1. (10) A hashtable contains the keys of 7, 8, 24, 9, 5, 42, 11, 25, 6, 13, and 12. Provide the table contents using:
   a. m=23 using the division method and open addressing with quadratic probing
   b. m=23 using the division method and chaining

2. (5) What is the expected number of probes for the table in 1a

3. (5) What is the load factor for the table in 1b?
4. (10) Apply the following insertions to build a red black tree. Clearly mark red and black nodes with r or b. Provide intermediate trees. Ambiguous answers will not be graded.

6, 2, 1, 3, 4, 8, 11, 5
5. (10) Given the following frequencies, provide the Huffman tree.

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>O</th>
<th>L</th>
<th>T</th>
<th>I</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq</td>
<td>25%</td>
<td>5%</td>
<td>15%</td>
<td>20%</td>
<td>20%</td>
<td>5%</td>
<td>10%</td>
</tr>
</tbody>
</table>

6. (10) Provide the code/pseudocode for the recursive randomized-select function

   RANDOMIZED-SELECT(A, p, r, i)

7. (15) Using dynamic programming, compute a longest common subsequence for the following strings: “fefgfedfe” “fgfed”. Provide the table and provide the found longest common subsequence indicated by the table. Put the longest string on the horizontal axis and work from the top left corner.
8. (5) For randomized-select, what is the expected runtime?

9. (10) Name the red black tree properties?

10. (5) What is meant by overlapping subproblems in dynamic programming?
11. (10) Can memorizing a problem affect its runtime? Why or why not?

12. (5) What is meant by optimal substructure?