CS106B Syllabus

Below is the tentative syllabus for this quarter’s offering of CS106B. The specific content ordering may change based on how quickly we’re able to move through the relevant topics. The assigned readings may be done before or after each lecture, though we recommend doing the readings before class.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics</th>
<th>Readings</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part One: Processing Data in C++</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, January 7</td>
<td>Why continue onward in programming?</td>
<td>Chapter 1</td>
<td>Assignment 0 Out</td>
</tr>
<tr>
<td></td>
<td>Course Overview</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The C++ Programming Language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday, January 9</td>
<td>How do we harness self-similarity?</td>
<td>Chapter 2</td>
<td>Assignment 0 Due</td>
</tr>
<tr>
<td></td>
<td>Functions in C++</td>
<td></td>
<td>Assignment 1 Out</td>
</tr>
<tr>
<td></td>
<td>Recursive Functions</td>
<td>Chapter 7</td>
<td></td>
</tr>
<tr>
<td>Friday, January 11</td>
<td>How can we process text recursively?</td>
<td>Chapter 3</td>
<td>Assignment 0 Due</td>
</tr>
<tr>
<td></td>
<td>Strings and Streams</td>
<td>Chapter 4.1 – 4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recursion over Strings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, January 14</td>
<td>How do we store aggregate data?</td>
<td>Chapter 5.1</td>
<td>Assignment 1 Due</td>
</tr>
<tr>
<td></td>
<td>Vector and Grid</td>
<td></td>
<td>Assignment 1 Out</td>
</tr>
<tr>
<td></td>
<td>An Optimization Problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday, January 16</td>
<td>How do we model and explore nested structures?</td>
<td>Chapter 5.2 – 5.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stack and Queue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday, January 18</td>
<td>How do we work with associative data?</td>
<td>Chapter 5.4 – 5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Map, Set, and Lexicon</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part Two: Recursive Problem-Solving</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, January 21</td>
<td>Dr. Martin Luther King, Jr. Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Holiday</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday, January 23</td>
<td>How do we model self-similar structures?</td>
<td>Chapter 8.1</td>
<td>Assignment 2 Due</td>
</tr>
<tr>
<td></td>
<td>Graphical Recursion</td>
<td></td>
<td>Assignment 3 Out</td>
</tr>
<tr>
<td></td>
<td>Recursive Enumeration</td>
<td>Chapter 8.4</td>
<td></td>
</tr>
<tr>
<td>Friday, January 25</td>
<td>How do we find all solutions to a problem?</td>
<td>Chapter 8.2 – 8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enumerating Subsets</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enumerating Permutations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, January 28</td>
<td>How do we choose the best team for the job?</td>
<td>Assignment 2 Due</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enumerating Combinations</td>
<td></td>
<td>Assignment 3 Out</td>
</tr>
<tr>
<td></td>
<td>Recursive Optimization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday, January 30</td>
<td>How can we optimally allocate resources?</td>
<td>Chapter 9.1 – 9.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enumeration and Optimization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recursive Backtracking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday, February 1</td>
<td>How do we find a needle in a haystack?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Applications of Backtracking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, February 4</td>
<td>Why are some algorithms faster than others?</td>
<td>Chapter 10.1 – 10.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Algorithmic Efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Big-O Notation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Title</td>
<td>Chapter</td>
<td>Assignment</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| **Wednesday, February 6**  | *What’s the best way to organize our data?*  
Sorting Algorithms                                                                                                                             | 10.3 – 10.5   | 3 Due               |
| **Friday, February 8**      | *How do we define our own collection classes?*  
Designing Abstractions                                                                                                                       | 6             |                    |
| **Monday, February 11**     | *How are dynamic arrays implemented?*  
Dynamic Allocation  
Implementing Stack                                                                                                                       | 11, 12.1      |                    |
| **Wednesday, February 13**  | *How does data representation impact efficiency?*  
Optimizing Stack                                                                                                                             |               |                    |
| **Friday, February 15**     | *How do we form sequences from individual elements?*  
Linked Lists                                                                                                                                     | 12            | 4 Due               |
| **Monday, February 18**     | Presidents’ Day  
National Holiday  
No Class                                                                                                                                 |               |                    |
| **Tuesday, February 19**    | Midterm Exam  
7:00PM – 10:00PM, Location TBA  
Covers Topics from Assignment 0 – Assignment 4                                                                                           |               |                    |
| **Wednesday, February 20**  | *What tradeoffs exist in data representation?*  
Implementing Stack and Queue                                                                                                                   | 13            |                    |
| **Friday, February 22**     | *How can we efficiently store data in sorted order?*  
Binary Search Trees                                                                                                                          | 16.1 – 16.2   |                    |
| **Monday, February 25**     | *How can we efficiently search data in sorted order?*  
Tree and Range Searches                                                                                                                       |               |                    |
| **Wednesday, February 27**  | *How can we efficiently store text?*  
Tries  
Implementing Lexicon                                                                                                                        |               | 5 Due               |
| **Friday, March 1**         | *How can we rapidly store and look up information?*  
Hash Tables  
Implementing HashMap                                                                                                                      | 15            |                    |
| **Part Three: Representing Information** |                                                                                                                                             |               |                    |
| **Monday, March 4**         | *How do we explore network structures?*  
Graphs  
Graph Searches                                                                                                                                | 18.1 – 18.3   |                    |
| **Wednesday, March 6**      | *In what order should we perform a series of tasks?*  
Depth-First Search  
Topological Sorting                                                                                                                        | 18.4          |                    |
| **Friday, March 8**         | *How do we best play matchmaker?*  
Bipartite Matching                                                                                                                               |               | 6 Due               |
| **Monday, March 11**        | *How do we analyze networks?*  
Graph Algorithms                                                                                                                                     |               | 7 Out               |
<table>
<thead>
<tr>
<th>Date</th>
<th>Topics</th>
<th>Readings</th>
<th>Assignments</th>
</tr>
</thead>
</table>
| Wednesday, March 13 | **What do you want to know?**  
Your Questions           |          |                                      |
| Friday, March 15   | **What comes after CS106?**  
Where to Go from Here |          | Assignment 7 Due  
*No Late Submissions*        |
| Monday, March 18   | **Final Exam**  
8:30AM – 11:30AM, Location TBA  
Cumulative; Covers All Topics |          |                                      |

*Part Five: Looking Forward*