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Vector pseudocode:

ADD libraries: iostream, fstream, iomanip

CREATE vector: courses

CREATE objects: courses.number, courses.prereq, courses.title

CREATE and OPEN file: ifstream inFile, open inFile

CREATE function: getRows

IN function:

FOR I gets 0, I less than inFile.rowCount(), increment i

CREATE course variable

ADD parameters to vector: course.number gets inFile[I][0}

Course.title gets inFile[i][1], course.prereq gets [I][2]

FOR I gets 0, I less than courses.size(), increment I

IF courses[I] has less than 2 parameters:

PRINT error and index at error

ELSE continue

IF courses.prereq is not in the file:

PRINT error and index of error

CREATE variable: searchItem

searchItem gets input of user

CHECK searchItem against vector

IF searchItem is found in vector:

PRINT line of seacrhItem

ELSE:

Print nothing found

Menu pseudocode:

ADD libraries: iostream, iomanip

CREATE functions: displayMenu, printCourseList

CREATE variable: userInput

IN function displayMenu:

CREATE output following structure:

1. Load Data structure
2. Print Course list
3. Print course
4. Exit

IN function printCourseList:

LOAD data structure used

PRINT use data structure used

Run time Analysis and evaluation:

| **Code** | **Line Cost** | **# Times Executes** | **Total Cost** |
| --- | --- | --- | --- |
| **for all courses in the vector** | 4 | n | n |
| **if the course is the same as courseNumber** | 2 | n | n |
| **If course has less than two parameters** | 2 | n | n |
| **print out the course information** | 1 | 1 | 1 |
| **for each prerequisite of the course** | 1 | n | n |
| **print the prerequisite course information** | 1 | n | n |
| **Total Cost** | | | 5n + 1 |
| **Runtime** | | | O(n) |

The advantages of a vector easiest to sort, commonly used to store data from a file, elements can be deleted, and multiple objects can be stored. The disadvantages of a vector are the coding takes longer and it has a longer runtime. The advantages of hash tables are that it reduces the time it takes to access stored values. The disadvantage of hash tables is the hash table must be filled either by a separate data structure or by user input. The advantage of binary search trees is that when its balanced, the insertion and deletion is the fastest. The disadvantage of binary search trees is that it is slightly slower than an array and if the binary search tree is imbalanced, the complexity is increased. Based on this information and the runtime analysis, the vector is the most efficient, as the sorting aspect is necessary for the client requirements.