**Run-Time + Memory of Data Structures**

Wilda Cheng

Southern New Hampshire University

CS-300 Analysis and Design

Professor Jeff Sanford

June 13th 2022

1. Linked List

Reading File + Creating Course Object

| **Code** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Initialize node structure** | 9 | 9 | 9 |
| **For all rows in CSV file** | 1 | n | n |
| **Initialize a course using data from current row (i)** | 1 | n | n |
| **If file[i][2] exists** | 1 | n | n |
| **Loop through remaining data** | 1 | n | n |
| **Initialize course data as prerequisites** | 1 | n | n |
| **Create new node** | 1 | n | n |
| **If head is empty** | 1 | n | n |
| **Assign head to the new node** | 1 | n | n |
| **Else assign tail to the new node** | 1 | n | n |
| **Increase size count** | 1 | n | n |
| **Total Cost** | | | 10n + 9 |
| **Runtime** | | | O(n) |

1. Hash Table

Reading file + Creating Course Object

| **Code** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Initialize node structure** | 9 | 9 | 9 |
| **Initialize hash table size** | 1 | 1 | 1 |
| **Declare hashFunction(string key)** | 1 | 1 | 1 |
| **Convert last 3 string values from key into integer** | 1 | 1 | 1 |
| **Convert the string part of key into ASCII values** | 1 | 1 | 1 |
| **Get sum of the integer values** | 1 | 1 | 1 |
| **Return sum % hash table size** | 1 | 1 | 1 |
| **Declare hash insert(hashTable, courses)** | 1 | 1 | 1 |
| **Initialize bucket + buckets probed** | 1 | 1 | 1 |
| **For all rows in CSV file** | 1 | n | n |
| **Initialize a course using data from current row (i)** | 1 | n | n |
| **Call hashFunction using the first index containing the courseNum to obtain index** | 1 | n | n |
| **While buckets probed < N** | 1 | n | n |
| **If bucket is empty** | 1 | n | n |
| **Set bucket = course** | 1 | n | n |
| **Return** | 1 | n | n |
| **Increment bucket index + buckets probed** | 1 | n | n |
| **Total Cost** | | | 8n + 17 |
| **Runtime** | | | O(n) |

1. Binary Search Tree

Reading File + Creating Course Object

| **Code** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Initialize node structure** | 9 | 9 | 9 |
| **For all rows in CSV file** | 1 | n | n |
| **Initialize a course using data from current row (i)** | 1 | n | n |
| **Create new node** | 1 | n | n |
| **If tree root is null** | 1 | n | n |
| **Assign tree root to node** | 1 | n | n |
| **Assign node left to null** | 1 | n | n |
| **Assign node right to null** | 1 | n | n |
| **Else declare variable cur = tree root** | 1 | n | n |
| **While cur is not null** | 1 | n | n |
| **If node bidId < curBidId** | 1 | n | n |
| **If cur left is nullptr** | 1 | n | n |
| **Assign cur left = node** | 1 | n | n |
| **Assign cur = null** | 1 | n | n |
| **Else assign cur = cur left** | 1 | n | n |
| **Else** | 1 | n | n |
| **If cur right is null** | 1 | n | n |
| **Assign cur right = node** | 1 | n | n |
| **Assign cur = null** | 1 | n | n |
| **Else assign cur = cur right** | 1 | n | n |
| **Assign node left = null** | 1 | n | n |
| **Assign node right = null** | 1 | n | n |
| **Total Cost** | | | 21n + 9 |
| **Runtime** | | | O(n) |