**Question 1:**

Q, stored in an array A[0…5]

Enqueue(4)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 4 |  |  |  |  |  |
| Head / Tail |  |  |  |  |  |

Enqueue(1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 4 | 1 |  |  |  |  |
| Head | Tail |  |  |  |  |

Enqueue(3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 4 | 1 | 3 |  |  |  |
| Head |  | Tail |  |  |  |

Dequeue()

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
|  | 1 | 3 |  |  |  |
|  | Head | Tail |  |  |  |

Enqueue(8)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
|  | 1 | 3 | 8 |  |  |
|  | Head |  |  |  |  |

Dequeue()

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
|  |  | 3 | 8 |  |  |
|  |  | Head | Tail |  |  |

Question 2:

Perform binary search on the following array:

[3, 14, 27, 31, 39, 42, 55, 70, 74, 81, 85, 93, 98]

Keys:

// lower

// higher

While do:

First iteration:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 14 | 27 | 31 | 39 | 42 | 55 | 70 | 74 | 81 | 85 | 93 | 98 |
| l |  |  |  |  |  | m |  |  |  |  |  | r |

Since , we found the match

Return

55: Execute the if statement 1 time

70:

First iteration:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **3** | **14** | **27** | **31** | **39** | **42** | **55** | **70** | **74** | **81** | **85** | **93** | **98** |
| l |  |  |  |  |  | m |  |  |  |  |  | r |

Since (K > A[m]):

Second iteration:

, round to 9

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 14 | 27 | 31 | 39 | 42 | 55 | **70** | **74** | **81** | **85** | **93** | **98** |
|  |  |  |  |  |  |  | l |  | m |  |  | r |

Since (K < A[m]):

Third iteration:

, round to 7

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 14 | 27 | 31 | 39 | 42 | 55 | **70** | **74** | 81 | 85 | 93 | 98 |
|  |  |  |  |  |  |  | l, m | r |  |  |  |  |

Since (K == A[m]): return 70

Took 3 iterations

72

14

b. iii: The initial input n into the binary search algorithm is reduced to n/2 after the first iteration.

**Question 3:**

Devise a strategy to implement a stack

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | Invalid |
| 1 | 6 | 5 | 9 | 8 |  |
|  |  |  |  |  | top |

Add(1); Add(6); Add(2); Pop(); Add(5); Add(9);

Add(8); Add(7)

Need a pointer to the top