Bachelor of IT (Computer Science)
Assignment 2
CAB301 - Algorithms and Complexity

Dane Madsen
n10983864@qut.edu.au

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1 NoDVDs Method

1.1 Algorithm Design

This method calculates the total number of DVDs in a MovieCollection through a in-order node tree traversal using a stack of BTreeNodes. Firstly, it initializes the DVD count to be 0, creates an empty stack of BTreeNodes and starts traversing from the root. Next, an outer while loop starts and continues until the current BTreeNode is null and the stack count is equal to 0. Inside the outer while loop, the inner while loop traverses the left subtree, pushing left child BTreeNodes onto the stack. After traversing the left subtree, the method pops the first movie from the top of the stack, adds its total copies to the running total, and moves to the right child of the popped movie. This process visits each node, cumulatively adding the total copies to the count. Once the traversal finishes, it returns the total DVDs.

ALGORITHM *NoDVDs()*
  // Calculates the total number of DVDs
  // Returns the total number of DVDs in the MovieCollection
  totalDVDs ← 0
  stack ← an empty BTreeNodes stack
  curr ← root node of the MovieCollection
  while *curr* ≠ null **or** *stack* **is not** empty
    while *curr* ≠ null
      stack.push(curr)
      curr ← *curr.LChild*
    curr ← *stack.pop()*
    totalDVDs ← *totalDVDs* + *curr.Movie.TotalCopies*
    curr ← *curr.RChild*
  return *totalDVDs*

1.2 Algorithm Analysis

To perform an emperical analysis of the NoDVDs method, I created 20 MovieCollections of exponentially increasing sizes (from 1 to 524388 movies). Then, for each of these MovieCollections, I ran the NoDVDs method 10 times and averaged the time taken to run the method. The results of this analysis are shown in Figure 1.

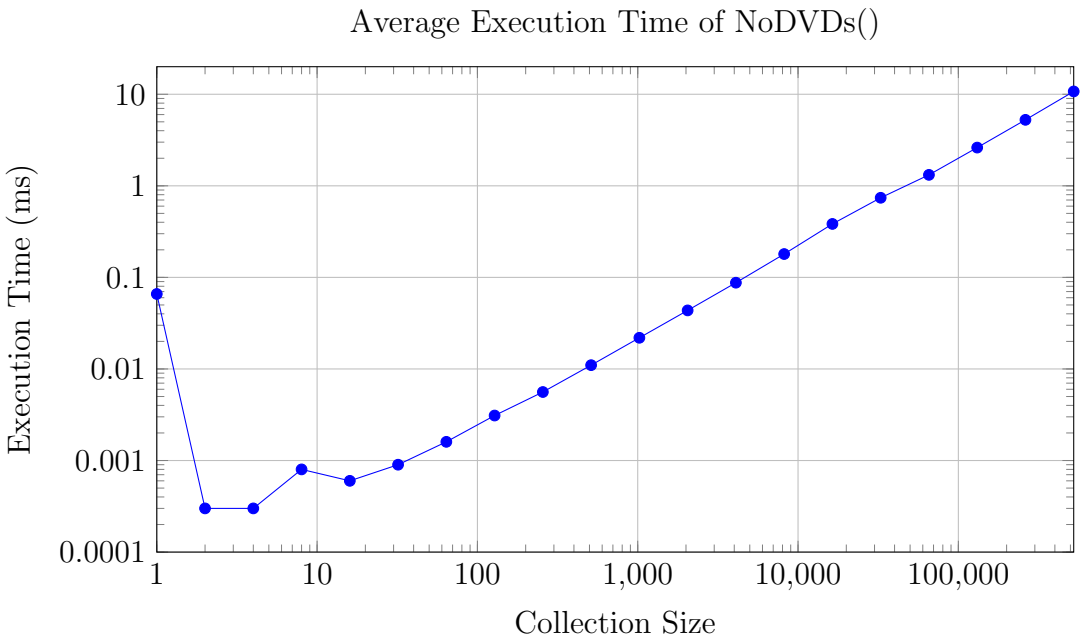

Figure 1: Average Execution Time of NoDVDs()

As this figure shows, though some of the first few MovieCollections have timings that are outliers, after the third MovieCollection (with 8 values), the average execution times of the NoDVDs method increase linearly.