Algorithms and Data Structures

# Question 2

The hash table begins as

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| - | - | - | - | - | - | - | - | - | - |

Where “-“ indicates a blank space.

The first number to be inserted is 4 which, when hashed, returns position 4. So the table becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| - | - | - | - | 4 | - | - | - | - | - |

The next number to be inserted, , is 1, which returns 5 when hashed. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| - | - | - | - | 4 | 1 | - | - | - | - |

The next number to be inserted, , is 3, which returns 0 when hashed. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | - | - | - | 4 | 1 | - | - | - | - |

The next number to be inserted, , is 0, which returns 0 when hashed. But since 3 is already in index 0, it needs to be moved up to index 1. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | - | - | 4 | 1 | - | - | - | - |

The next number to be inserted, , is 6, which returns 4 when hashed. But since 4 is already in index 4, it needs to be moved up. As 1 is in index 5, 6 moves to index 6. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | - | - | 4 | 1 | 6 | - | - | - |

The next number to be inserted, , is 8, which returns 5 when hashed. But since 1 is already in index 5, it needs to be moved up. As 6 is in index 6, 8 moves to index 7. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | - | - | 4 | 1 | 6 | 8 | - | - |

The next number to be inserted, , is 9, which returns 5 when hashed. But since 5 is already in index 5, it needs to be moved up. As 6 is in index 6, and 8 is in index 7, 9 moves to index 8. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | - | - | 4 | 1 | 6 | 8 | 9 | - |

The next number to be inserted, , is 7, which returns 0 when hashed. But since 3 is already in index 0, it needs to be moved up. As 0 is in index 1, 7 moves to index 2. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | 7 | - | 4 | 1 | 6 | 8 | 9 | - |

The next number to be inserted, , is 2, which returns 5 when hashed. But since 1 is already in index 5, it needs to be moved up. As indices 6, 7, and 9 are filled, 2 moves to index 9. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | 7 | - | 4 | 1 | 6 | 8 | 9 | 2 |

The final number to be inserted, , is 5, which returns 3 when hashed. So the table now becomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 0 | 7 | 5 | 4 | 1 | 6 | 8 | 9 | 2 |