**Runtime Analysis**

Parsing the file and creating objects is independent of the data structure used so the analysis would be the same for all the structures.

| **PARSE FILE AND CREATE OBJECTS** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Open courses file** | 1 | 1 | 1 |
| **For each line in courses file** | 1 | n | n |
| **Create course object** | 1 | n | n |
| **Split into tokens** | 1 | n | n |
| **For each token in tokens** | 1 | n | n |
| **if token index is 0** | 1 | 1 | 1 |
| **add token as**  **course number** | 1 | 1 | 1 |
| **if token index is 1** | 1 | 1 | 1 |
| **add token as**  **course title** | 1 | 1 | 1 |
| **if token index is >**  **1** | 1 | n | n |
| **add token as**  **course pre-req** | 1 | n | n |
| **Total Cost** | | | 6n + 5 |
| **Runtime** | | | O(n) |

| **VECTOR INSERT** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Instantiate vector collection** | 1 | 1 | 1 |
| **For each course object created** | 1 | n | n |
| **Append object to vector** | 1 | 1 | 1 |
| **Total Cost** | | | n + 2 |
| **Runtime** | | | O(n) |

| **HASH TABLE INSERT** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Instantiate hash table collection** | 1 | 1 | 1 |
| **For each course object created** | 1 | n | n |
| **call hash func and get**  **key** | 1 | n | n |
| **create new node with**  **course and key** | 1 | n | n |
| **if node is null but not**  **empty** | 1 | n | n |
| **insert node to key**  **index** | 1 | n | n |
| **else if node is not used** | 1 | n | n |
| **update that node with**  **course data** | 1 | n | n |
| **else if there is collision** | 1 | n | n |
| **find next open**  **position and add node**  **object** | 1 | n | n |
| **Total Cost** | | | 9n + 1 |
| **Runtime** | | | O(n) |

| **BINARY SEARCH TREE INSERT** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **Instantiate Tree collection** | 1 | 1 | 1 |
| **Set root to null** | 1 | 1 | 1 |
| **For each course object created** | 1 | n | n |
| **if root is empty** | 1 | n | n |
| **root becomes current**  **course object** | 1 | 1 | 1 |
| **else if node course**  **number is smaller than**  **course number being**  **added** | 1 | n | n |
| **if no node to left** | 1 | n | n |
| **node becomes**  **current course**  **object** | 1 | n | n |
| **else traverse down**  **left** | 1 | n | n |
| **traverse down left** | 1 | n | n |
| **else if node course**  **number is larger than**  **course number being**  **added** | 1 | n | n |
| **if no node to right** | 1 | n | n |
| **node becomes**  **current course**  **object** | 1 | n | n |
| **else traverse down**  **right** | 1 | n | n |
| **Total Cost** | | | 11n + 3 |
| **Runtime** | | | O(n) |