

```
/Library/Java/JavaVirtualMachines/jdk-13.0.1.jdk/Contents/Home/bin/java "-javaagent:/Applications/IntelliJ
IDEA CE.app/Contents/lib/idea_rt.jar=63700:/Applications/IntelliJ IDEA CE.app/Contents/bin" -
Dfile.encoding=UTF-8 -classpath /Users/lanshunfang/Documents/NEU-Classes-Courses/JAVA/alg-
hw/out/production/alg-hw org.neu.alg.hw.hw4.duplicateN
```

duplicateN problem STARTS

```
0  1  2
1  1  1
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 3 CPU = 1.0357E-5 secs

$O(n)$ Time $O(n)$ Space Alg. n = 3 CPU = 8.056E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 3 CPU = 1.3059E-5 secs

```
0  1  2  3
1  0  0  0
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 4 CPU = 3.3310000000000004E-6 secs

$O(n)$ Time $O(n)$ Space Alg. n = 4 CPU = 2.653E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 4 CPU = 3.102E-6 secs

```
0  1  2  3  4  5  6
1  2  3  1  3  6  6
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 7 CPU = 3.7169999999999997E-6 secs

$O(n)$ Time $O(n)$ Space Alg. n = 7 CPU = 2.74E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 7 CPU = 4.074E-6 secs

```
0  1  2  3  4  5  6
1  2  3  1  3  0  0
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 7 CPU = 4.7980000000000005E-6 secs

$O(n)$ Time $O(n)$ Space Alg. n = 7 CPU = 2.963E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 7 CPU = 4.0E-6 secs

```
0  1  2
0  0  1
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 3 CPU = 2.6519999999999998E-6 secs

$O(n)$ Time $O(n)$ Space Alg. n = 3 CPU = 2.715E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 3 CPU = 2.5839999999999997E-6 secs

```
0  1  2  3
3  2  0  1
```

$O(n^2)$ Time $O(1)$ Space Alg. n = 4 CPU = 2.9339999999999998E-6 secs

$O(n)$ Time $O(n)$ Space Alg. n = 4 CPU = 2.614E-6 secs

$O(n)$ Time $O(1)$ Space Alg. n = 4 CPU = 3.111E-6 secs

All simple tests passed

$O(n^2)$ Time $O(1)$ Space Alg.	n = 10000 CPU = 0.25663248099999997 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 10000 CPU = 5.3021300000000001E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 10000 CPU = 9.90933E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 10000 CPU = 0.298457932000000004 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 10000 CPU = 0.00189107200000000002 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 10000 CPU = 0.0024802599999999998 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 20000 CPU = 0.552551289 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 20000 CPU = 0.002359304 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 20000 CPU = 0.002697662 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 20000 CPU = 0.295028058 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 20000 CPU = 6.1492500000000001E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 20000 CPU = 0.003557935 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 30000 CPU = 0.663311422 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 30000 CPU = 3.20831E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 30000 CPU = 5.94068E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 30000 CPU = 0.380575234000000004 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 30000 CPU = 3.57419E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 30000 CPU = 5.95617E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 40000 CPU = 0.864123045 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 40000 CPU = 2.14418E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 40000 CPU = 2.61899E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 40000 CPU = 0.65464445 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 40000 CPU = 2.81604E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 40000 CPU = 6.81894E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 50000 CPU = 1.429249893 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 50000 CPU = 2.82059E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 50000 CPU = 3.27759E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 50000 CPU = 1.02306764 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 50000 CPU = 4.6053699999999996E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 50000 CPU = 9.4093800000000001E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 60000 CPU = 2.0016480469999998 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 60000 CPU = 3.01988E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 60000 CPU = 1.8139E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 60000 CPU = 1.498209881 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 60000 CPU = 4.75752E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 60000 CPU = 7.81806E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 70000 CPU = 2.774643776 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 70000 CPU = 3.59089E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 70000 CPU = 2.38337E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 70000 CPU = 2.0979956950000003 secs

O(n)Time O(n)Space Alg.	n = 70000 CPU = 5.620169999999999E-4 secs
O(n)Time O(1)Space Alg.	n = 70000 CPU = 9.3021E-4 secs
O(n^2)Time O(1)Space Alg.	n = 80000 CPU = 3.6810649709999996 secs
O(n)Time O(n)Space Alg.	n = 80000 CPU = 5.89005E-4 secs
O(n)Time O(1)Space Alg.	n = 80000 CPU = 4.28162E-4 secs
O(n^2)Time O(1)Space Alg.	n = 80000 CPU = 2.700862698 secs
O(n)Time O(n)Space Alg.	n = 80000 CPU = 7.18738E-4 secs
O(n)Time O(1)Space Alg.	n = 80000 CPU = 0.001194727 secs
O(n^2)Time O(1)Space Alg.	n = 90000 CPU = 4.64705306 secs
O(n)Time O(n)Space Alg.	n = 90000 CPU = 4.37868E-4 secs
O(n)Time O(1)Space Alg.	n = 90000 CPU = 2.9920999999999995E-4 secs
O(n^2)Time O(1)Space Alg.	n = 90000 CPU = 3.420115315 secs
O(n)Time O(n)Space Alg.	n = 90000 CPU = 6.86264E-4 secs
O(n)Time O(1)Space Alg.	n = 90000 CPU = 0.001332003 secs
O(n^2)Time O(1)Space Alg.	n = 100000 CPU = 5.8726528689999995 secs
O(n)Time O(n)Space Alg.	n = 100000 CPU = 2.66944E-4 secs
O(n)Time O(1)Space Alg.	n = 100000 CPU = 2.96603E-4 secs
O(n^2)Time O(1)Space Alg.	n = 100000 CPU = 4.3860721940000005 secs
O(n)Time O(n)Space Alg.	n = 100000 CPU = 0.0010596639999999999 secs
O(n)Time O(1)Space Alg.	n = 100000 CPU = 0.002455636 secs
O(n^2)Time O(1)Space Alg.	n = 110000 CPU = 6.9475351790000001 secs
O(n)Time O(n)Space Alg.	n = 110000 CPU = 3.26286E-4 secs
O(n)Time O(1)Space Alg.	n = 110000 CPU = 3.78225E-4 secs
O(n^2)Time O(1)Space Alg.	n = 110000 CPU = 5.443920378 secs
O(n)Time O(n)Space Alg.	n = 110000 CPU = 5.71184E-4 secs
O(n)Time O(1)Space Alg.	n = 110000 CPU = 0.001786658 secs
O(n^2)Time O(1)Space Alg.	n = 120000 CPU = 8.258725791000002 secs
O(n)Time O(n)Space Alg.	n = 120000 CPU = 3.9317999999999997E-4 secs
O(n)Time O(1)Space Alg.	n = 120000 CPU = 4.44268E-4 secs
O(n^2)Time O(1)Space Alg.	n = 120000 CPU = 6.097875235 secs
O(n)Time O(n)Space Alg.	n = 120000 CPU = 7.89389E-4 secs
O(n)Time O(1)Space Alg.	n = 120000 CPU = 0.001686353 secs
O(n^2)Time O(1)Space Alg.	n = 130000 CPU = 9.559464147 secs
O(n)Time O(n)Space Alg.	n = 130000 CPU = 3.7448799999999997E-4 secs
O(n)Time O(1)Space Alg.	n = 130000 CPU = 5.04244E-4 secs
O(n^2)Time O(1)Space Alg.	n = 130000 CPU = 7.180196994 secs
O(n)Time O(n)Space Alg.	n = 130000 CPU = 8.579379999999999E-4 secs
O(n)Time O(1)Space Alg.	n = 130000 CPU = 0.001862305 secs
O(n^2)Time O(1)Space Alg.	n = 140000 CPU = 10.860203946 secs
O(n)Time O(n)Space Alg.	n = 140000 CPU = 6.13699E-4 secs
O(n)Time O(1)Space Alg.	n = 140000 CPU = 4.08286E-4 secs

$O(n^2)$ Time $O(1)$ Space Alg.	n = 140000 CPU = 8.237548495999999 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 140000 CPU = 0.001098284 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 140000 CPU = 0.002169035 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 150000 CPU = 13.274032691 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 150000 CPU = 7.3535700000000001E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 150000 CPU = 4.978739999999999E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 150000 CPU = 9.539934598 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 150000 CPU = 0.001505785 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 150000 CPU = 0.00223839 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 160000 CPU = 14.324398762000001 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 160000 CPU = 6.79198E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 160000 CPU = 4.8097E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 160000 CPU = 10.694052566 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 160000 CPU = 0.001190313 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 160000 CPU = 0.002419458 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 170000 CPU = 18.15708079 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 170000 CPU = 7.98163E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 170000 CPU = 0.002234835 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 170000 CPU = 12.073036678000001 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 170000 CPU = 0.0011881189999999999 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 170000 CPU = 0.002420814 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 180000 CPU = 17.661740613000003 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 180000 CPU = 8.87948E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 180000 CPU = 5.8660000000000001E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 180000 CPU = 13.189532026999998 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 180000 CPU = 0.00127994800000000002 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 180000 CPU = 0.002470854 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 190000 CPU = 19.296753298 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 190000 CPU = 7.96658E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 190000 CPU = 5.88708E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 190000 CPU = 14.861030661000001 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 190000 CPU = 0.0013641389999999999 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 190000 CPU = 0.00320269000000000002 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 200000 CPU = 21.305529827999997 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 200000 CPU = 8.8748000000000001E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 200000 CPU = 6.20511E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 200000 CPU = 16.47201103 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 200000 CPU = 0.001412237 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 200000 CPU = 0.002810974 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 210000 CPU = 24.127639371 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 210000 CPU = 9.10192E-4 secs

$O(n)$ Time $O(1)$ Space Alg.	$n = 210000$ CPU = 6.9934300000000001E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 210000$ CPU = 17.882088777 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 210000$ CPU = 0.001537905 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 210000$ CPU = 0.002962709 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 220000$ CPU = 25.924265702 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 220000$ CPU = 9.46028E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 220000$ CPU = 6.58831E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 220000$ CPU = 19.476428745 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 220000$ CPU = 0.001634262 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 220000$ CPU = 0.00317589 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 230000$ CPU = 28.294443796 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 230000$ CPU = 8.91026E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 230000$ CPU = 7.6952E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 230000$ CPU = 21.450813515 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 230000$ CPU = 0.001654908 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 230000$ CPU = 0.004019246 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 240000$ CPU = 30.914566671 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 240000$ CPU = 8.27546E-4 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 240000$ CPU = 7.50253E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 240000$ CPU = 23.374157512999997 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 240000$ CPU = 0.00248698400000000002 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 240000$ CPU = 0.0047007149999999999 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 250000$ CPU = 33.902504325 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 250000$ CPU = 0.001427776 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 250000$ CPU = 8.30326E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 250000$ CPU = 25.884381265 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 250000$ CPU = 0.00259601099999999996 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 250000$ CPU = 0.004746904 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 260000$ CPU = 36.573076454 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 260000$ CPU = 0.001329953 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 260000$ CPU = 8.62961E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 260000$ CPU = 28.2000308230000002 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 260000$ CPU = 0.002308055 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 260000$ CPU = 0.00501187200000000005 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 270000$ CPU = 39.763600534 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 270000$ CPU = 0.001330658 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 270000$ CPU = 9.160199999999999E-4 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 270000$ CPU = 29.791552438 secs
$O(n)$ Time $O(n)$ Space Alg.	$n = 270000$ CPU = 0.001414404 secs
$O(n)$ Time $O(1)$ Space Alg.	$n = 270000$ CPU = 0.00393897 secs
$O(n^2)$ Time $O(1)$ Space Alg.	$n = 280000$ CPU = 42.872883857 secs

O(n)Time O(n)Space Alg.	n = 280000 CPU = 0.001310155 secs
O(n)Time O(1)Space Alg.	n = 280000 CPU = 9.314E-4 secs
O(n^2)Time O(1)Space Alg.	n = 280000 CPU = 32.210504704 secs
O(n)Time O(n)Space Alg.	n = 280000 CPU = 0.00154879 secs
O(n)Time O(1)Space Alg.	n = 280000 CPU = 0.004051917 secs
O(n^2)Time O(1)Space Alg.	n = 290000 CPU = 46.372556624 secs
O(n)Time O(n)Space Alg.	n = 290000 CPU = 0.0014072050000000001 secs
O(n)Time O(1)Space Alg.	n = 290000 CPU = 9.62415E-4 secs
O(n^2)Time O(1)Space Alg.	n = 290000 CPU = 33.70279754 secs
O(n)Time O(n)Space Alg.	n = 290000 CPU = 0.00169919 secs
O(n)Time O(1)Space Alg.	n = 290000 CPU = 0.004138075 secs
O(n^2)Time O(1)Space Alg.	n = 300000 CPU = 60.355555310999996 secs
O(n)Time O(n)Space Alg.	n = 300000 CPU = 0.001626361 secs
O(n)Time O(1)Space Alg.	n = 300000 CPU = 9.98087E-4 secs
O(n^2)Time O(1)Space Alg.	n = 300000 CPU = 41.591971264 secs
O(n)Time O(n)Space Alg.	n = 300000 CPU = 0.002522163 secs
O(n)Time O(1)Space Alg.	n = 300000 CPU = 0.020051536 secs
O(n^2)Time O(1)Space Alg.	n = 310000 CPU = 54.792945478 secs
O(n)Time O(n)Space Alg.	n = 310000 CPU = 0.0014658590000000001 secs
O(n)Time O(1)Space Alg.	n = 310000 CPU = 0.001055213 secs
O(n^2)Time O(1)Space Alg.	n = 310000 CPU = 39.31903862 secs
O(n)Time O(n)Space Alg.	n = 310000 CPU = 0.001658551 secs
O(n)Time O(1)Space Alg.	n = 310000 CPU = 0.004353838 secs
O(n^2)Time O(1)Space Alg.	n = 320000 CPU = 56.152028418 secs
O(n)Time O(n)Space Alg.	n = 320000 CPU = 0.00162816 secs
O(n)Time O(1)Space Alg.	n = 320000 CPU = 0.001088624 secs
O(n^2)Time O(1)Space Alg.	n = 320000 CPU = 41.212176299999996 secs
O(n)Time O(n)Space Alg.	n = 320000 CPU = 0.001729899 secs
O(n)Time O(1)Space Alg.	n = 320000 CPU = 0.004463342 secs
O(n^2)Time O(1)Space Alg.	n = 330000 CPU = 62.307369915 secs
O(n)Time O(n)Space Alg.	n = 330000 CPU = 0.0015366450000000001 secs
O(n)Time O(1)Space Alg.	n = 330000 CPU = 0.0011248579999999998 secs
O(n^2)Time O(1)Space Alg.	n = 330000 CPU = 44.706399742 secs
O(n)Time O(n)Space Alg.	n = 330000 CPU = 0.001966913 secs
O(n)Time O(1)Space Alg.	n = 330000 CPU = 0.004722402 secs
O(n^2)Time O(1)Space Alg.	n = 340000 CPU = 63.369253386 secs
O(n)Time O(n)Space Alg.	n = 340000 CPU = 0.0015737300000000002 secs
O(n)Time O(1)Space Alg.	n = 340000 CPU = 0.00114178 secs
O(n^2)Time O(1)Space Alg.	n = 340000 CPU = 48.309048949 secs
O(n)Time O(n)Space Alg.	n = 340000 CPU = 0.00196628 secs
O(n)Time O(1)Space Alg.	n = 340000 CPU = 0.004757037 secs

$O(n^2)$ Time $O(1)$ Space Alg.	n = 350000 CPU = 67.02263555900001 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 350000 CPU = 0.001578085 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 350000 CPU = 0.001175212 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 350000 CPU = 49.551082161 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 350000 CPU = 0.0020420919999999997 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 350000 CPU = 0.0051213579999999995 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 360000 CPU = 69.814245674 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 360000 CPU = 0.001581669 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 360000 CPU = 0.001269427 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 360000 CPU = 56.550689976 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 360000 CPU = 0.003229159 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 360000 CPU = 0.008581069 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 370000 CPU = 74.384001703 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 370000 CPU = 0.002053848 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 370000 CPU = 0.001329437 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 370000 CPU = 54.819980553 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 370000 CPU = 0.0035204 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 370000 CPU = 0.007121112 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 380000 CPU = 76.637296213 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 380000 CPU = 0.001996494 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 380000 CPU = 0.001356748 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 380000 CPU = 58.337755195 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 380000 CPU = 0.002533082 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 380000 CPU = 0.005772886 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 390000 CPU = 80.93337006099999 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 390000 CPU = 0.001722 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 390000 CPU = 0.001516942 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 390000 CPU = 61.783184363000004 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 390000 CPU = 0.00233008 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 390000 CPU = 0.005996861 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 400000 CPU = 85.08566341 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 400000 CPU = 0.00195078 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 400000 CPU = 0.001453914 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 400000 CPU = 64.874759516 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 400000 CPU = 0.002605823 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 400000 CPU = 0.005958997 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 410000 CPU = 93.092494698 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 410000 CPU = 0.001917623 secs
$O(n)$ Time $O(1)$ Space Alg.	n = 410000 CPU = 0.001401028 secs
$O(n^2)$ Time $O(1)$ Space Alg.	n = 410000 CPU = 68.66992263600001 secs
$O(n)$ Time $O(n)$ Space Alg.	n = 410000 CPU = 0.002593865 secs

O(n)Time O(1)Space Alg.	n = 410000 CPU = 0.006097712 secs
O(n^2)Time O(1)Space Alg.	n = 420000 CPU = 94.23112759600001 secs
O(n)Time O(n)Space Alg.	n = 420000 CPU = 0.001921332 secs
O(n)Time O(1)Space Alg.	n = 420000 CPU = 0.0014615020000000002 secs
O(n^2)Time O(1)Space Alg.	n = 420000 CPU = 70.800027823 secs
O(n)Time O(n)Space Alg.	n = 420000 CPU = 0.002506512 secs
O(n)Time O(1)Space Alg.	n = 420000 CPU = 0.0061044340000000001 secs
O(n^2)Time O(1)Space Alg.	n = 430000 CPU = 100.41011933499999 secs
O(n)Time O(n)Space Alg.	n = 430000 CPU = 0.00186017000000000002 secs
O(n)Time O(1)Space Alg.	n = 430000 CPU = 0.002202205 secs
O(n^2)Time O(1)Space Alg.	n = 430000 CPU = 74.31141081099999 secs
O(n)Time O(n)Space Alg.	n = 430000 CPU = 0.0032679619999999997 secs
O(n)Time O(1)Space Alg.	n = 430000 CPU = 0.006577104 secs
O(n^2)Time O(1)Space Alg.	n = 440000 CPU = 103.247698089 secs
O(n)Time O(n)Space Alg.	n = 440000 CPU = 0.0019044399999999999 secs
O(n)Time O(1)Space Alg.	n = 440000 CPU = 0.001472677 secs
O(n^2)Time O(1)Space Alg.	n = 440000 CPU = 77.42468460799999 secs
O(n)Time O(n)Space Alg.	n = 440000 CPU = 0.002842266 secs
O(n)Time O(1)Space Alg.	n = 440000 CPU = 0.0070909729999999995 secs
O(n^2)Time O(1)Space Alg.	n = 450000 CPU = 121.95642216099999 secs
O(n)Time O(n)Space Alg.	n = 450000 CPU = 0.002107551 secs
O(n)Time O(1)Space Alg.	n = 450000 CPU = 0.001504413 secs
O(n^2)Time O(1)Space Alg.	n = 450000 CPU = 85.558040732 secs
O(n)Time O(n)Space Alg.	n = 450000 CPU = 0.0027259899999999998 secs
O(n)Time O(1)Space Alg.	n = 450000 CPU = 0.006589574 secs
O(n^2)Time O(1)Space Alg.	n = 460000 CPU = 118.815567926 secs
O(n)Time O(n)Space Alg.	n = 460000 CPU = 0.002034655 secs
O(n)Time O(1)Space Alg.	n = 460000 CPU = 0.0016435249999999998 secs
O(n^2)Time O(1)Space Alg.	n = 460000 CPU = 88.02581724999999 secs
O(n)Time O(n)Space Alg.	n = 460000 CPU = 0.0032033689999999997 secs
O(n)Time O(1)Space Alg.	n = 460000 CPU = 0.007107593 secs
O(n^2)Time O(1)Space Alg.	n = 470000 CPU = 125.874570591 secs
O(n)Time O(n)Space Alg.	n = 470000 CPU = 0.002042683 secs
O(n)Time O(1)Space Alg.	n = 470000 CPU = 0.00237660200000000002 secs
O(n^2)Time O(1)Space Alg.	n = 470000 CPU = 92.552360205 secs
O(n)Time O(n)Space Alg.	n = 470000 CPU = 0.00304008 secs
O(n)Time O(1)Space Alg.	n = 470000 CPU = 0.006764739 secs
O(n^2)Time O(1)Space Alg.	n = 480000 CPU = 122.849080618 secs
O(n)Time O(n)Space Alg.	n = 480000 CPU = 0.002117759 secs
O(n)Time O(1)Space Alg.	n = 480000 CPU = 0.002265777 secs
O(n^2)Time O(1)Space Alg.	n = 480000 CPU = 93.591870182 secs

O(n)Time O(n)Space Alg. n = 480000 CPU = 0.002987565 secs
O(n)Time O(1)Space Alg. n = 480000 CPU = 0.0068774249999999995 secs
O(n^2)Time O(1)Space Alg. n = 490000 CPU = 126.20709835299999 secs
O(n)Time O(n)Space Alg. n = 490000 CPU = 0.002039001 secs
O(n)Time O(1)Space Alg. n = 490000 CPU = 0.0023752219999999998 secs
O(n^2)Time O(1)Space Alg. n = 490000 CPU = 96.18068623 secs
O(n)Time O(n)Space Alg. n = 490000 CPU = 0.003344359 secs
O(n)Time O(1)Space Alg. n = 490000 CPU = 0.007172084 secs

500000 Random tests passed

All test cases passed. You will get full grade now

Include only duplicateN.java and the output of this program for FULL grade

You now understand why we should reduce $O(n^2)$ algorithm to $O(n)$ algorithm
duplicateN problem ENDS

Process finished with exit code 0