# CS 300 Project One – Final Pseudocode and Runtime Analysis

## Pseudocode

### Vector

1. Load Data:  
- Open file  
- For each line:  
 - Split line by comma  
 - Create Course object  
 - Store in vector  
  
2. Print Course:  
- For each course in vector:  
 - If courseNumber matches, print title and prerequisites  
  
3. Print All Courses:  
- Sort vector by courseNumber  
- Print each course in order

### Hash Table

1. Load Data:  
- Open file  
- For each line:  
 - Split by commas  
 - Create Course object  
 - Insert into hash table with courseNumber as key  
  
2. Print Course:  
- Lookup courseNumber in hash table  
- Print title and prerequisites  
  
3. Print All Courses:  
- Retrieve all values from table  
- Sort by courseNumber  
- Print each course

### Binary Search Tree

1. Load Data:  
- Open file and read lines  
- First pass: collect all courseNumbers  
- Second pass:  
 - Validate format and prerequisites  
 - Create Course object  
 - Insert into tree by courseNumber  
  
2. Print Course:  
- Search tree by courseNumber  
- Print course title and prerequisites  
  
3. Print All Courses:  
- Use in-order traversal to print in alphanumeric order

## Menu Pseudocode

Loop until user exits:  
 Display menu:  
 1 - Load Data  
 2 - Print All Courses  
 3 - Print Specific Course  
 9 - Exit  
 Get user input  
 If 1, call load function  
 If 2, call print all function  
 If 3, prompt for courseNumber and print info  
 If 9, break loop

## Runtime Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Operation | Vector | Hash Table | Binary Search Tree |
| Insert | O(1) | O(1) | O(log n) |
| Search | O(n) | O(1) | O(log n) |
| Print All | O(n log n) | O(n log n) | O(n) |

## Structure Comparison

Vector:  
- Advantage: Simple to implement and sort  
- Disadvantage: Linear time search, inefficient for large data  
  
Hash Table:  
- Advantage: Fast lookup  
- Disadvantage: Cannot maintain order without extra steps  
  
Binary Search Tree:  
- Advantage: Maintains order naturally, good for sorted printing  
- Disadvantage: More complex insert/search logic

## Recommendation

I recommend using the binary search tree because it allows both efficient insertion and naturally sorted output using in-order traversal. While hash tables are faster for lookups, they require extra steps for sorting, which makes BST the most balanced choice for this program.