Instructions

1. This is an individual assignment. You must do your own work.

2. Show all work. Incomplete solutions will not receive full credit

Problem 1 (8 Points)

Given two hash functions: \( h_1(x) = (x + 5) \mod 7 \) and \( h_2(x) = 3x \mod 7 \), compute the hashes for the values listed in the table.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( h_1(x) )</th>
<th>( h_2(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Problem 2 (4 Points)

Suppose a DNS (domain name server) is using a cache to keep a table that associates a name its corresponding IP address. It uses a bloom filter with \( m \) bits (by hashing \( k \) values) to quickly determine whether the user’s query is stored in its cache of \( n \) IP addresses. However, the current values of \( m \) and \( n \) have caused many false positives, increasing search time.

1. List two steps that can be taken to reduce collisions and

2. a short explanation why it would reduce collisions

Problem 3 (3 Points)

Give the pre-order traversal of the following tree.

```plaintext
F
 /  \
B    K
 /    \
H    O
 /     
G
```