swap**($A[l], A[pivotloc]$)
31:     **end for**
32:     **return** $pivotloc$
33: **end function**

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3 Theoretical Analysis of the Algorithms

3.1 Brute Force Median

3.1.1 Choice of Basic Operations

The operation that best defines the complexity and running time of the brute force median algorithm is the comparison $A[j] < A[i]$. This comparison operation is performed more than any other operation in the algorithm - a minimum of $n - 1$ times, and a maximum of $(n - 1)^2$ times.

3.1.2 Choice of Problem Size

Words

3.1.3 Average Case Efficiency

Words

3.2 Selection Median

3.2.1 Choice of Basic Operations

Words

3.2.2 Choice of Problem Size

Words

3.2.3 Average Case Efficiency

Words

4 Methodology, Tools and Techniques

4.1 Programming Environment

4.2 Implementation of the Algorithms

4.3 Generating Test Data and Running the Experiments

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5.1 Functional Testing

5.2 Average-Case Number of Basic Operations for an Item in the Set

5.3 Average-Case Number of Basic Operations for an Item not in the Set

5.4 Average-Case Execution Time for an Item in the Set

5.5 Average-Case Execution Time for an Item not in the Set