**Runtime Analysis**

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| --- | --- | --- | --- |
| **Code for Reading a file** | **Line cost** | **# Times Executed** | **Total Cost** |
| Use fstream to allow for opening of the file | 1 | 1 | 1 |
| Open file | 1 | 1 | 1 |
| If file does not equal open | 1 | 1 | 1 |
| Print “Error could not open file” | 1 | 1 | 1 |
| Else | 1 | 1 | 1 |
| While it is not the end of the file | 1 | n | n |
| Use inFS to read the file | 1 | 1 | 1 |
| If parameters is less than two | 1 | n | n |
| Print “Error” | 1 | 1 | 1 |
| Else | 1 | 1 | 1 |
| Read parameters | 1 | n | n |
| If parameters is greater than or equal to three | 1 | n | n |
| If third (or other) parameter is equal to the first parameter | 1 | n | n |
| Read parameters | 1 | n | n |
| Else | 1 | 1 | 1 |
| Print “Error” | 1 | 1 | 1 |
| Close File | 1 | 1 | 1 |
|  |  | Total Cost | 6n + 11 |
|  |  | Runtime | O(n) |

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| **Code for Vector Creating Course Objects** | **Line Cost** | **# Times Executed** | **Total Cost** |
| Declare vector<Course> | 1 | 1 | 1 |
| Open file | 1 | 1 | 1 |
| While filename does not equal fail | 1 | n | n |
| For each line in the file | 1 | n | n |
| Use pushback to add each line to the vector | 1 | n | n |
| Close file | 1 | 1 | 1 |
|  |  | Total Cost | 3n + 3 |
|  |  | Runtime | O(n) |

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| **Code for Hash Table Creating Course Objects** | **Line Cost** | **# Times Executed** | **Total Cost** |
| Initialize Course Vector | 1 | 1 | 1 |
| Declare Hash Table class | 1 | 1 | 1 |
| Insert method | 1 | 1 | 1 |
| While filename does not equal fail | 1 | n | n |
| For each line in file | 1 | n | n |
| For first and second course | 1 | n | n |
| Hold values using a created temp | 1 | 1 | 1 |
| If there is a third course | 1 | n | n |
| Add it to temp | 1 | 1 | 1 |
| Insert method | 1 | 1 | 1 |
|  |  | Total Cost | 4n + 4 |
|  |  | Runtime | O(n) |

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| **Code for Binary Tree Creating Course Objects** | **Line Cost** | **# Times Executed** | **Total Cost** |
| Initialize Course structure struct course | 1 | 1 | 1 |
| Create Binary Tree class | 1 | 1 | 1 |
| Insert method | 1 | 1 | 1 |
| While filename does not equal fail | 1 | 1 | 1 |
| For each line in file | 1 | n | n |
| For first and second value | 1 | n | n |
| Add courseId | 1 | 1 | 1 |
| Add courseName | 1 | 1 | 1 |
| If there is a third value | 1 | n | n |
| Add until newline | 1 | n | n |
| If root is equal to null | 1 | 1 | 1 |
| Assign current course to root | 1 | 1 | 1 |
| Assign left to null | 1 | 1 | 1 |
| Assign right to null | 1 | 1 | 1 |
| Else if course number is less than root | 1 | n | n |
| Add to left node | 1 | 1 | 1 |
| If left is equal to null | 1 | n | n |
| Add current course number | 1 | 1 | 1 |
| Else | 1 | 1 | 1 |
| If course number is less than lead | 1 | n | n |
| Add to left node | 1 | 1 | 1 |
| If course number is greater than leaf | 1 | n | n |
| Add to right node | 1 | 1 | 1 |
| Else if course number is less than root | 1 | n | n |
| Add to right node | 1 | 1 | 1 |
| If right is equal to null | 1 | n | n |
| Add current course number | 1 | 1 | 1 |
| Else | 1 | 1 | 1 |
| If course number is less than leaf | 1 | n | n |
| Add to left node | 1 | 1 | 1 |
| If course number is greater than leaf | 1 | n | n |
| Add to right node | 1 | 1 | 1 |
|  |  | Total Cost | 12n + 20 |
|  |  | Runtime | O(n) |