

19.14 LeetCode Problem 162. Find Peak Element

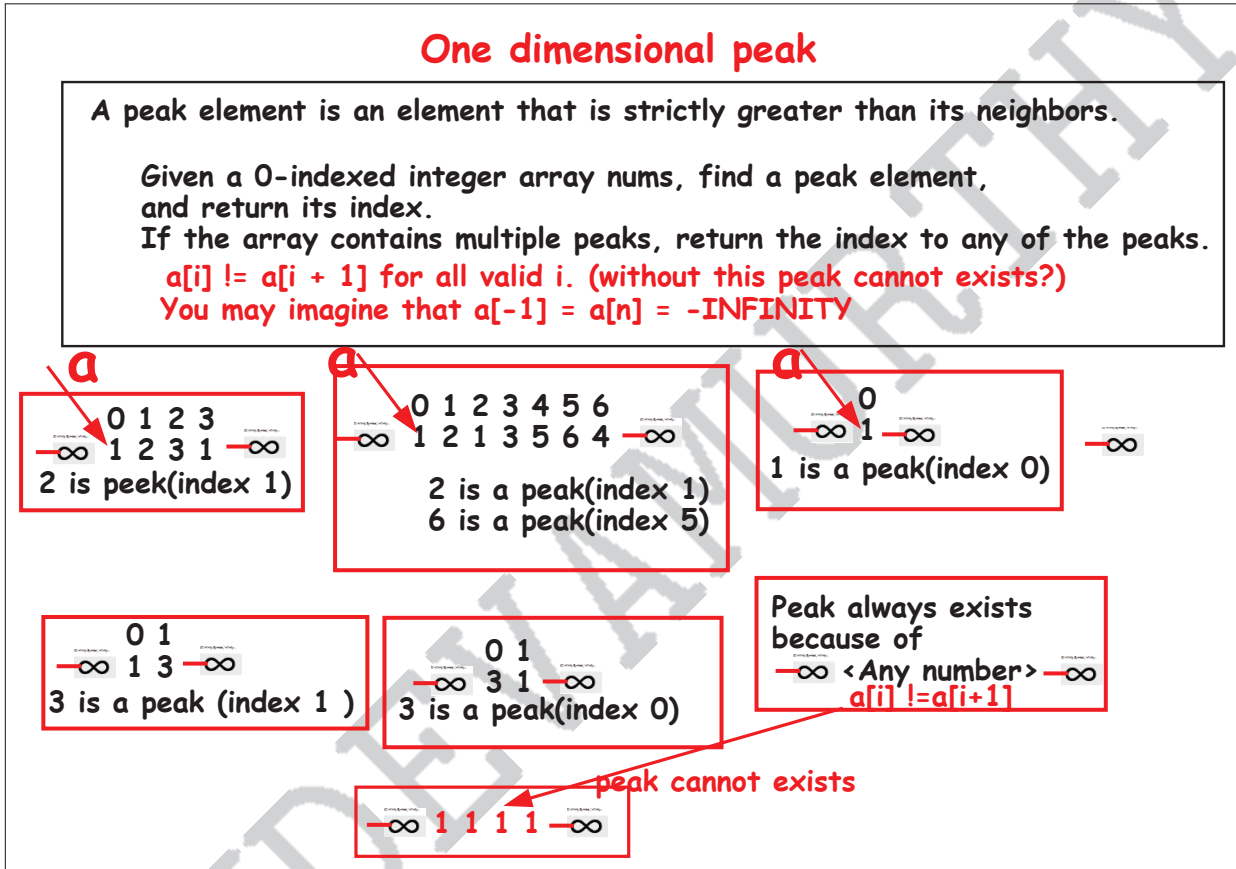


Figure 19.24: L0162: Find Peak Element

19.14.1 Expected output

Testing L0162Test Starts

-----PROBLEM 1 -----

0 1 2 3

1 2 3 1

n time constant space: Peak pos= 2 Peak val= 3 work= 8 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

step: [1] 1: -1 m 2 h 5 P= 2 C= 3 N= 1

logn time logn space: Peak pos= 2 Peak val= 3 work= 3 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

```

step: 1 l: -1 m 2 h 5 P= 2 C= 3 N= 1
-----
logn time constant space: pos= 2 Peak val= 3 work=      3 CPU time in Sec 0.0
-----PROBLEM 2 -----
    0   1   2   3   4   5   6
    1   2   1   3   5   6   4
n time constant space: Peak pos= 1 Peak val= 2 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 3 h 8 P= 1 C= 3 N= 5
step: [2] l: 4 m 6 h 8 P= 6 C= 4 N= -inf
step: [3] l: 4 m 4 h 5 P= 3 C= 5 N= 6
step: [4] l: 5 m 5 h 5 P= 5 C= 6 N= 4
-----
logn time logn space: Peak pos= 5 Peak val= 6 work=     11 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 3 h 8 P= 1 C= 3 N= 5
step: 2 l: 4 m 6 h 8 P= 6 C= 4 N= -inf
step: 3 l: 4 m 4 h 5 P= 3 C= 5 N= 6
step: 4 l: 5 m 5 h 5 P= 5 C= 6 N= 4
-----
logn time constant space: pos= 5 Peak val= 6 work=     11 CPU time in Sec 0.0
-----PROBLEM 3 -----
    0
    1
n time constant space: Peak pos= 0 Peak val= 1 work=      1 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 0 h 2 P= -inf C= 1 N= -inf
-----
logn time logn space: Peak pos= 0 Peak val= 1 work=      1 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 0 h 2 P= -inf C= 1 N= -inf
-----
logn time constant space: pos= 0 Peak val= 1 work=      1 CPU time in Sec 0.0
-----PROBLEM 4 -----
    0   1
    0   1
n time constant space: Peak pos= 1 Peak val= 1 work=      4 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 1 h 3 P= 0 C= 1 N= -inf
-----
logn time logn space: Peak pos= 1 Peak val= 1 work=      2 CPU time in Sec 0.0

```

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```
-----_logn_time_constant_space show-----
step: 1 l: -1 m 1 h 3 P= 0 C= 1 N= -inf
-----
logn time constant space: pos= 1 Peak val= 1 work=      2 CPU time in Sec 0.0
-----PROBLEM 5 -----
    0   1
    1   0
n time constant space: Peak pos= 0 Peak val= 1 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 1 h 3 P= 1 C= 0 N= -inf
step: [2] l: -1 m 0 h 0 P= -inf C= 1 N= 0
-----
logn time logn space: Peak pos= 0 Peak val= 1 work=      4 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 1 h 3 P= 1 C= 0 N= -inf
step: 2 l: -1 m 0 h 0 P= -inf C= 1 N= 0
-----
logn time constant space: pos= 0 Peak val= 1 work=      4 CPU time in Sec 0.0
-----PROBLEM 6 -----
    0   1   2   3   4   5
    0   1   2   3   4   5
n time constant space: Peak pos= 5 Peak val= 5 work=     16 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 3 h 7 P= 2 C= 3 N= 4
step: [2] l: 4 m 5 h 7 P= 4 C= 5 N= -inf
-----
logn time logn space: Peak pos= 5 Peak val= 5 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 3 h 7 P= 2 C= 3 N= 4
step: 2 l: 4 m 5 h 7 P= 4 C= 5 N= -inf
-----
logn time constant space: pos= 5 Peak val= 5 work=      5 CPU time in Sec 0.0
-----PROBLEM 7 -----
    0   1   2   3   4   5
    5   4   3   1   2   0
n time constant space: Peak pos= 0 Peak val= 5 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 3 h 7 P= 3 C= 1 N= 2
step: [2] l: -1 m 0 h 2 P= -inf C= 5 N= 4
-----
logn time logn space: Peak pos= 0 Peak val= 5 work=      5 CPU time in Sec 0.0
```

```

-----_logn_time_constant_space show-----
step: 1 l: -1 m 3 h 7 P= 3 C= 1 N= 2
step: 2 l: -1 m 0 h 2 P= -inf C= 5 N= 4
-----
logn time constant space: pos= 0 Peak val= 5 work=      5 CPU time in Sec 0.0
-----PROBLEM 8 -----
      0   1   2   3   4   5
      4   6   5   0   2   1
n time constant space: Peak pos= 1 Peak val= 6 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 3 h 7 P= 5 C= 0 N= 2
step: [2] l: -1 m 0 h 2 P= -inf C= 4 N= 6
step: [3] l: 1 m 1 h 2 P= 4 C= 6 N= 5
-----
logn time logn space: Peak pos= 1 Peak val= 6 work=      8 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 3 h 7 P= 5 C= 0 N= 2
step: 2 l: -1 m 0 h 2 P= -inf C= 4 N= 6
step: 3 l: 1 m 1 h 2 P= 4 C= 6 N= 5
-----
logn time constant space: pos= 1 Peak val= 6 work=      8 CPU time in Sec 0.0
-----PROBLEM 9 -----
      0   1   2
      3   2   1
n time constant space: Peak pos= 0 Peak val= 3 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 1 h 4 P= 3 C= 2 N= 1
step: [2] l: -1 m 0 h 0 P= -inf C= 3 N= 2
-----
logn time logn space: Peak pos= 0 Peak val= 3 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 1 h 4 P= 3 C= 2 N= 1
step: 2 l: -1 m 0 h 0 P= -inf C= 3 N= 2
-----
logn time constant space: pos= 0 Peak val= 3 work=      5 CPU time in Sec 0.0
-----PROBLEM 10 -----
      0   1   2
      1   2   3
n time constant space: Peak pos= 2 Peak val= 3 work=      7 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 1 h 4 P= 1 C= 2 N= 3

```

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```
step: [2] l: 2 m 2 h 4 P= 2 C= 3 N= -inf
-----
logn time logn space: Peak pos= 2 Peak val= 3 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 1 h 4 P= 1 C= 2 N= 3
step: 2 l: 2 m 2 h 4 P= 2 C= 3 N= -inf
-----
logn time constant space: pos= 2 Peak val= 3 work=      5 CPU time in Sec 0.0
-----PROBLEM 11 -----
--- Length of list: 5000
n time constant space: Peak pos= 4999 Peak val= 4999 work=    14998 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 2499 C= 2500 N= 2501
step: [2] l: 2501 m 3751 h 5001 P= 3750 C= 3751 N= 3752
step: [3] l: 3752 m 4376 h 5001 P= 4375 C= 4376 N= 4377
step: [4] l: 4377 m 4689 h 5001 P= 4688 C= 4689 N= 4690
step: [5] l: 4690 m 4845 h 5001 P= 4844 C= 4845 N= 4846
step: [6] l: 4846 m 4923 h 5001 P= 4922 C= 4923 N= 4924
step: [7] l: 4924 m 4962 h 5001 P= 4961 C= 4962 N= 4963
step: [8] l: 4963 m 4982 h 5001 P= 4981 C= 4982 N= 4983
step: [9] l: 4983 m 4992 h 5001 P= 4991 C= 4992 N= 4993
step: [10] l: 4993 m 4997 h 5001 P= 4996 C= 4997 N= 4998
step: [11] l: 4998 m 4999 h 5001 P= 4998 C= 4999 N= -inf
-----
logn time logn space: Peak pos= 4999 Peak val= 4999 work=    32 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 2499 C= 2500 N= 2501
step: 2 l: 2501 m 3751 h 5001 P= 3750 C= 3751 N= 3752
step: 3 l: 3752 m 4376 h 5001 P= 4375 C= 4376 N= 4377
step: 4 l: 4377 m 4689 h 5001 P= 4688 C= 4689 N= 4690
step: 5 l: 4690 m 4845 h 5001 P= 4844 C= 4845 N= 4846
step: 6 l: 4846 m 4923 h 5001 P= 4922 C= 4923 N= 4924
step: 7 l: 4924 m 4962 h 5001 P= 4961 C= 4962 N= 4963
step: 8 l: 4963 m 4982 h 5001 P= 4981 C= 4982 N= 4983
step: 9 l: 4983 m 4992 h 5001 P= 4991 C= 4992 N= 4993
step: 10 l: 4993 m 4997 h 5001 P= 4996 C= 4997 N= 4998
step: 11 l: 4998 m 4999 h 5001 P= 4998 C= 4999 N= -inf
-----
logn time constant space: pos= 4999 Peak val= 4999 work=    32 CPU time in Sec 0.0
-----PROBLEM 12 -----
--- Length of list: 5000
```

n time constant space: Peak pos= 0 Peak val= 4999 work= 2 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

step: [1] l: -1 m 2500 h 5001 P= 2500 C= 2499 N= 2498

step: [2] l: -1 m 1249 h 2499 P= 3751 C= 3750 N= 3749

step: [3] l: -1 m 623 h 1248 P= 4377 C= 4376 N= 4375

step: [4] l: -1 m 310 h 622 P= 4690 C= 4689 N= 4688

step: [5] l: -1 m 154 h 309 P= 4846 C= 4845 N= 4844

step: [6] l: -1 m 76 h 153 P= 4924 C= 4923 N= 4922

step: [7] l: -1 m 37 h 75 P= 4963 C= 4962 N= 4961

step: [8] l: -1 m 17 h 36 P= 4983 C= 4982 N= 4981

step: [9] l: -1 m 7 h 16 P= 4993 C= 4992 N= 4991

step: [10] l: -1 m 2 h 6 P= 4998 C= 4997 N= 4996

step: [11] l: -1 m 0 h 1 P= -inf C= 4999 N= 4998

logn time logn space: Peak pos= 0 Peak val= 4999 work= 32 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

step: 1 l: -1 m 2500 h 5001 P= 2500 C= 2499 N= 2498

step: 2 l: -1 m 1249 h 2499 P= 3751 C= 3750 N= 3749

step: 3 l: -1 m 623 h 1248 P= 4377 C= 4376 N= 4375

step: 4 l: -1 m 310 h 622 P= 4690 C= 4689 N= 4688

step: 5 l: -1 m 154 h 309 P= 4846 C= 4845 N= 4844

step: 6 l: -1 m 76 h 153 P= 4924 C= 4923 N= 4922

step: 7 l: -1 m 37 h 75 P= 4963 C= 4962 N= 4961

step: 8 l: -1 m 17 h 36 P= 4983 C= 4982 N= 4981

step: 9 l: -1 m 7 h 16 P= 4993 C= 4992 N= 4991

step: 10 l: -1 m 2 h 6 P= 4998 C= 4997 N= 4996

step: 11 l: -1 m 0 h 1 P= -inf C= 4999 N= 4998

logn time constant space: pos= 0 Peak val= 4999 work= 32 CPU time in Sec 0.0

-----PROBLEM 13 -----

--- Length of list: 5000

n time constant space: Peak pos= 1 Peak val= 3639 work= 5 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

step: [1] l: -1 m 2500 h 5001 P= 1093 C= 3239 N= 2501

logn time logn space: Peak pos= 2500 Peak val= 3239 work= 3 CPU time in Sec 0.0

-----_logn_time_constant_space show-----

step: 1 l: -1 m 2500 h 5001 P= 1093 C= 3239 N= 2501

logn time constant space: pos= 2500 Peak val= 3239 work= 3 CPU time in Sec 0.0

-----PROBLEM 14 -----

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```
--- Length of list: 5000
n time constant space: Peak pos= 0 Peak val= 2400 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 805 C= 4023 N= 733
-----
logn time logn space: Peak pos= 2500 Peak val= 4023 work=      3 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 805 C= 4023 N= 733
-----
logn time constant space: pos= 2500 Peak val= 4023 work=      3 CPU time in Sec 0.0
-----PROBLEM 15 -----
--- Length of list: 5000
n time constant space: Peak pos= 2 Peak val= 3682 work=      8 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 761 C= 4601 N= 306
-----
logn time logn space: Peak pos= 2500 Peak val= 4601 work=      3 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 761 C= 4601 N= 306
-----
logn time constant space: pos= 2500 Peak val= 4601 work=      3 CPU time in Sec 0.0
-----PROBLEM 16 -----
--- Length of list: 5000
n time constant space: Peak pos= 1 Peak val= 4902 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 2460 C= 1713 N= 557
step: [2] l: -1 m 1249 h 2499 P= 1163 C= 3695 N= 1135
-----
logn time logn space: Peak pos= 1249 Peak val= 3695 work=      6 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 2460 C= 1713 N= 557
step: 2 l: -1 m 1249 h 2499 P= 1163 C= 3695 N= 1135
-----
logn time constant space: pos= 1249 Peak val= 3695 work=      6 CPU time in Sec 0.0
-----PROBLEM 17 -----
--- Length of list: 5000
n time constant space: Peak pos= 0 Peak val= 4404 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 2976 C= 1403 N= 2808
step: [2] l: -1 m 1249 h 2499 P= 398 C= 3974 N= 1250
-----
```

```

logn time logn space: Peak pos= 1249 Peak val= 3974 work=      6 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 2976 C= 1403 N= 2808
step: 2 l: -1 m 1249 h 2499 P= 398 C= 3974 N= 1250
-----
logn time constant space: pos= 1249 Peak val= 3974 work=      6 CPU time in Sec 0.0
-----PROBLEM 18 -----
--- Length of list: 5000
n time constant space: Peak pos= 1 Peak val= 4379 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 192 C= 4124 N= 1419
-----
logn time logn space: Peak pos= 2500 Peak val= 4124 work=      3 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 192 C= 4124 N= 1419
-----
logn time constant space: pos= 2500 Peak val= 4124 work=      3 CPU time in Sec 0.0
-----PROBLEM 19 -----
--- Length of list: 5000
n time constant space: Peak pos= 0 Peak val= 3589 work=      2 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 3201 C= 3037 N= 444
step: [2] l: -1 m 1249 h 2499 P= 1248 C= 1249 N= 1035
-----
logn time logn space: Peak pos= 1249 Peak val= 1249 work=      6 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 3201 C= 3037 N= 444
step: 2 l: -1 m 1249 h 2499 P= 1248 C= 1249 N= 1035
-----
logn time constant space: pos= 1249 Peak val= 1249 work=      6 CPU time in Sec 0.0
-----PROBLEM 20 -----
--- Length of list: 5000
n time constant space: Peak pos= 2 Peak val= 4797 work=      8 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 2640 C= 2029 N= 1357
step: [2] l: -1 m 1249 h 2499 P= 434 C= 335 N= 1250
step: [3] l: -1 m 623 h 1248 P= 622 C= 4134 N= 2949
-----
logn time logn space: Peak pos= 623 Peak val= 4134 work=      9 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 2640 C= 2029 N= 1357

```


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```
step: 2 l: -1 m 1249 h 2499 P= 434 C= 335 N= 1250
step: 3 l: -1 m 623 h 1248 P= 622 C= 4134 N= 2949
-----
logn time constant space: pos= 623 Peak val= 4134 work=      9 CPU time in Sec 0.0
-----PROBLEM 21 -----
--- Length of list: 5000
n time constant space: Peak pos= 1 Peak val= 1672 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 2765 C= 1731 N= 3154
step: [2] l: -1 m 1249 h 2499 P= 1259 C= 396 N= 1250
step: [3] l: -1 m 623 h 1248 P= 1428 C= 623 N= 3225
step: [4] l: -1 m 310 h 622 P= 3540 C= 271 N= 2762
step: [5] l: -1 m 154 h 309 P= 4780 C= 154 N= 1761
step: [6] l: -1 m 76 h 153 P= 3049 C= 2990 N= 4674
step: [7] l: -1 m 37 h 75 P= 2225 C= 3398 N= 4642
step: [8] l: 38 m 56 h 75 P= 1316 C= 3204 N= 534
-----
logn time logn space: Peak pos= 56 Peak val= 3204 work=      24 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 2765 C= 1731 N= 3154
step: 2 l: -1 m 1249 h 2499 P= 1259 C= 396 N= 1250
step: 3 l: -1 m 623 h 1248 P= 1428 C= 623 N= 3225
step: 4 l: -1 m 310 h 622 P= 3540 C= 271 N= 2762
step: 5 l: -1 m 154 h 309 P= 4780 C= 154 N= 1761
step: 6 l: -1 m 76 h 153 P= 3049 C= 2990 N= 4674
step: 7 l: -1 m 37 h 75 P= 2225 C= 3398 N= 4642
step: 8 l: 38 m 56 h 75 P= 1316 C= 3204 N= 534
-----
logn time constant space: pos= 56 Peak val= 3204 work=      24 CPU time in Sec 0.0
-----PROBLEM 22 -----
--- Length of list: 5000
n time constant space: Peak pos= 1 Peak val= 3436 work=      5 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: [1] l: -1 m 2500 h 5001 P= 4263 C= 3234 N= 4513
step: [2] l: -1 m 1249 h 2499 P= 3292 C= 1112 N= 1250
step: [3] l: -1 m 623 h 1248 P= 622 C= 2998 N= 1243
-----
logn time logn space: Peak pos= 623 Peak val= 2998 work=      9 CPU time in Sec 0.0
-----_logn_time_constant_space show-----
step: 1 l: -1 m 2500 h 5001 P= 4263 C= 3234 N= 4513
step: 2 l: -1 m 1249 h 2499 P= 3292 C= 1112 N= 1250
```

step: 3 l: -1 m 623 h 1248 P= 622 C= 2998 N= 1243

-----SOME OUTPUT IS REMOVED FOT RANDOM CASES-----

logn time constant space: pos= 623 Peak val= 2998 work= 9 CPU time in Sec 0.0
You are genius. All tests passed. Evalaute me on Trace NOW

19.14.2 Leetcode output

162. Find Peak Element
<https://leetcode.com/problems/find-peak-element/>

```
class Solution:
    def findPeakElement(self, nums: List[int]) -> 'int':
        work = [0]
        ans = [-1]
        show = False
        if (False):
            b = L0162(nums,ans,work,show,"n time constant space")
        if (False):
            b = L0162(nums,ans,work,show,"logn time logn space")
        if (True):
            b = L0162(nums,ans,work,show,"logn time constant space")
        return ans[0]
```

Success Details >

Runtime: 66 ms, faster than 21.11% of Python3 online submissions for Find Peak Element.

Memory Usage: 16.8 MB, less than 17.33% of Python3 online submissions for Find Peak Element.

Success Details >

Runtime: 64 ms, faster than 30.39% of Python3 online submissions for Find Peak Element.

Memory Usage: 17 MB, less than 17.33% of Python3 online submissions for Find Peak Element.

Success Details >

Runtime: 63 ms, faster than 35.24% of Python3 online submissions for Find Peak Element.

Memory Usage: 16.7 MB, less than 17.33% of Python3 online submissions for Find Peak Element.

Figure 19.25: Problem 162: Find Peak Element passed