CAB302 - Assignment 2

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May 10, 2016

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1   Summary

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2   Description of the Algorithms

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2.1   Brute Force

2.1.1   The Algorithm

Algorithm 1 Brute Force Median
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function BRUTEFORCEMEDIAN($A[0..n-1]$)
    $k \leftarrow \|n/2\|$
    for $i \leftarrow 1$ **to** $n-1$ **do**
        $numsmaller \leftarrow 0$
        $numeqal \leftarrow 0$
        for $j \leftarrow 0$ **to** $n-1$ **do**
            if $A[j] < A[i]$ **then**
                $numsmaller \leftarrow numsmaller + 1$
            else
                if $A[j] = A[i]$ **then**
                    $numequal \leftarrow numequal + 1$
                end if
            end if
            if $numsmaller < k$ **and** $k \leq (numsmaller + numequal)$ **then**
                return $A[i]$
            end if
        end for
    end for
end function

2.2 Johnsonbaugh and Schaefers Algorithm

2.2.1 The Algorithm

Algorithm 2 Johnsonbaugh and Schaefers Algorithm

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  function $\text{MEDIAN}(A[0..n-1])$
    if $n = 1$ **then**
      return $A[0]$
    else
      $\text{Select}(A, 0, \lfloor n/2 \rfloor, n-1)$
    end if
  end function

  function $\text{SELECT}(A[0..n-1], l, m, h)$
    $pos \leftarrow \text{Partition}(A, l, h)$
    if $pos = m$ **then**
      return $A[pos]$
    end if
    if $pos > m$ **then**
      return Select$(A, l, m, pos - 1)$
    end if
    if $pos < m$ **then**
      return Select$(A, pos + 1, m, h)$
    end if
  end function

  function $\text{PARTITION}(A[0..n-1], l, h)$
    $pivotval \leftarrow A[l]$
    $pivotloc \leftarrow l$
    for $j \leftarrow l + 1$ **to** h **do**
      if $A[j] < pivotval$ **then**
        $pivotloc \leftarrow pivotloc + 1$
        swap$(A[pivotloc], A[j])$
      end if
      swap$(A[l], A[pivotloc])$
    end for
    return $pivotloc$
  end function

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3 Theoretical Analysis of the Algorithms

3.1 Choice of Basic Operations

3.2 Choice of Problem Size

3.3 Average Case Efficiency

4 Methodology, Tools and Techniques

4.1 Programming Environment

4.2 Implementation of the Algorithms

4.3 Generating Test Data and Running the Experiments

5 Experimental Results

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