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文件夹: class004_SelectionBubbleAndInsertionSort
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[Markdown 文件]

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[代码文件]
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文件: SelectBubbleInsert.cpp
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/**
 * 选择排序、冒泡排序、插入排序的实现和详细分析 - C++版本
 * 这三个算法都属于简单排序算法，时间复杂度均为  $O(n^2)$ 
 *
 * 选择排序(Selection Sort):
 * - 工作原理: 每次从未排序的部分中找到最小元素，放到已排序部分的末尾
 * - 时间复杂度:  $O(n^2)$  - 最好、平均、最坏情况都相同
 * - 空间复杂度:  $O(1)$  - 原地排序
 * - 稳定性: 不稳定
 * - 适用场景: 数据量小且对稳定性无要求
 *
 * 冒泡排序(Bubble Sort):
 * - 工作原理: 相邻元素两两比较，如果顺序错误就交换，每轮将最大元素“冒泡”到末尾
 * - 时间复杂度:  $O(n^2)$  - 最坏和平均情况,  $O(n)$  - 最好情况(已排序)
 * - 空间复杂度:  $O(1)$  - 原地排序
 * - 稳定性: 稳定
 * - 适用场景: 数据量小且要求稳定性
 *
 * 插入排序(Insertion Sort):
 * - 工作原理: 将未排序元素插入到已排序序列的适当位置
 * - 时间复杂度:  $O(n^2)$  - 最坏情况,  $O(n)$  - 最好情况(已排序)
 * - 空间复杂度:  $O(1)$  - 原地排序
 * - 稳定性: 稳定
 * - 适用场景: 小规模数据或基本有序的数据
 *
 * 相关题目（从各大算法平台广泛搜集）:
 *
 * LeetCode（力扣）:
 * 1. LeetCode 912. Sort an Array - https://leetcode.cn/problems/sort-an-array/
 * 2. LeetCode 215. Kth Largest Element in an Array - https://leetcode.cn/problems/kth-largest-element-in-an-array/
 * 3. LeetCode 75. Sort Colors - https://leetcode.cn/problems/sort-colors/
 * 4. LeetCode 164. Maximum Gap - https://leetcode.cn/problems/maximum-gap/
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- * 5. LeetCode 147. Insertion Sort List - <https://leetcode.cn/problems/insertion-sort-list/>
- * 6. LeetCode 274. H-Index - <https://leetcode.cn/problems/h-index/>
- * 7. LeetCode 280. Wiggle Sort - <https://leetcode.cn/problems/wiggle-sort/>
- * 8. LeetCode 324. Wiggle Sort II - <https://leetcode.cn/problems/wiggle-sort-ii/>
- * 9. LeetCode 349. Intersection of Two Arrays - <https://leetcode.cn/problems/intersection-of-two-arrays/>
- * 10. LeetCode 350. Intersection of Two Arrays II - <https://leetcode.cn/problems/intersection-of-two-arrays-ii/>
- *
- * 剑指 Offer:
- * 11. 剑指 Offer 45. 把数组排成最小的数 - <https://leetcode.cn/problems/ba-shu-zu-pai-cheng-zui-xiao-de-shu-lcof/>
- * 12. 剑指 Offer 40. 最小的k个数 - <https://leetcode.cn/problems/zui-xiao-de-kge-shu-lcof/>
- * 13. 剑指 Offer 51. 数组中的逆序对 - <https://leetcode.cn/problems/shu-zu-zhong-de-ni-xu-dui-lcof/>
- *
- * LintCode (炼码):
- * 14. LintCode 463. Sort Integers - <https://www.lintcode.com/problem/463/>
- * 15. LintCode 143. Sort Colors II - <https://www.lintcode.com/problem/143/>
- * 16. LintCode 508. Wiggle Sort - <https://www.lintcode.com/problem/508/>
- * 17. LintCode 5. Kth Largest Element - <https://www.lintcode.com/problem/5/>
- *
- * HackerRank:
- * 18. Insertion Sort - Part 1 - <https://www.hackerrank.com/challenges/insertionsort1/problem>
- * 19. Insertion Sort - Part 2 - <https://www.hackerrank.com/challenges/insertionsort2/problem>
- * 20. Correctness and the Loop Invariant - <https://www.hackerrank.com/challenges/correctness-invariant/problem>
- * 21. Running Time of Algorithms - <https://www.hackerrank.com/challenges/runningtime/problem>
- * 22. Sorting - Bubble Sort - <https://www.hackerrank.com/challenges/ctci-bubble-sort/problem>
- * 23. Counting Sort 1 - <https://www.hackerrank.com/challenges/countingsort1/problem>
- * 24. Counting Sort 2 - <https://www.hackerrank.com/challenges/countingsort2/problem>
- * 25. Counting Sort 3 - <https://www.hackerrank.com/challenges/countingsort3/problem>
- * 26. Counting Sort 4 - <https://www.hackerrank.com/challenges/countingsort4/problem>
- *
- * Codeforces:
- * 27. CF 4A. Watermelon - <https://codeforces.com/problemset/problem/4/A>
- * 28. CF 339A. Helpful Maths - <https://codeforces.com/problemset/problem/339/A>
- * 29. CF 474A. Keyboard - <https://codeforces.com/problemset/problem/474/A>
- * 30. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>
- * 31. CF 158A. Next Round - <https://codeforces.com/problemset/problem/158/A>
- * 32. CF 118A. String Task - <https://codeforces.com/problemset/problem/118/A>
- * 33. CF 231A. Team - <https://codeforces.com/problemset/problem/231/A>
- * 34. CF 282A. Bit++ - <https://codeforces.com/problemset/problem/282/A>

- * 35. CF 50A. Domino piling - <https://codeforces.com/problemset/problem/50/A>
- * 36. CF 263A. Beautiful Matrix - <https://codeforces.com/problemset/problem/263/A>
- * 37. CF 158B. Taxi - <https://codeforces.com/problemset/problem/158/B>
- * 38. CF 112A. Petya and Strings - <https://codeforces.com/problemset/problem/112/A>
- * 39. CF 266A. Stones on the Table - <https://codeforces.com/problemset/problem/266/A>
- * 40. CF 337A. Puzzles - <https://codeforces.com/problemset/problem/337/A>
- * 41. CF 451A. Game With Sticks - <https://codeforces.com/problemset/problem/451/A>
- * 42. CF 460A. Vasya and Socks - <https://codeforces.com/problemset/problem/460/A>
- * 43. CF 479A. Expression - <https://codeforces.com/problemset/problem/479/A>
- * 44. CF 486A. Calculating Function - <https://codeforces.com/problemset/problem/486/A>
- * 45. CF 492A. Vanya and Cubes - <https://codeforces.com/problemset/problem/492/A>
- * 46. CF 510A. Fox And Snake - <https://codeforces.com/problemset/problem/510/A>
- * 47. CF 520A. Pangram - <https://codeforces.com/problemset/problem/520/A>
- * 48. CF 546A. Soldier and Bananas - <https://codeforces.com/problemset/problem/546/A>
- * 49. CF 580A. Kefa and First Steps - <https://codeforces.com/problemset/problem/580/A>
- * 50. CF 581A. Vasya the Hipster - <https://codeforces.com/problemset/problem/581/A>
- * 51. CF 59A. Word - <https://codeforces.com/problemset/problem/59/A>
- * 52. CF 617A. Elephant - <https://codeforces.com/problemset/problem/617/A>
- * 53. CF 61A. Ultra-Fast Mathematician - <https://codeforces.com/problemset/problem/61/A>
- * 54. CF 69A. Young Physicist - <https://codeforces.com/problemset/problem/69/A>
- * 55. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>
- * 56. CF 96A. Football - <https://codeforces.com/problemset/problem/96/A>
- * 57. CF 110A. Nearly Lucky Number - <https://codeforces.com/problemset/problem/110/A>
- * 58. CF 116A. Tram - <https://codeforces.com/problemset/problem/116/A>
- * 59. CF 131A. cAPS lOCK - <https://codeforces.com/problemset/problem/131/A>
- * 60. CF 133A. HQ9+ - <https://codeforces.com/problemset/problem/133/A>
- * 61. CF 136A. Presents - <https://codeforces.com/problemset/problem/136/A>
- * 62. CF 144A. Arrival of the General - <https://codeforces.com/problemset/problem/144/A>
- * 63. CF 148A. Insomnia cure - <https://codeforces.com/problemset/problem/148/A>
- * 64. CF 155A. I_love_username - <https://codeforces.com/problemset/problem/155/A>
- * 65. CF 160A. Twins - <https://codeforces.com/problemset/problem/160/A>
- * 66. CF 200B. Drinks - <https://codeforces.com/problemset/problem/200/B>
- * 67. CF 228A. Is your horseshoe on the other hoof? -
<https://codeforces.com/problemset/problem/228/A>
- * 68. CF 233A. Perfect Permutation - <https://codeforces.com/problemset/problem/233/A>
- * 69. CF 236A. Boy or Girl - <https://codeforces.com/problemset/problem/236/A>
- * 70. CF 268A. Games - <https://codeforces.com/problemset/problem/268/A>
- * 71. CF 271A. Beautiful Year - <https://codeforces.com/problemset/problem/271/A>
- * 72. CF 281A. Word Capitalization - <https://codeforces.com/problemset/problem/281/A>
- * 73. CF 318A. Even Odds - <https://codeforces.com/problemset/problem/318/A>
- * 74. CF 320A. Magic Numbers - <https://codeforces.com/problemset/problem/320/A>
- * 75. CF 334A. Candy Bags - <https://codeforces.com/problemset/problem/334/A>
- * 76. CF 339B. Xenia and Ringroad - <https://codeforces.com/problemset/problem/339/B>

- * 77. CF 344A. Magnets - <https://codeforces.com/problemset/problem/344/A>
- * 78. CF 379A. New Year Candles - <https://codeforces.com/problemset/problem/379/A>
- * 79. CF 381A. Sereja and Dima - <https://codeforces.com/problemset/problem/381/A>
- * 80. CF 405A. Gravity Flip - <https://codeforces.com/problemset/problem/405/A>
- * 81. CF 427A. Police Recruits - <https://codeforces.com/problemset/problem/427/A>
- * 82. CF 431A. Black Square - <https://codeforces.com/problemset/problem/431/A>
- * 83. CF 432A. Choosing Teams - <https://codeforces.com/problemset/problem/432/A>
- * 84. CF 443A. Anton and Letters - <https://codeforces.com/problemset/problem/443/A>
- * 85. CF 448A. Rewards - <https://codeforces.com/problemset/problem/448/A>
- * 86. CF 450A. Jzzhu and Children - <https://codeforces.com/problemset/problem/450/A>
- * 87. CF 455A. Boredom - <https://codeforces.com/problemset/problem/455/A>
- * 88. CF 459A. Pashmak and Garden - <https://codeforces.com/problemset/problem/459/A>
- * 89. CF 461A. Appleman and Toastman - <https://codeforces.com/problemset/problem/461/A>
- * 90. CF 462A. Appleman and Easy Task - <https://codeforces.com/problemset/problem/462/A>
- * 91. CF 463A. Caisa and Sugar - <https://codeforces.com/problemset/problem/463/A>
- * 92. CF 465A. inc ARG - <https://codeforces.com/problemset/problem/465/A>
- * 93. CF 466A. Cheap Travel - <https://codeforces.com/problemset/problem/466/A>
- * 94. CF 467A. George and Accommodation - <https://codeforces.com/problemset/problem/467/A>
- * 95. CF 469A. I Wanna Be the Guy - <https://codeforces.com/problemset/problem/469/A>
- * 96. CF 471A. MUH and Sticks - <https://codeforces.com/problemset/problem/471/A>
- * 97. CF 472A. Design Tutorial: Learn from Math -
<https://codeforces.com/problemset/problem/472/A>
- * 98. CF 476A. Dreamoon and Stairs - <https://codeforces.com/problemset/problem/476/A>
- * 99. CF 478A. Initial Bet - <https://codeforces.com/problemset/problem/478/A>
- * 100. CF 483A. Counterexample - <https://codeforces.com/problemset/problem/483/A>
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- * 洛谷 (Luogu):
- * 101. P1177 【模板】快速排序 - <https://www.luogu.com.cn/problem/P1177>
- * 102. P1271 【深基 9. 例 1】选举学生会 - <https://www.luogu.com.cn/problem/P1271>
- * 103. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- * 104. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- * 105. P1059 [NOIP2006 普及组] 明明的随机数 - <https://www.luogu.com.cn/problem/P1059>
- * 106. P1093 [NOIP2007 普及组] 奖学金 - <https://www.luogu.com.cn/problem/P1093>
- * 107. P1152 欢乐的跳 - <https://www.luogu.com.cn/problem/P1152>
- * 108. P1177 【模板】快速排序 - <https://www.luogu.com.cn/problem/P1177>
- * 109. P1271 【深基 9. 例 1】选举学生会 - <https://www.luogu.com.cn/problem/P1271>
- * 110. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- * 111. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- * 112. P3913 车的攻击 - <https://www.luogu.com.cn/problem/P3913>
- * 113. P4053 [JSOI2007]建筑抢修 - <https://www.luogu.com.cn/problem/P4053>
- * 114. P4447 [AHOI2018 初中组]分组 - <https://www.luogu.com.cn/problem/P4447>
- * 115. P5143 攀爬者 - <https://www.luogu.com.cn/problem/P5143>
- * 116. P5683 [CSP-J2019 江西] 道路拆除 - <https://www.luogu.com.cn/problem/P5683>

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* POJ:

- * 117. POJ 2388. Who's in the Middle - <http://poj.org/problem?id=2388>
- * 118. POJ 2299. Ultra-QuickSort - <http://poj.org/problem?id=2299>
- * 119. POJ 1007. DNA Sorting - <http://poj.org/problem?id=1007>
- * 120. POJ 1804. Brainman - <http://poj.org/problem?id=1804>
- * 121. POJ 2017. Speed Limit - <http://poj.org/problem?id=2017>
- * 122. POJ 2136. Vertical Histogram - <http://poj.org/problem?id=2136>
- * 123. POJ 2159. Ancient Cipher - <http://poj.org/problem?id=2159>
- * 124. POJ 2190. ISBN - <http://poj.org/problem?id=2190>
- * 125. POJ 2362. Square - <http://poj.org/problem?id=2362>
- * 126. POJ 2371. Questions and answers - <http://poj.org/problem?id=2371>
- * 127. POJ 2403. Hay Points - <http://poj.org/problem?id=2403>
- * 128. POJ 2407. Relatives - <http://poj.org/problem?id=2407>
- * 129. POJ 2453. An Easy Problem - <http://poj.org/problem?id=2453>
- * 130. POJ 2498. StuPId - <http://poj.org/problem?id=2498>
- * 131. POJ 2509. Peter's smokes - <http://poj.org/problem?id=2509>
- * 132. POJ 2521. How much did the businessman lose - <http://poj.org/problem?id=2521>
- * 133. POJ 2562. Primary Arithmetic - <http://poj.org/problem?id=2562>
- * 134. POJ 2608. Soundex - <http://poj.org/problem?id=2608>
- * 135. POJ 2739. Sum of Consecutive Prime Numbers - <http://poj.org/problem?id=2739>
- * 136. POJ 2909. Goldbach's Conjecture - <http://poj.org/problem?id=2909>
- * 137. POJ 2954. Triangle - <http://poj.org/problem?id=2954>
- * 138. POJ 3006. Dirichlet's Theorem on Arithmetic Progressions - <http://poj.org/problem?id=3006>
- * 139. POJ 3030. Nasty Hacks - <http://poj.org/problem?id=3030>
- * 140. POJ 3062. Celebrity jeopardy - <http://poj.org/problem?id=3062>
- * 141. POJ 3094. Quicksum - <http://poj.org/problem?id=3094>
- * 142. POJ 3256. Moo University - <http://poj.org/problem?id=3256>
- * 143. POJ 3299. Humidex - <http://poj.org/problem?id=3299>
- * 144. POJ 3370. Halloween treats - <http://poj.org/problem?id=3370>
- * 145. POJ 3518. Prime Gap - <http://poj.org/problem?id=3518>
- * 146. POJ 3619. Speed Reading - <http://poj.org/problem?id=3619>
- * 147. POJ 3650. The Seven Percent Solution - <http://poj.org/problem?id=3650>
- * 148. POJ 3748. 网线主管 - <http://poj.org/problem?id=3748>
- * 149. POJ 3751. 时间日期格式转换 - <http://poj.org/problem?id=3751>
- * 150. POJ 3980. 取模运算 - <http://poj.org/problem?id=3980>

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* HDU (杭电 OJ) :

- * 151. HDU 1040. As Easy As A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1040>
- * 152. HDU 2092. 整数解 - <http://acm.hdu.edu.cn/showproblem.php?pid=2092>
- * 153. HDU 1862. EXCEL 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1862>
- * 154. HDU 1003. Max Sum - <http://acm.hdu.edu.cn/showproblem.php?pid=1003>
- * 155. HDU 1004. Let the Balloon Rise - <http://acm.hdu.edu.cn/showproblem.php?pid=1004>

* 156. HDU 1005. Number Sequence - <http://acm.hdu.edu.cn/showproblem.php?pid=1005>

* 157. HDU 1008. Elevator - <http://acm.hdu.edu.cn/showproblem.php?pid=1008>

* 158. HDU 1012. u Calculate e - <http://acm.hdu.edu.cn/showproblem.php?pid=1012>

* 159. HDU 1013. Digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1013>

* 160. HDU 1014. Uniform Generator - <http://acm.hdu.edu.cn/showproblem.php?pid=1014>

* 161. HDU 1017. A Mathematical Curiosity - <http://acm.hdu.edu.cn/showproblem.php?pid=1017>

* 162. HDU 1019. Least Common Multiple - <http://acm.hdu.edu.cn/showproblem.php?pid=1019>

* 163. HDU 1021. Fibonacci Again - <http://acm.hdu.edu.cn/showproblem.php?pid=1021>

* 164. HDU 1022. Train Problem I - <http://acm.hdu.edu.cn/showproblem.php?pid=1022>

* 165. HDU 1023. Train Problem II - <http://acm.hdu.edu.cn/showproblem.php?pid=1023>

* 166. HDU 1028. Ignatius and the Princess III - <http://acm.hdu.edu.cn/showproblem.php?pid=1028>

* 167. HDU 1029. Ignatius and the Princess IV - <http://acm.hdu.edu.cn/showproblem.php?pid=1029>

* 168. HDU 1032. The $3n + 1$ problem - <http://acm.hdu.edu.cn/showproblem.php?pid=1032>

* 169. HDU 1037. Keep on Truckin' - <http://acm.hdu.edu.cn/showproblem.php?pid=1037>

* 170. HDU 1042. N! - <http://acm.hdu.edu.cn/showproblem.php?pid=1042>

* 171. HDU 1047. Integer Inquiry - <http://acm.hdu.edu.cn/showproblem.php?pid=1047>

* 172. HDU 1048. The Hardest Problem Ever - <http://acm.hdu.edu.cn/showproblem.php?pid=1048>

* 173. HDU 1049. Climbing Worm - <http://acm.hdu.edu.cn/showproblem.php?pid=1049>

* 174. HDU 1051. Wooden Sticks - <http://acm.hdu.edu.cn/showproblem.php?pid=1051>

* 175. HDU 1056. HangOver - <http://acm.hdu.edu.cn/showproblem.php?pid=1056>

* 176. HDU 1058. Humble Numbers - <http://acm.hdu.edu.cn/showproblem.php?pid=1058>

* 177. HDU 1061. Rightmost Digit - <http://acm.hdu.edu.cn/showproblem.php?pid=1061>

* 178. HDU 1062. Text Reverse - <http://acm.hdu.edu.cn/showproblem.php?pid=1062>

* 179. HDU 1063. Exponentiation - <http://acm.hdu.edu.cn/showproblem.php?pid=1063>

* 180. HDU 1064. Financial Management - <http://acm.hdu.edu.cn/showproblem.php?pid=1064>

* 181. HDU 1070. Milk - <http://acm.hdu.edu.cn/showproblem.php?pid=1070>

* 182. HDU 1076. An Easy Task - <http://acm.hdu.edu.cn/showproblem.php?pid=1076>

* 183. HDU 1089. A+B for Input-Output Practice (I) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1089>

* 184. HDU 1090. A+B for Input-Output Practice (II) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1090>

* 185. HDU 1091. A+B for Input-Output Practice (III) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1091>

* 186. HDU 1092. A+B for Input-Output Practice (IV) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1092>

* 187. HDU 1093. A+B for Input-Output Practice (V) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1093>

* 188. HDU 1094. A+B for Input-Output Practice (VI) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1094>

* 189. HDU 1095. A+B for Input-Output Practice (VII) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1095>

* 190. HDU 1096. A+B for Input-Output Practice (VIII) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1096>

* 191. HDU 1106. 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1106>

* 192. HDU 1108. 最小公倍数 - <http://acm.hdu.edu.cn/showproblem.php?pid=1108>

* 193. HDU 1163. Eddy's digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1163>

* 194. HDU 1170. Balloon Comes! - <http://acm.hdu.edu.cn/showproblem.php?pid=1170>

* 195. HDU 1201. 18 岁生日 - <http://acm.hdu.edu.cn/showproblem.php?pid=1201>

* 196. HDU 1202. The Best Sightseeing Pair - <http://acm.hdu.edu.cn/showproblem.php?pid=1202>

* 197. HDU 1205. 吃糖果 - <http://acm.hdu.edu.cn/showproblem.php?pid=1205>

* 198. HDU 1219. AC Me - <http://acm.hdu.edu.cn/showproblem.php?pid=1219>

* 199. HDU 1228. A + B - <http://acm.hdu.edu.cn/showproblem.php?pid=1228>

* 200. HDU 1229. 还是 A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1229>

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* AtCoder:

* 201. ABC 051 B - Sum of Three Integers - https://atcoder.jp/contests/abc051/tasks/abc051_b

* 202. ABC 088 B - Card Game for Two - https://atcoder.jp/contests/abc088/tasks/abc088_b

* 203. ABC 149 B - Greedy Takahashi - https://atcoder.jp/contests/abc149/tasks/abc149_b

* 204. ABC 152 B - Comparing Strings - https://atcoder.jp/contests/abc152/tasks/abc152_b

* 205. ABC 169 B - Multiplication 2 - https://atcoder.jp/contests/abc169/tasks/abc169_b

* 206. ABC 186 B - Blocks on Grid - https://atcoder.jp/contests/abc186/tasks/abc186_b

* 207. ABC 194 B - Job Assignment - https://atcoder.jp/contests/abc194/tasks/abc194_b

* 208. ABC 203 B - AtCoder Condominium - https://atcoder.jp/contests/abc203/tasks/abc203_b

* 209. ABC 210 B - Bouzu Mekuri - https://atcoder.jp/contests/abc210/tasks/abc210_b

* 210. ABC 215 B - $\log_2(N)$ - https://atcoder.jp/contests/abc215/tasks/abc215_b

* 211. ABC 220 B - Base K - https://atcoder.jp/contests/abc220/tasks/abc220_b

* 212. ABC 225 B - Star or Not - https://atcoder.jp/contests/abc225/tasks/abc225_b

* 213. ABC 230 B - Triple Metre - https://atcoder.jp/contests/abc230/tasks/abc230_b

* 214. ABC 235 B - Climbing Takahashi - https://atcoder.jp/contests/abc235/tasks/abc235_b

* 215. ABC 241 B - Pasta - https://atcoder.jp/contests/abc241/tasks/abc241_b

* 216. ABC 245 B - Mex - https://atcoder.jp/contests/abc245/tasks/abc245_b

* 217. ABC 250 B - Enlarged Checker Board - https://atcoder.jp/contests/abc250/tasks/abc250_b

* 218. ABC 255 B - Light It Up - https://atcoder.jp/contests/abc255/tasks/abc255_b

* 219. ABC 260 B - Better Students Are Needed! -
https://atcoder.jp/contests/abc260/tasks/abc260_b

* 220. ABC 265 B - Explore - https://atcoder.jp/contests/abc265/tasks/abc265_b

* 221. ABC 270 B - Hammer - https://atcoder.jp/contests/abc270/tasks/abc270_b

* 222. ABC 275 B - Abs - https://atcoder.jp/contests/abc275/tasks/abc275_b

* 223. ABC 280 B - Inverse Prefix Sum - https://atcoder.jp/contests/abc280/tasks/abc280_b

* 224. ABC 285 B - Longest Uncommon Prefix - https://atcoder.jp/contests/abc285/tasks/abc285_b

* 225. ABC 290 B - Qual B - https://atcoder.jp/contests/abc290/tasks/abc290_b

* 226. ABC 295 B - ASCII Art - https://atcoder.jp/contests/abc295/tasks/abc295_b

* 227. ABC 300 B - Same Map in the RPG World - https://atcoder.jp/contests/abc300/tasks/abc300_b

* 228. ABC 305 B - ABC 334 - https://atcoder.jp/contests/abc305/tasks/abc305_b

* 229. ABC 310 B - Strictly Superior - https://atcoder.jp/contests/abc310/tasks/abc310_b

* 230. ABC 315 B - The Middle Day - https://atcoder.jp/contests/abc315/tasks/abc315_b

- * 231. ABC 320 B - Longest Palindrome - https://atcoder.jp/contests/abc320/tasks/abc320_b
- * 232. ABC 325 B - World Meeting - https://atcoder.jp/contests/abc325/tasks/abc325_b
- * 233. ABC 330 B - Minimize Abs 1 - https://atcoder.jp/contests/abc330/tasks/abc330_b
- * 234. ABC 335 B - Tetrahedral Number - https://atcoder.jp/contests/abc335/tasks/abc335_b
- * 235. ABC 340 B - Append - https://atcoder.jp/contests/abc340/tasks/abc340_b
- * 236. ABC 345 B - Integer Division - https://atcoder.jp/contests/abc345/tasks/abc345_b
- * 237. ABC 350 B - Dentist Aoki - https://atcoder.jp/contests/abc350/tasks/abc350_b
- * 238. ABC 355 B - Piano 2 - https://atcoder.jp/contests/abc355/tasks/abc355_b
- * 239. ABC 360 B - Vertical Reading - https://atcoder.jp/contests/abc360/tasks/abc360_b
- * 240. ABC 365 B - Right Triangle - https://atcoder.jp/contests/abc365/tasks/abc365_b
- * 241. ABC 370 B - Cross Explosion - https://atcoder.jp/contests/abc370/tasks/abc370_b
- * 242. ABC 375 B - Cross-free Matching - https://atcoder.jp/contests/abc375/tasks/abc375_b
- * 243. ABC 380 B - RGB Points - https://atcoder.jp/contests/abc380/tasks/abc380_b
- * 244. ABC 385 B - Trick or Treat - https://atcoder.jp/contests/abc385/tasks/abc385_b
- * 245. ABC 390 B - Character Points - https://atcoder.jp/contests/abc390/tasks/abc390_b
- * 246. ABC 395 B - Piano 3 - https://atcoder.jp/contests/abc395/tasks/abc395_b
- * 247. ABC 400 B - Relative Position - https://atcoder.jp/contests/abc400/tasks/abc400_b
- * 248. ABC 405 B - Piano 4 - https://atcoder.jp/contests/abc405/tasks/abc405_b
- * 249. ABC 410 B - Median Pyramid - https://atcoder.jp/contests/abc410/tasks/abc410_b
- * 250. ABC 415 B - Piano 5 - https://atcoder.jp/contests/abc415/tasks/abc415_b
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- * 251. 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>
- * 252. 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>
- * 253. 合并两个排序的数组 - <https://www.nowcoder.com/practice/89865d4375634fc484f3a24b7fe65665>
- * 254. 剑指 Offer 45. 把数组排成最小的数 -
<https://www.nowcoder.com/practice/8fec3f8ba334add803bf2a06af1b993>
- * 255. 剑指 Offer 40. 最小的 k 个数 -
<https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>
- * 256. 剑指 Offer 51. 数组中的逆序对 -
<https://www.nowcoder.com/practice/96bd6684e04a44eb80e6a68efc0ec6c5>
- * 257. NC78 链表反转 - <https://www.nowcoder.com/practice/75e878df47f24fdc9dc3e400ec6058ca>
- * 258. NC45 实现二叉树先序，中序和后序遍历 -
<https://www.nowcoder.com/practice/a9fec6c46a684ad5a3abd4e365a9d362>
- * 259. NC140 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>
- * 260. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>
- * 261. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>
- * 262. NC61 两数之和 - <https://www.nowcoder.com/practice/20ef097ee8bf49358a47f8f1974028c4>
- * 263. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31c1aed01b394f0b8b7734de0324e00f>
- * 264. NC102 在二叉树中找到两个节点的最近公共祖先 -
<https://www.nowcoder.com/practice/e19927a8fd8d4b2d883013510d11c166>
- * 265. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>
- * 266. NC150 二叉树的层序遍历 -

<https://www.nowcoder.com/practice/0e26e5551f2f45b8b0b22b8dd68252e4>

* 267. NC4 判断链表中是否有环 -

<https://www.nowcoder.com/practice/650474f313294468a4ded3ce0f7898b9>

* 268. NC141 判断回文 - <https://www.nowcoder.com/practice/e297fdd8e9f543059b0b5f05f3a7f3b2>

* 269. NC103 反转字符串 - <https://www.nowcoder.com/practice/c9c5715a5d244709800fa8f7146160dd>

* 270. NC76 用两个栈实现队列 -

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* 271. NC13 二叉树的最大深度 -

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* 272. NC109 岛屿数量 - <https://www.nowcoder.com/practice/0c9664d1556e458f9c38e6504115437d>

* 273. NC12 重建二叉树 - <https://www.nowcoder.com/practice/8a19cbe657394eeaac2f6ea9b0f6fcf6>

* 274. NC1 大数加法 - <https://www.nowcoder.com/practice/11ae12e8c6fe4df79d7f7bda8418de7a>

* 275. NC3 链表中环的入口结点 -

<https://www.nowcoder.com/practice/253d2c59ec3e4bc68da16833f79a38e4>

* 276. NC50 链表中的节点每 k 个一组翻转 -

<https://www.nowcoder.com/practice/b49c3dc907814e9bbfa8437c251b028e>

* 277. NC40 链表相加(二) - <https://www.nowcoder.com/practice/c56f6c70fb3f4849bc56e33ff2a50b6b>

* 278. NC93 设计 LRU 缓存结构 -

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* 279. NC119 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>

* 280. NC68 跳台阶 - <https://www.nowcoder.com/practice/8c82a5b80378478f9484d87d1c5f12a4>

* 281. NC10 大数乘法 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 282. NC33 合并有序链表 - <https://www.nowcoder.com/practice/a166719f58b24f87810c2d54859336f1>

* 283. NC136 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 284. NC15 二叉树的之字形层序遍历 -

<https://www.nowcoder.com/practice/91b69814117f4e8097390d107d2efbe0>

* 285. NC108 矩阵的最小路径和 -

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* 286. NC121 字符串的排列 - <https://www.nowcoder.com/practice/fe6b651b66ae47d7acce78ffdd9a96c7>

* 287. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>

* 288. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>

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* 290. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31claed01b394f0b8b7734de0324e00f>

* 291. NC102 在二叉树中找到两个节点的最近公共祖先 -

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* 292. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 293. NC150 二叉树的层序遍历 -

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* 294. NC4 判断链表中是否有环 -

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* 301. TSORT - Turbo Sort - <https://www.codechef.com/problems/TSORT>

* 302. STFOOD - Chef and Street Food - <https://www.codechef.com/problems/STFOOD>

* 303. FLOW017 - Second Largest - <https://www.codechef.com/problems/FLOW017>

* 304. FLOW018 - Small factorials - <https://www.codechef.com/problems/FLOW018>

* 305. FSQRT - Finding Square Roots - <https://www.codechef.com/problems/FSQRT>

* 306. CHOPRT - Chef And Operators - <https://www.codechef.com/problems/CHOPRT>

* 307. REMISS - Chef and Remissness - <https://www.codechef.com/problems/REMISS>

* 308. AMR15A - Mahasena - <https://www.codechef.com/problems/AMR15A>

* 309. DIFFSUM - Sum OR Difference - <https://www.codechef.com/problems/DIFFSUM>

* 310. PPSUM - Pairwise AND sum - <https://www.codechef.com/problems/PPSUM>

* 311. DECINC - Decrement OR Increment - <https://www.codechef.com/problems/DECINC>

* 312. FLOW008 - Chef and Table Tennis - <https://www.codechef.com/problems/FLOW008>

* 313. FLOW013 - Valid Triangles - <https://www.codechef.com/problems/FLOW013>

* 314. FLOW005 - Minimum Number of Notes - <https://www.codechef.com/problems/FLOW005>

* 315. FLOW010 - Id and Ship - <https://www.codechef.com/problems/FLOW010>

* 316. FLOW014 - Grade The Steel - <https://www.codechef.com/problems/FLOW014>

* 317. FLOW004 - First and Last Digit - <https://www.codechef.com/problems/FLOW004>

* 318. FLOW006 - Sum of Digits - <https://www.codechef.com/problems/FLOW006>

* 319. FLOW007 - Reverse The Number - <https://www.codechef.com/problems/FLOW007>

* 320. FLOW016 - GCD and LCM - <https://www.codechef.com/problems/FLOW016>

* 321. FLOW011 - Gross Salary - <https://www.codechef.com/problems/FLOW011>

* 322. START01 - Number Mirror - <https://www.codechef.com/problems/START01>

* 323. HS08TEST - ATM - <https://www.codechef.com/problems/HS08TEST>

* 324. INTEST - Enormous Input Test - <https://www.codechef.com/problems/INTEST>

* 325. FCTRL - Factorial - <https://www.codechef.com/problems/FCTRL>

* 326. FCTRL2 - Small factorials - <https://www.codechef.com/problems/FCTRL2>

* 327. CIELAB - Ciel and A-B Problem - <https://www.codechef.com/problems/CIELAB>

* 328. COOK82C - Bear and Clique Distances - <https://www.codechef.com/problems/COOK82C>

* 329. LECANDY - Little Elephant and Candies - <https://www.codechef.com/problems/LECANDY>

* 330. PRB01 - Primality Test - <https://www.codechef.com/problems/PRB01>

* 331. TLG - The Lead Game - <https://www.codechef.com/problems/TLG>

* 332. ONP - Transform the Expression - <https://www.codechef.com/problems/ONP>

* 333. PERMUT2 - Ambiguous Permutations - <https://www.codechef.com/problems/PERMUT2>

* 334. VOWELTB - Vowel Count - <https://www.codechef.com/problems/VOWELTB>

* 335. RECTANGL - Rectangle - <https://www.codechef.com/problems/RECTANGL>

* 336. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>

- * 337. SIMDISH - Similar Dishes - <https://www.codechef.com/problems/SIMDISH>
- * 338. TALAZY - Lazy Jem - <https://www.codechef.com/problems/TALAZY>
- * 339. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
- * 340. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
- * 341. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>
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* 393. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>

* 394. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>

* 395. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>

* 396. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>

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* 414. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>

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* 418. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>

* 419. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>

* 420. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>

* 421. SIMDISH - Similar Dishes - <https://www.codechef.com/problems/SIMDISH>

* 422. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>

* 423. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 424. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 425. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 426. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 427. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 428. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 429. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 430. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 431. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 432. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 433. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 434. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 435. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 436. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 437. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 438. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 439. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 440. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 441. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 442. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 443. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 444. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 445. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 446. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 447. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 448. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 449. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 450. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 451. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 452. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 453. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 454. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 455. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 456. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 457. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 458. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 459. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

* 460. CHN09 – Chef and Strings – <https://www.codechef.com/problems/CHN09>

* 461. TWOVSTEN – Two vs Ten – <https://www.codechef.com/problems/TWOVSTEN>

* 462. FRGTNLNG – Forgotten Language – <https://www.codechef.com/problems/FRGTNLNG>

* 463. SIMDISH – Similar Dishes – <https://www.codechef.com/problems/SIMDISH>

* 464. CANDY123 – Candy Distribution – <https://www.codechef.com/problems/CANDY123>

* 465. COLOR – Chef and Colorful Tree – <https://www.codechef.com/problems/COLOR>

```

* 466. CHN09 - Chef and Strings - https://www.codechef.com/problems/CHN09
* 467. TWOVSTEN - Two vs Ten - https://www.codechef.com/problems/TWOVSTEN
* 468. FRGTNLNG - Forgotten Language - https://www.codechef.com/problems/FRGTNLNG
* 469. SIMDISH - Similar Dishes - https://www.codechef.com/problems/SIMDISH
* 470. CANDY123 - Candy Distribution - https://www.codechef.com/problems/CANDY123
* 471. COLOR - Chef and Colorful Tree - https://www.codechef.com/problems/COLOR
*/

```

```

#include <iostream>
#include <vector>
#include <algorithm>
#include <chrono>
#include <random>

```

// 选择排序实现

```

void selectionSort(std::vector<int>& arr) {
    int n = arr.size();
    for (int i = 0; i < n - 1; i++) {
        int minIndex = i;
        for (int j = i + 1; j < n; j++) {
            if (arr[j] < arr[minIndex]) {
                minIndex = j;
            }
        }
        if (minIndex != i) {
            std::swap(arr[i], arr[minIndex]);
        }
    }
}

```

// 冒泡排序实现

```

void bubbleSort(std::vector<int>& arr) {
    int n = arr.size();
    for (int i = 0; i < n - 1; i++) {
        bool swapped = false;
        for (int j = 0; j < n - i - 1; j++) {
            if (arr[j] > arr[j + 1]) {
                std::swap(arr[j], arr[j + 1]);
                swapped = true;
            }
        }
    }
    // 如果没有发生交换, 说明数组已经有序
    if (!swapped) {

```

```

        break;
    }
}
}

```

// 插入排序实现

```

void insertionSort(std::vector<int>& arr) {
    int n = arr.size();
    for (int i = 1; i < n; i++) {
        int key = arr[i];
        int j = i - 1;
        // 将大于 key 的元素向后移动
        while (j >= 0 && arr[j] > key) {
            arr[j + 1] = arr[j];
            j--;
        }
        arr[j + 1] = key;
    }
}

```

```

int main() {
    // 测试数据
    std::vector<int> testData = {64, 34, 25, 12, 22, 11, 90, 88, 76, 50, 42};

    std::cout << "原始数据: ";
    for (int num : testData) {
        std::cout << num << " ";
    }
    std::cout << std::endl;

    // 测试选择排序
    std::vector<int> selectionData = testData;
    selectionSort(selectionData);
    std::cout << "选择排序结果: ";
    for (int num : selectionData) {
        std::cout << num << " ";
    }
    std::cout << std::endl;

    // 测试冒泡排序
    std::vector<int> bubbleData = testData;
    bubbleSort(bubbleData);
    std::cout << "冒泡排序结果: ";

```

```

    for (int num : bubbleData) {
        std::cout << num << " ";
    }
    std::cout << std::endl;

    // 测试插入排序
    std::vector<int> insertionData = testData;
    insertionSort(insertionData);
    std::cout << "插入排序结果：";
    for (int num : insertionData) {
        std::cout << num << " ";
    }
    std::cout << std::endl;

    return 0;
}

```

文件: SelectBubbleInsert.java

```

/**
 * 选择排序、冒泡排序、插入排序的实现和详细分析
 * 这三个算法都属于简单排序算法，时间复杂度均为  $O(n^2)$ 
 *
 * 选择排序(Selection Sort):
 * - 工作原理：每次从未排序的部分中找到最小元素，放到已排序部分的末尾
 * - 时间复杂度： $O(n^2)$  - 最好、平均、最坏情况都相同
 * - 空间复杂度： $O(1)$  - 原地排序
 * - 稳定性：不稳定
 * - 适用场景：数据量小且对稳定性无要求
 *
 * 冒泡排序(Bubble Sort):
 * - 工作原理：相邻元素两两比较，如果顺序错误就交换，每轮将最大元素“冒泡”到末尾
 * - 时间复杂度： $O(n^2)$  - 最坏和平均情况， $O(n)$  - 最好情况(已排序)
 * - 空间复杂度： $O(1)$  - 原地排序
 * - 稳定性：稳定
 * - 适用场景：数据量小且要求稳定性
 *
 * 插入排序(Insertion Sort):
 * - 工作原理：将未排序元素插入到已排序序列的适当位置
 * - 时间复杂度： $O(n^2)$  - 最坏情况， $O(n)$  - 最好情况(已排序)
 * - 空间复杂度： $O(1)$  - 原地排序

```


- * - 稳定性: 稳定
- * - 适用场景: 小规模数据或基本有序的数据
- *
- * 相关题目 (从各大算法平台广泛搜集):
- *
- * LeetCode (力扣):
- * 1. LeetCode 912. Sort an Array - <https://leetcode.cn/problems/sort-an-array/>
- * 2. LeetCode 215. Kth Largest Element in an Array - <https://leetcode.cn/problems/kth-largest-element-in-an-array/>
- * 3. LeetCode 75. Sort Colors - <https://leetcode.cn/problems/sort-colors/>
- * 4. LeetCode 164. Maximum Gap - <https://leetcode.cn/problems/maximum-gap/>
- * 5. LeetCode 147. Insertion Sort List - <https://leetcode.cn/problems/insertion-sort-list/>
- * 6. LeetCode 274. H-Index - <https://leetcode.cn/problems/h-index/>
- * 7. LeetCode 280. Wiggle Sort - <https://leetcode.cn/problems/wiggle-sort/>
- * 8. LeetCode 324. Wiggle Sort II - <https://leetcode.cn/problems/wiggle-sort-ii/>
- * 9. LeetCode 349. Intersection of Two Arrays - <https://leetcode.cn/problems/intersection-of-two-arrays/>
- * 10. LeetCode 350. Intersection of Two Arrays II - <https://leetcode.cn/problems/intersection-of-two-arrays-ii/>
- *
- * 剑指 Offer:
- * 11. 剑指 Offer 45. 把数组排成最小的数 - <https://leetcode.cn/problems/ba-shu-zu-pai-cheng-zui-xiao-de-shu-lcof/>
- * 12. 剑指 Offer 40. 最小的 k 个数 - <https://leetcode.cn/problems/zui-xiao-de-kge-shu-lcof/>
- * 13. 剑指 Offer 51. 数组中的逆序对 - <https://leetcode.cn/problems/shu-zu-zhong-de-ni-xu-dui-lcof/>
- *
- * LintCode (炼码):
- * 14. LintCode 463. Sort Integers - <https://www.lintcode.com/problem/463/>
- * 15. LintCode 143. Sort Colors II - <https://www.lintcode.com/problem/143/>
- * 16. LintCode 508. Wiggle Sort - <https://www.lintcode.com/problem/508/>
- * 17. LintCode 5. Kth Largest Element - <https://www.lintcode.com/problem/5/>
- *
- * HackerRank:
- * 18. Insertion Sort - Part 1 - <https://www.hackerrank.com/challenges/insertionsort1/problem>
- * 19. Insertion Sort - Part 2 - <https://www.hackerrank.com/challenges/insertionsort2/problem>
- * 20. Correctness and the Loop Invariant - <https://www.hackerrank.com/challenges/correctness-invariant/problem>
- * 21. Running Time of Algorithms - <https://www.hackerrank.com/challenges/runningtime/problem>
- * 22. Sorting - Bubble Sort - <https://www.hackerrank.com/challenges/ctci-bubble-sort/problem>
- * 23. Counting Sort 1 - <https://www.hackerrank.com/challenges/countingsort1/problem>
- * 24. Counting Sort 2 - <https://www.hackerrank.com/challenges/countingsort2/problem>
- * 25. Counting Sort 3 - <https://www.hackerrank.com/challenges/countingsort3/problem>

* 26. Counting Sort 4 - <https://www.hackerrank.com/challenges/countingsort4/problem>

*

* Codeforces:

* 27. CF 4A. Watermelon - <https://codeforces.com/problemset/problem/4/A>

* 28. CF 339A. Helpful Maths - <https://codeforces.com/problemset/problem/339/A>

* 29. CF 474A. Keyboard - <https://codeforces.com/problemset/problem/474/A>

* 30. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>

* 31. CF 158A. Next Round - <https://codeforces.com/problemset/problem/158/A>

* 32. CF 118A. String Task - <https://codeforces.com/problemset/problem/118/A>

* 33. CF 231A. Team - <https://codeforces.com/problemset/problem/231/A>

* 34. CF 282A. Bit++ - <https://codeforces.com/problemset/problem/282/A>

* 35. CF 50A. Domino piling - <https://codeforces.com/problemset/problem/50/A>

* 36. CF 263A. Beautiful Matrix - <https://codeforces.com/problemset/problem/263/A>

* 37. CF 158B. Taxi - <https://codeforces.com/problemset/problem/158/B>

* 38. CF 112A. Petya and Strings - <https://codeforces.com/problemset/problem/112/A>

* 39. CF 266A. Stones on the Table - <https://codeforces.com/problemset/problem/266/A>

* 40. CF 337A. Puzzles - <https://codeforces.com/problemset/problem/337/A>

* 41. CF 451A. Game With Sticks - <https://codeforces.com/problemset/problem/451/A>

* 42. CF 460A. Vasya and Socks - <https://codeforces.com/problemset/problem/460/A>

* 43. CF 479A. Expression - <https://codeforces.com/problemset/problem/479/A>

* 44. CF 486A. Calculating Function - <https://codeforces.com/problemset/problem/486/A>

* 45. CF 492A. Vanya and Cubes - <https://codeforces.com/problemset/problem/492/A>

* 46. CF 510A. Fox And Snake - <https://codeforces.com/problemset/problem/510/A>

* 47. CF 520A. Pangram - <https://codeforces.com/problemset/problem/520/A>

* 48. CF 546A. Soldier and Bananas - <https://codeforces.com/problemset/problem/546/A>

* 49. CF 580A. Kefa and First Steps - <https://codeforces.com/problemset/problem/580/A>

* 50. CF 581A. Vasya the Hipster - <https://codeforces.com/problemset/problem/581/A>

* 51. CF 59A. Word - <https://codeforces.com/problemset/problem/59/A>

* 52. CF 617A. Elephant - <https://codeforces.com/problemset/problem/617/A>

* 53. CF 61A. Ultra-Fast Mathematician - <https://codeforces.com/problemset/problem/61/A>

* 54. CF 69A. Young Physicist - <https://codeforces.com/problemset/problem/69/A>

* 55. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>

* 56. CF 96A. Football - <https://codeforces.com/problemset/problem/96/A>

* 57. CF 110A. Nearly Lucky Number - <https://codeforces.com/problemset/problem/110/A>

* 58. CF 116A. Tram - <https://codeforces.com/problemset/problem/116/A>

* 59. CF 131A. cAPS lOCK - <https://codeforces.com/problemset/problem/131/A>

* 60. CF 133A. HQ9+ - <https://codeforces.com/problemset/problem/133/A>

* 61. CF 136A. Presents - <https://codeforces.com/problemset/problem/136/A>

* 62. CF 144A. Arrival of the General - <https://codeforces.com/problemset/problem/144/A>

* 63. CF 148A. Insomnia cure - <https://codeforces.com/problemset/problem/148/A>

* 64. CF 155A. I_love_username - <https://codeforces.com/problemset/problem/155/A>

* 65. CF 160A. Twins - <https://codeforces.com/problemset/problem/160/A>

* 66. CF 200B. Drinks - <https://codeforces.com/problemset/problem/200/B>

- * 67. CF 228A. Is your horseshoe on the other hoof? -
<https://codeforces.com/problemset/problem/228/A>
- * 68. CF 233A. Perfect Permutation - <https://codeforces.com/problemset/problem/233/A>
- * 69. CF 236A. Boy or Girl - <https://codeforces.com/problemset/problem/236/A>
- * 70. CF 268A. Games - <https://codeforces.com/problemset/problem/268/A>
- * 71. CF 271A. Beautiful Year - <https://codeforces.com/problemset/problem/271/A>
- * 72. CF 281A. Word Capitalization - <https://codeforces.com/problemset/problem/281/A>
- * 73. CF 318A. Even Odds - <https://codeforces.com/problemset/problem/318/A>
- * 74. CF 320A. Magic Numbers - <https://codeforces.com/problemset/problem/320/A>
- * 75. CF 334A. Candy Bags - <https://codeforces.com/problemset/problem/334/A>
- * 76. CF 339B. Xenia and Ringroad - <https://codeforces.com/problemset/problem/339/B>
- * 77. CF 344A. Magnets - <https://codeforces.com/problemset/problem/344/A>
- * 78. CF 379A. New Year Candles - <https://codeforces.com/problemset/problem/379/A>
- * 79. CF 381A. Sereja and Dima - <https://codeforces.com/problemset/problem/381/A>
- * 80. CF 405A. Gravity Flip - <https://codeforces.com/problemset/problem/405/A>
- * 81. CF 427A. Police Recruits - <https://codeforces.com/problemset/problem/427/A>
- * 82. CF 431A. Black Square - <https://codeforces.com/problemset/problem/431/A>
- * 83. CF 432A. Choosing Teams - <https://codeforces.com/problemset/problem/432/A>
- * 84. CF 443A. Anton and Letters - <https://codeforces.com/problemset/problem/443/A>
- * 85. CF 448A. Rewards - <https://codeforces.com/problemset/problem/448/A>
- * 86. CF 450A. Jzzhu and Children - <https://codeforces.com/problemset/problem/450/A>
- * 87. CF 455A. Boredom - <https://codeforces.com/problemset/problem/455/A>
- * 88. CF 459A. Pashmak and Garden - <https://codeforces.com/problemset/problem/459/A>
- * 89. CF 461A. Appleman and Toastman - <https://codeforces.com/problemset/problem/461/A>
- * 90. CF 462A. Appleman and Easy Task - <https://codeforces.com/problemset/problem/462/A>
- * 91. CF 463A. Caisa and Sugar - <https://codeforces.com/problemset/problem/463/A>
- * 92. CF 465A. inc ARG - <https://codeforces.com/problemset/problem/465/A>
- * 93. CF 466A. Cheap Travel - <https://codeforces.com/problemset/problem/466/A>
- * 94. CF 467A. George and Accommodation - <https://codeforces.com/problemset/problem/467/A>
- * 95. CF 469A. I Wanna Be the Guy - <https://codeforces.com/problemset/problem/469/A>
- * 96. CF 471A. MUH and Sticks - <https://codeforces.com/problemset/problem/471/A>
- * 97. CF 472A. Design Tutorial: Learn from Math -
<https://codeforces.com/problemset/problem/472/A>
- * 98. CF 476A. Dreamoon and Stairs - <https://codeforces.com/problemset/problem/476/A>
- * 99. CF 478A. Initial Bet - <https://codeforces.com/problemset/problem/478/A>
- * 100. CF 483A. Counterexample - <https://codeforces.com/problemset/problem/483/A>
- *
- * 洛谷 (Luogu):
- * 101. P1177 【模板】快速排序 - <https://www.luogu.com.cn/problem/P1177>
- * 102. P1271 【深基 9. 例 1】选举学生会 - <https://www.luogu.com.cn/problem/P1271>
- * 103. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- * 104. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- * 105. P1059 [NOIP2006 普及组] 明明的随机数 - <https://www.luogu.com.cn/problem/P1059>

- * 106. P1093 [NOIP2007 普及组] 奖学金 - <https://www.luogu.com.cn/problem/P1093>
- * 107. P1152 欢乐的跳 - <https://www.luogu.com.cn/problem/P1152>
- * 108. P1177 【模板】快速排序 - <https://www.luogu.com.cn/problem/P1177>
- * 109. P1271 【深基 9. 例 1】选举学生会 - <https://www.luogu.com.cn/problem/P1271>
- * 110. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- * 111. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- * 112. P3913 车的攻击 - <https://www.luogu.com.cn/problem/P3913>
- * 113. P4053 [JSOI2007]建筑抢修 - <https://www.luogu.com.cn/problem/P4053>
- * 114. P4447 [AHOI2018 初中组]分组 - <https://www.luogu.com.cn/problem/P4447>
- * 115. P5143 攀爬者 - <https://www.luogu.com.cn/problem/P5143>
- * 116. P5683 [CSP-J2019 江西] 道路拆除 - <https://www.luogu.com.cn/problem/P5683>
- *
- * POJ:
- * 117. POJ 2388. Who's in the Middle - <http://poj.org/problem?id=2388>
- * 118. POJ 2299. Ultra-QuickSort - <http://poj.org/problem?id=2299>
- * 119. POJ 1007. DNA Sorting - <http://poj.org/problem?id=1007>
- * 120. POJ 1804. Brainman - <http://poj.org/problem?id=1804>
- * 121. POJ 2017. Speed Limit - <http://poj.org/problem?id=2017>
- * 122. POJ 2136. Vertical Histogram - <http://poj.org/problem?id=2136>
- * 123. POJ 2159. Ancient Cipher - <http://poj.org/problem?id=2159>
- * 124. POJ 2190. ISBN - <http://poj.org/problem?id=2190>
- * 125. POJ 2362. Square - <http://poj.org/problem?id=2362>
- * 126. POJ 2371. Questions and answers - <http://poj.org/problem?id=2371>
- * 127. POJ 2403. Hay Points - <http://poj.org/problem?id=2403>
- * 128. POJ 2407. Relatives - <http://poj.org/problem?id=2407>
- * 129. POJ 2453. An Easy Problem - <http://poj.org/problem?id=2453>
- * 130. POJ 2498. Stupid - <http://poj.org/problem?id=2498>
- * 131. POJ 2509. Peter's smokes - <http://poj.org/problem?id=2509>
- * 132. POJ 2521. How much did the businessman lose - <http://poj.org/problem?id=2521>
- * 133. POJ 2562. Primary Arithmetic - <http://poj.org/problem?id=2562>
- * 134. POJ 2608. Soundex - <http://poj.org/problem?id=2608>
- * 135. POJ 2739. Sum of Consecutive Prime Numbers - <http://poj.org/problem?id=2739>
- * 136. POJ 2909. Goldbach's Conjecture - <http://poj.org/problem?id=2909>
- * 137. POJ 2954. Triangle - <http://poj.org/problem?id=2954>
- * 138. POJ 3006. Dirichlet's Theorem on Arithmetic Progressions - <http://poj.org/problem?id=3006>
- * 139. POJ 3030. Nasty Hacks - <http://poj.org/problem?id=3030>
- * 140. POJ 3062. Celebrity jeopardy - <http://poj.org/problem?id=3062>
- * 141. POJ 3094. Quicksum - <http://poj.org/problem?id=3094>
- * 142. POJ 3256. Moo University - <http://poj.org/problem?id=3256>
- * 143. POJ 3299. Humidex - <http://poj.org/problem?id=3299>
- * 144. POJ 3370. Halloween treats - <http://poj.org/problem?id=3370>
- * 145. POJ 3518. Prime Gap - <http://poj.org/problem?id=3518>
- * 146. POJ 3619. Speed Reading - <http://poj.org/problem?id=3619>

- * 147. POJ 3650. The Seven Percent Solution - <http://poj.org/problem?id=3650>
- * 148. POJ 3748. 网线主管 - <http://poj.org/problem?id=3748>
- * 149. POJ 3751. 时间日期格式转换 - <http://poj.org/problem?id=3751>
- * 150. POJ 3980. 取模运算 - <http://poj.org/problem?id=3980>
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- * HDU (杭电 OJ) :
- * 151. HDU 1040. As Easy As A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1040>
- * 152. HDU 2092. 整数解 - <http://acm.hdu.edu.cn/showproblem.php?pid=2092>
- * 153. HDU 1862. EXCEL 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1862>
- * 154. HDU 1003. Max Sum - <http://acm.hdu.edu.cn/showproblem.php?pid=1003>
- * 155. HDU 1004. Let the Balloon Rise - <http://acm.hdu.edu.cn/showproblem.php?pid=1004>
- * 156. HDU 1005. Number Sequence - <http://acm.hdu.edu.cn/showproblem.php?pid=1005>
- * 157. HDU 1008. Elevator - <http://acm.hdu.edu.cn/showproblem.php?pid=1008>
- * 158. HDU 1012. u Calculate e - <http://acm.hdu.edu.cn/showproblem.php?pid=1012>
- * 159. HDU 1013. Digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1013>
- * 160. HDU 1014. Uniform Generator - <http://acm.hdu.edu.cn/showproblem.php?pid=1014>
- * 161. HDU 1017. A Mathematical Curiosity - <http://acm.hdu.edu.cn/showproblem.php?pid=1017>
- * 162. HDU 1019. Least Common Multiple - <http://acm.hdu.edu.cn/showproblem.php?pid=1019>
- * 163. HDU 1021. Fibonacci Again - <http://acm.hdu.edu.cn/showproblem.php?pid=1021>
- * 164. HDU 1022. Train Problem I - <http://acm.hdu.edu.cn/showproblem.php?pid=1022>
- * 165. HDU 1023. Train Problem II - <http://acm.hdu.edu.cn/showproblem.php?pid=1023>
- * 166. HDU 1028. Ignatius and the Princess III - <http://acm.hdu.edu.cn/showproblem.php?pid=1028>
- * 167. HDU 1029. Ignatius and the Princess IV - <http://acm.hdu.edu.cn/showproblem.php?pid=1029>
- * 168. HDU 1032. The $3n + 1$ problem - <http://acm.hdu.edu.cn/showproblem.php?pid=1032>
- * 169. HDU 1037. Keep on Truckin' - <http://acm.hdu.edu.cn/showproblem.php?pid=1037>
- * 170. HDU 1042. N! - <http://acm.hdu.edu.cn/showproblem.php?pid=1042>
- * 171. HDU 1047. Integer Inquiry - <http://acm.hdu.edu.cn/showproblem.php?pid=1047>
- * 172. HDU 1048. The Hardest Problem Ever - <http://acm.hdu.edu.cn/showproblem.php?pid=1048>
- * 173. HDU 1049. Climbing Worm - <http://acm.hdu.edu.cn/showproblem.php?pid=1049>
- * 174. HDU 1051. Wooden Sticks - <http://acm.hdu.edu.cn/showproblem.php?pid=1051>
- * 175. HDU 1056. HangOver - <http://acm.hdu.edu.cn/showproblem.php?pid=1056>
- * 176. HDU 1058. Humble Numbers - <http://acm.hdu.edu.cn/showproblem.php?pid=1058>
- * 177. HDU 1061. Rightmost Digit - <http://acm.hdu.edu.cn/showproblem.php?pid=1061>
- * 178. HDU 1062. Text Reverse - <http://acm.hdu.edu.cn/showproblem.php?pid=1062>
- * 179. HDU 1063. Exponentiation - <http://acm.hdu.edu.cn/showproblem.php?pid=1063>
- * 180. HDU 1064. Financial Management - <http://acm.hdu.edu.cn/showproblem.php?pid=1064>
- * 181. HDU 1070. Milk - <http://acm.hdu.edu.cn/showproblem.php?pid=1070>
- * 182. HDU 1076. An Easy Task - <http://acm.hdu.edu.cn/showproblem.php?pid=1076>
- * 183. HDU 1089. A+B for Input-Output Practice (I) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1089>
- * 184. HDU 1090. A+B for Input-Output Practice (II) -
<http://acm.hdu.edu.cn/showproblem.php?pid=1090>
- * 185. HDU 1091. A+B for Input-Output Practice (III) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1091>

* 186. HDU 1092. A+B for Input-Output Practice (IV) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1092>

* 187. HDU 1093. A+B for Input-Output Practice (V) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1093>

* 188. HDU 1094. A+B for Input-Output Practice (VI) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1094>

* 189. HDU 1095. A+B for Input-Output Practice (VII) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1095>

* 190. HDU 1096. A+B for Input-Output Practice (VIII) -

<http://acm.hdu.edu.cn/showproblem.php?pid=1096>

* 191. HDU 1106. 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1106>

* 192. HDU 1108. 最小公倍数 - <http://acm.hdu.edu.cn/showproblem.php?pid=1108>

* 193. HDU 1163. Eddy's digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1163>

* 194. HDU 1170. Balloon Comes! - <http://acm.hdu.edu.cn/showproblem.php?pid=1170>

* 195. HDU 1201. 18 岁生日 - <http://acm.hdu.edu.cn/showproblem.php?pid=1201>

* 196. HDU 1202. The Best Sightseeing Pair - <http://acm.hdu.edu.cn/showproblem.php?pid=1202>

* 197. HDU 1205. 吃糖果 - <http://acm.hdu.edu.cn/showproblem.php?pid=1205>

* 198. HDU 1219. AC Me - <http://acm.hdu.edu.cn/showproblem.php?pid=1219>

* 199. HDU 1228. A + B - <http://acm.hdu.edu.cn/showproblem.php?pid=1228>

* 200. HDU 1229. 还是 A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1229>

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* AtCoder:

* 201. ABC 051 B - Sum of Three Integers - https://atcoder.jp/contests/abc051/tasks/abc051_b

* 202. ABC 088 B - Card Game for Two - https://atcoder.jp/contests/abc088/tasks/abc088_b

* 203. ABC 149 B - Greedy Takahashi - https://atcoder.jp/contests/abc149/tasks/abc149_b

* 204. ABC 152 B - Comparing Strings - https://atcoder.jp/contests/abc152/tasks/abc152_b

* 205. ABC 169 B - Multiplication 2 - https://atcoder.jp/contests/abc169/tasks/abc169_b

* 206. ABC 186 B - Blocks on Grid - https://atcoder.jp/contests/abc186/tasks/abc186_b

* 207. ABC 194 B - Job Assignment - https://atcoder.jp/contests/abc194/tasks/abc194_b

* 208. ABC 203 B - AtCoder Condominium - https://atcoder.jp/contests/abc203/tasks/abc203_b

* 209. ABC 210 B - Bouzu Mekuri - https://atcoder.jp/contests/abc210/tasks/abc210_b

* 210. ABC 215 B - $\log_2(N)$ - https://atcoder.jp/contests/abc215/tasks/abc215_b

* 211. ABC 220 B - Base K - https://atcoder.jp/contests/abc220/tasks/abc220_b

* 212. ABC 225 B - Star or Not - https://atcoder.jp/contests/abc225/tasks/abc225_b

* 213. ABC 230 B - Triple Metre - https://atcoder.jp/contests/abc230/tasks/abc230_b

* 214. ABC 235 B - Climbing Takahashi - https://atcoder.jp/contests/abc235/tasks/abc235_b

* 215. ABC 241 B - Pasta - https://atcoder.jp/contests/abc241/tasks/abc241_b

* 216. ABC 245 B - Mex - https://atcoder.jp/contests/abc245/tasks/abc245_b

* 217. ABC 250 B - Enlarged Checker Board - https://atcoder.jp/contests/abc250/tasks/abc250_b

* 218. ABC 255 B - Light It Up - https://atcoder.jp/contests/abc255/tasks/abc255_b

* 219. ABC 260 B - Better Students Are Needed! -

https://atcoder.jp/contests/abc260/tasks/abc260_b

- * 220. ABC 265 B - Explore - https://atcoder.jp/contests/abc265/tasks/abc265_b
- * 221. ABC 270 B - Hammer - https://atcoder.jp/contests/abc270/tasks/abc270_b
- * 222. ABC 275 B - Abs - https://atcoder.jp/contests/abc275/tasks/abc275_b
- * 223. ABC 280 B - Inverse Prefix Sum - https://atcoder.jp/contests/abc280/tasks/abc280_b
- * 224. ABC 285 B - Longest Uncommon Prefix - https://atcoder.jp/contests/abc285/tasks/abc285_b
- * 225. ABC 290 B - Qual B - https://atcoder.jp/contests/abc290/tasks/abc290_b
- * 226. ABC 295 B - ASCII Art - https://atcoder.jp/contests/abc295/tasks/abc295_b
- * 227. ABC 300 B - Same Map in the RPG World - https://atcoder.jp/contests/abc300/tasks/abc300_b
- * 228. ABC 305 B - ABC 334 - https://atcoder.jp/contests/abc305/tasks/abc305_b
- * 229. ABC 310 B - Strictly Superior - https://atcoder.jp/contests/abc310/tasks/abc310_b
- * 230. ABC 315 B - The Middle Day - https://atcoder.jp/contests/abc315/tasks/abc315_b
- * 231. ABC 320 B - Longest Palindrome - https://atcoder.jp/contests/abc320/tasks/abc320_b
- * 232. ABC 325 B - World Meeting - https://atcoder.jp/contests/abc325/tasks/abc325_b
- * 233. ABC 330 B - Minimize Abs 1 - https://atcoder.jp/contests/abc330/tasks/abc330_b
- * 234. ABC 335 B - Tetrahedral Number - https://atcoder.jp/contests/abc335/tasks/abc335_b
- * 235. ABC 340 B - Append - https://atcoder.jp/contests/abc340/tasks/abc340_b
- * 236. ABC 345 B - Integer Division - https://atcoder.jp/contests/abc345/tasks/abc345_b
- * 237. ABC 350 B - Dentist Aoki - https://atcoder.jp/contests/abc350/tasks/abc350_b
- * 238. ABC 355 B - Piano 2 - https://atcoder.jp/contests/abc355/tasks/abc355_b
- * 239. ABC 360 B - Vertical Reading - https://atcoder.jp/contests/abc360/tasks/abc360_b
- * 240. ABC 365 B - Right Triangle - https://atcoder.jp/contests/abc365/tasks/abc365_b
- * 241. ABC 370 B - Cross Explosion - https://atcoder.jp/contests/abc370/tasks/abc370_b
- * 242. ABC 375 B - Cross-free Matching - https://atcoder.jp/contests/abc375/tasks/abc375_b
- * 243. ABC 380 B - RGB Points - https://atcoder.jp/contests/abc380/tasks/abc380_b
- * 244. ABC 385 B - Trick or Treat - https://atcoder.jp/contests/abc385/tasks/abc385_b
- * 245. ABC 390 B - Character Points - https://atcoder.jp/contests/abc390/tasks/abc390_b
- * 246. ABC 395 B - Piano 3 - https://atcoder.jp/contests/abc395/tasks/abc395_b
- * 247. ABC 400 B - Relative Position - https://atcoder.jp/contests/abc400/tasks/abc400_b
- * 248. ABC 405 B - Piano 4 - https://atcoder.jp/contests/abc405/tasks/abc405_b
- * 249. ABC 410 B - Median Pyramid - https://atcoder.jp/contests/abc410/tasks/abc410_b
- * 250. ABC 415 B - Piano 5 - https://atcoder.jp/contests/abc415/tasks/abc415_b

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- * 251. 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>
- * 252. 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>
- * 253. 合并两个排序的数组 - <https://www.nowcoder.com/practice/89865d4375634fc484f3a24b7fe65665>
- * 254. 剑指 Offer 45. 把数组排成最小的数 -

<https://www.nowcoder.com/practice/8fec3f8ba334add803bf2a06af1b993>

- * 255. 剑指 Offer 40. 最小的 k 个数 -

<https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>

- * 256. 剑指 Offer 51. 数组中的逆序对 -

<https://www.nowcoder.com/practice/96bd6684e04a44eb80e6a68efc0ec6c5>

- * 257. NC78 链表反转 - <https://www.nowcoder.com/practice/75e878df47f24fdc9dc3e400ec6058ca>

* 258. NC45 实现二叉树先序，中序和后序遍历 -

<https://www.nowcoder.com/practice/a9fec6c46a684ad5a3abd4e365a9d362>

* 259. NC140 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>

* 260. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>

* 261. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>

* 262. NC61 两数之和 - <https://www.nowcoder.com/practice/20ef097ee8bf49358a47f8f1974028c4>

* 263. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31c1aed01b394f0b8b7734de0324e00f>

* 264. NC102 在二叉树中找到两个节点的最近公共祖先 -

<https://www.nowcoder.com/practice/e19927a8fd8d4b2d883013510d11c166>

* 265. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 266. NC150 二叉树的层序遍历 -

<https://www.nowcoder.com/practice/0e26e5551f2f45b8b0b22b8dd68252e4>

* 267. NC4 判断链表中是否有环 -

<https://www.nowcoder.com/practice/650474f313294468a4ded3ce0f7898b9>

* 268. NC141 判断回文 - <https://www.nowcoder.com/practice/e297fdd8e9f543059b0b5f05f3a7f3b2>

* 269. NC103 反转字符串 - <https://www.nowcoder.com/practice/c9c5715a5d244709800fa8f7146160dd>

* 270. NC76 用两个栈实现队列 -

<https://www.nowcoder.com/practice/54275ddae22f475981afa2244dd448c6>

* 271. NC13 二叉树的最大深度 -

<https://www.nowcoder.com/practice/8a2b2bf6c19b4f23a9bdb9b233eefa73>

* 272. NC109 岛屿数量 - <https://www.nowcoder.com/practice/0c9664d1556e458f9c38e6504115437d>

* 273. NC12 重建二叉树 - <https://www.nowcoder.com/practice/8a19cbe657394eeaac2f6ea9b0f6fcb6>

* 274. NC1 大数加法 - <https://www.nowcoder.com/practice/11ae12e8c6fe4df79d7f7bda8418de7a>

* 275. NC3 链表中环的入口结点 -

<https://www.nowcoder.com/practice/253d2c59ec3e4bc68da16833f79a38e4>

* 276. NC50 链表中的节点每 k 个一组翻转 -

<https://www.nowcoder.com/practice/b49c3dc907814e9bbfa8437c251b028e>

* 277. NC40 链表相加(二) - <https://www.nowcoder.com/practice/c56f6c70fb3f4849bc56e33ff2a50b6b>

* 278. NC93 设计 LRU 缓存结构 -

<https://www.nowcoder.com/practice/e3769a5f49894d49b871c09cadd13a61>

* 279. NC119 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>

* 280. NC68 跳台阶 - <https://www.nowcoder.com/practice/8c82a5b80378478f9484d87d1c5f12a4>

* 281. NC10 大数乘法 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 282. NC33 合并有序链表 - <https://www.nowcoder.com/practice/a166719f58b24f87810c2d54859336f1>

* 283. NC136 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 284. NC15 二叉树的之字形层序遍历 -

<https://www.nowcoder.com/practice/91b69814117f4e8097390d107d2efbe0>

* 285. NC108 矩阵的最小路径和 -

<https://www.nowcoder.com/practice/7d21d60579194b098959234b091cdecc>

* 286. NC121 字符串的排列 - <https://www.nowcoder.com/practice/fe6b651b66ae47d7acce78ffdd9a96c7>

* 287. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>

* 288. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>

* 289. NC61 两数之和 - <https://www.nowcoder.com/practice/20ef097ee8bf49358a47f8f1974028c4>

* 290. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31c1aed01b394f0b8b7734de0324e00f>

* 291. NC102 在二叉树中找到两个节点的最近公共祖先 - <https://www.nowcoder.com/practice/e19927a8fd8d4b2d883013510d11c166>

* 292. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

* 293. NC150 二叉树的层序遍历 - <https://www.nowcoder.com/practice/0e26e5551f2f45b8b0b22b8dd68252e4>

* 294. NC4 判断链表中是否有环 - <https://www.nowcoder.com/practice/650474f313294468a4ded3ce0f7898b9>

* 295. NC141 判断回文 - <https://www.nowcoder.com/practice/e297fdd8e9f543059b0b5f05f3a7f3b2>

* 296. NC103 反转字符串 - <https://www.nowcoder.com/practice/c9c5715a5d244709800fa8f7146160dd>

* 297. NC76 用两个栈实现队列 - <https://www.nowcoder.com/practice/54275ddae22f475981afa2244dd448c6>

* 298. NC13 二叉树的最大深度 - <https://www.nowcoder.com/practice/8a2b2bf6c19b4f23a9bdb9b233eefa73>

* 299. NC109 岛屿数量 - <https://www.nowcoder.com/practice/0c9664d1556e458f9c38e6504115437d>

* 300. NC12 重建二叉树 - <https://www.nowcoder.com/practice/8a19cbe657394eeaac2f6ea9b0f6fcf6>

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* 301. TSORT - Turbo Sort - <https://www.codechef.com/problems/TSORT>

* 302. STFOOD - Chef and Street Food - <https://www.codechef.com/problems/STFOOD>

* 303. FLOW017 - Second Largest - <https://www.codechef.com/problems/FLOW017>

* 304. FLOW018 - Small factorials - <https://www.codechef.com/problems/FLOW018>

* 305. FSQRT - Finding Square Roots - <https://www.codechef.com/problems/FSQRT>

* 306. CHOPRT - Chef And Operators - <https://www.codechef.com/problems/CHOPRT>

* 307. REMISS - Chef and Remissness - <https://www.codechef.com/problems/REMISS>

* 308. AMR15A - Mahasena - <https://www.codechef.com/problems/AMR15A>

* 309. DIFFSUM - Sum OR Difference - <https://www.codechef.com/problems/DIFFSUM>

* 310. PPSUM - Pairwise AND sum - <https://www.codechef.com/problems/PPSUM>

* 311. DECINC - Decrement OR Increment - <https://www.codechef.com/problems/DECINC>

* 312. FLOW008 - Chef and Table Tennis - <https://www.codechef.com/problems/FLOW008>

* 313. FLOW013 - Valid Triangles - <https://www.codechef.com/problems/FLOW013>

* 314. FLOW005 - Minimum Number of Notes - <https://www.codechef.com/problems/FLOW005>

* 315. FLOW010 - Id and Ship - <https://www.codechef.com/problems/FLOW010>

* 316. FLOW014 - Grade The Steel - <https://www.codechef.com/problems/FLOW014>

* 317. FLOW004 - First and Last Digit - <https://www.codechef.com/problems/FLOW004>

* 318. FLOW006 - Sum of Digits - <https://www.codechef.com/problems/FLOW006>

* 319. FLOW007 - Reverse The Number - <https://www.codechef.com/problems/FLOW007>

* 320. FLOW016 - GCD and LCM - <https://www.codechef.com/problems/FLOW016>

* 321. FLOW011 - Gross Salary - <https://www.codechef.com/problems/FLOW011>

* 322. START01 - Number Mirror - <https://www.codechef.com/problems/START01>

* 323. HS08TEST - ATM - <https://www.codechef.com/problems/HS08TEST>

* 324. INTEST - Enormous Input Test - <https://www.codechef.com/problems/INTEST>

* 325. FCTRL - Factorial - <https://www.codechef.com/problems/FCTRL>

- * 326. FCTRL2 - Small factorials - <https://www.codechef.com/problems/FCTRL2>
- * 327. CIELAB - Ciel and A-B Problem - <https://www.codechef.com/problems/CIELAB>
- * 328. COOK82C - Bear and Clique Distances - <https://www.codechef.com/problems/COOK82C>
- * 329. LECANDY - Little Elephant and Candies - <https://www.codechef.com/problems/LECANDY>
- * 330. PRB01 - Primality Test - <https://www.codechef.com/problems/PRB01>
- * 331. TLG - The Lead Game - <https://www.codechef.com/problems/TLG>
- * 332. ONP - Transform the Expression - <https://www.codechef.com/problems/ONP>
- * 333. PERMUT2 - Ambiguous Permutations - <https://www.codechef.com/problems/PERMUT2>
- * 334. VOWELTB - Vowel Count - <https://www.codechef.com/problems/VOWELTB>
- * 335. RECTANGL - Rectangle - <https://www.codechef.com/problems/RECTANGL>
- * 336. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>
- * 337. SIMDISH - Similar Dishes - <https://www.codechef.com/problems/SIMDISH>
- * 338. TALAZY - Lazy Jem - <https://www.codechef.com/problems/TALAZY>
- * 339. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
- * 340. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
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* 470. CANDY123 - Candy Distribution - https://www.codechef.com/problems/CANDY123
* 471. COLOR - Chef and Colorful Tree - https://www.codechef.com/problems/COLOR
*/

```

```

import java.util.Arrays;
import java.util.Random;

```

```

class SelectBubbleInsert {
    // 选择排序实现
    public static void selectionSort(int[] arr) {
        int n = arr.length;
        for (int i = 0; i < n - 1; i++) {
            int minIndex = i;
            for (int j = i + 1; j < n; j++) {
                if (arr[j] < arr[minIndex]) {
                    minIndex = j;
                }
            }
            if (minIndex != i) {
                int temp = arr[i];
                arr[i] = arr[minIndex];
                arr[minIndex] = temp;
            }
        }
    }
}

```

```

// 冒泡排序实现
public static void bubbleSort(int[] arr) {

```

```

int n = arr.length;
for (int i = 0; i < n - 1; i++) {
    boolean swapped = false;
    for (int j = 0; j < n - i - 1; j++) {
        if (arr[j] > arr[j + 1]) {
            int temp = arr[j];
            arr[j] = arr[j + 1];
            arr[j + 1] = temp;
            swapped = true;
        }
    }
    // 如果没有发生交换, 说明数组已经有序
    if (!swapped) {
        break;
    }
}
}

```

// 插入排序实现

```

public static void insertionSort(int[] arr) {
    int n = arr.length;
    for (int i = 1; i < n; i++) {
        int key = arr[i];
        int j = i - 1;
        // 将大于 key 的元素向后移动
        while (j >= 0 && arr[j] > key) {
            arr[j + 1] = arr[j];
            j--;
        }
        arr[j + 1] = key;
    }
}

```

```

public static void main(String[] args) {
    // 测试数据
    int[] testData = {64, 34, 25, 12, 22, 11, 90, 88, 76, 50, 42};

    System.out.print("原始数据: ");
    for (int num : testData) {
        System.out.print(num + " ");
    }
    System.out.println();
}

```

```

// 测试选择排序
int[] selectionData = testData.clone();
selectionSort(selectionData);
System.out.print("选择排序结果: ");
for (int num : selectionData) {
    System.out.print(num + " ");
}
System.out.println();

// 测试冒泡排序
int[] bubbleData = testData.clone();
bubbleSort(bubbleData);
System.out.print("冒泡排序结果: ");
for (int num : bubbleData) {
    System.out.print(num + " ");
}
System.out.println();

// 测试插入排序
int[] insertionData = testData.clone();
insertionSort(insertionData);
System.out.print("插入排序结果: ");
for (int num : insertionData) {
    System.out.print(num + " ");
}
System.out.println();
}
}

```

=====

文件: SelectBubbleInsert.py

=====

"""

选择排序、冒泡排序、插入排序的实现和详细分析 - Python 版本
 这三个算法都属于简单排序算法，时间复杂度均为 $O(n^2)$

选择排序(Selection Sort):

- 工作原理: 每次从未排序的部分中找到最小元素，放到已排序部分的末尾
- 时间复杂度: $O(n^2)$ - 最好、平均、最坏情况都相同
- 空间复杂度: $O(1)$ - 原地排序
- 稳定性: 不稳定
- 适用场景: 数据量小且对稳定性无要求

冒泡排序(Bubble Sort):

- 工作原理: 相邻元素两两比较, 如果顺序错误就交换, 每轮将最大元素“冒泡”到末尾
- 时间复杂度: $O(n^2)$ - 最坏和平均情况, $O(n)$ - 最好情况(已排序)
- 空间复杂度: $O(1)$ - 原地排序
- 稳定性: 稳定
- 适用场景: 数据量小且要求稳定性

插入排序(Insertion Sort):

- 工作原理: 将未排序元素插入到已排序序列的适当位置
- 时间复杂度: $O(n^2)$ - 最坏情况, $O(n)$ - 最好情况(已排序)
- 空间复杂度: $O(1)$ - 原地排序
- 稳定性: 稳定
- 适用场景: 小规模数据或基本有序的数据

相关题目(从各大算法平台广泛搜集):

LeetCode(力扣):

1. LeetCode 912. Sort an Array - <https://leetcode.cn/problems/sort-an-array/>
2. LeetCode 215. Kth Largest Element in an Array - <https://leetcode.cn/problems/kth-largest-element-in-an-array/>
3. LeetCode 75. Sort Colors - <https://leetcode.cn/problems/sort-colors/>
4. LeetCode 164. Maximum Gap - <https://leetcode.cn/problems/maximum-gap/>
5. LeetCode 147. Insertion Sort List - <https://leetcode.cn/problems/insertion-sort-list/>
6. LeetCode 274. H-Index - <https://leetcode.cn/problems/h-index/>
7. LeetCode 280. Wiggle Sort - <https://leetcode.cn/problems/wiggle-sort/>
8. LeetCode 324. Wiggle Sort II - <https://leetcode.cn/problems/wiggle-sort-ii/>
9. LeetCode 349. Intersection of Two Arrays - <https://leetcode.cn/problems/intersection-of-two-arrays/>
10. LeetCode 350. Intersection of Two Arrays II - <https://leetcode.cn/problems/intersection-of-two-arrays-ii/>

剑指 Offer:

11. 剑指 Offer 45. 把数组排成最小的数 - <https://leetcode.cn/problems/ba-shu-zu-pai-cheng-zui-xiao-de-shu-lcof/>
12. 剑指 Offer 40. 最小的 k 个数 - <https://leetcode.cn/problems/zui-xiao-de-kge-shu-lcof/>
13. 剑指 Offer 51. 数组中的逆序对 - <https://leetcode.cn/problems/shu-zu-zhong-de-ni-xu-dui-lcof/>

LintCode(炼码):

14. LintCode 463. Sort Integers - <https://www.lintcode.com/problem/463/>
15. LintCode 143. Sort Colors II - <https://www.lintcode.com/problem/143/>
16. LintCode 508. Wiggle Sort - <https://www.lintcode.com/problem/508/>
17. LintCode 5. Kth Largest Element - <https://www.lintcode.com/problem/5/>

HackerRank:

18. Insertion Sort - Part 1 - <https://www.hackerrank.com/challenges/insertionsort1/problem>
19. Insertion Sort - Part 2 - <https://www.hackerrank.com/challenges/insertionsort2/problem>
20. Correctness and the Loop Invariant - <https://www.hackerrank.com/challenges/correctness-invariant/problem>
21. Running Time of Algorithms - <https://www.hackerrank.com/challenges/runningtime/problem>
22. Sorting - Bubble Sort - <https://www.hackerrank.com/challenges/ctci-bubble-sort/problem>
23. Counting Sort 1 - <https://www.hackerrank.com/challenges/countingsort1/problem>
24. Counting Sort 2 - <https://www.hackerrank.com/challenges/countingsort2/problem>
25. Counting Sort 3 - <https://www.hackerrank.com/challenges/countingsort3/problem>
26. Counting Sort 4 - <https://www.hackerrank.com/challenges/countingsort4/problem>

Codeforces:

27. CF 4A. Watermelon - <https://codeforces.com/problemset/problem/4/A>
28. CF 339A. Helpful Maths - <https://codeforces.com/problemset/problem/339/A>
29. CF 474A. Keyboard - <https://codeforces.com/problemset/problem/474/A>
30. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>
31. CF 158A. Next Round - <https://codeforces.com/problemset/problem/158/A>
32. CF 118A. String Task - <https://codeforces.com/problemset/problem/118/A>
33. CF 231A. Team - <https://codeforces.com/problemset/problem/231/A>
34. CF 282A. Bit++ - <https://codeforces.com/problemset/problem/282/A>
35. CF 50A. Domino piling - <https://codeforces.com/problemset/problem/50/A>
36. CF 263A. Beautiful Matrix - <https://codeforces.com/problemset/problem/263/A>
37. CF 158B. Taxi - <https://codeforces.com/problemset/problem/158/B>
38. CF 112A. Petya and Strings - <https://codeforces.com/problemset/problem/112/A>
39. CF 266A. Stones on the Table - <https://codeforces.com/problemset/problem/266/A>
40. CF 337A. Puzzles - <https://codeforces.com/problemset/problem/337/A>
41. CF 451A. Game With Sticks - <https://codeforces.com/problemset/problem/451/A>
42. CF 460A. Vasya and Socks - <https://codeforces.com/problemset/problem/460/A>
43. CF 479A. Expression - <https://codeforces.com/problemset/problem/479/A>
44. CF 486A. Calculating Function - <https://codeforces.com/problemset/problem/486/A>
45. CF 492A. Vanya and Cubes - <https://codeforces.com/problemset/problem/492/A>
46. CF 510A. Fox And Snake - <https://codeforces.com/problemset/problem/510/A>
47. CF 520A. Pangram - <https://codeforces.com/problemset/problem/520/A>
48. CF 546A. Soldier and Bananas - <https://codeforces.com/problemset/problem/546/A>
49. CF 580A. Kefa and First Steps - <https://codeforces.com/problemset/problem/580/A>
50. CF 581A. Vasya the Hipster - <https://codeforces.com/problemset/problem/581/A>
51. CF 59A. Word - <https://codeforces.com/problemset/problem/59/A>
52. CF 617A. Elephant - <https://codeforces.com/problemset/problem/617/A>
53. CF 61A. Ultra-Fast Mathematician - <https://codeforces.com/problemset/problem/61/A>
54. CF 69A. Young Physicist - <https://codeforces.com/problemset/problem/69/A>
55. CF 71A. Way Too Long Words - <https://codeforces.com/problemset/problem/71/A>

56. CF 96A. Football - <https://codeforces.com/problemset/problem/96/A>
57. CF 110A. Nearly Lucky Number - <https://codeforces.com/problemset/problem/110/A>
58. CF 116A. Tram - <https://codeforces.com/problemset/problem/116/A>
59. CF 131A. cAPS 10CK - <https://codeforces.com/problemset/problem/131/A>
60. CF 133A. HQ9+ - <https://codeforces.com/problemset/problem/133/A>
61. CF 136A. Presents - <https://codeforces.com/problemset/problem/136/A>
62. CF 144A. Arrival of the General - <https://codeforces.com/problemset/problem/144/A>
63. CF 148A. Insomnia cure - <https://codeforces.com/problemset/problem/148/A>
64. CF 155A. I_love_username - <https://codeforces.com/problemset/problem/155/A>
65. CF 160A. Twins - <https://codeforces.com/problemset/problem/160/A>
66. CF 200B. Drinks - <https://codeforces.com/problemset/problem/200/B>
67. CF 228A. Is your horseshoe on the other hoof? -
<https://codeforces.com/problemset/problem/228/A>
68. CF 233A. Perfect Permutation - <https://codeforces.com/problemset/problem/233/A>
69. CF 236A. Boy or Girl - <https://codeforces.com/problemset/problem/236/A>
70. CF 268A. Games - <https://codeforces.com/problemset/problem/268/A>
71. CF 271A. Beautiful Year - <https://codeforces.com/problemset/problem/271/A>
72. CF 281A. Word Capitalization - <https://codeforces.com/problemset/problem/281/A>
73. CF 318A. Even Odds - <https://codeforces.com/problemset/problem/318/A>
74. CF 320A. Magic Numbers - <https://codeforces.com/problemset/problem/320/A>
75. CF 334A. Candy Bags - <https://codeforces.com/problemset/problem/334/A>
76. CF 339B. Xenia and Ringroad - <https://codeforces.com/problemset/problem/339/B>
77. CF 344A. Magnets - <https://codeforces.com/problemset/problem/344/A>
78. CF 379A. New Year Candles - <https://codeforces.com/problemset/problem/379/A>
79. CF 381A. Sereja and Dima - <https://codeforces.com/problemset/problem/381/A>
80. CF 405A. Gravity Flip - <https://codeforces.com/problemset/problem/405/A>
81. CF 427A. Police Recruits - <https://codeforces.com/problemset/problem/427/A>
82. CF 431A. Black Square - <https://codeforces.com/problemset/problem/431/A>
83. CF 432A. Choosing Teams - <https://codeforces.com/problemset/problem/432/A>
84. CF 443A. Anton and Letters - <https://codeforces.com/problemset/problem/443/A>
85. CF 448A. Rewards - <https://codeforces.com/problemset/problem/448/A>
86. CF 450A. Jzzhu and Children - <https://codeforces.com/problemset/problem/450/A>
87. CF 455A. Boredom - <https://codeforces.com/problemset/problem/455/A>
88. CF 459A. Pashmak and Garden - <https://codeforces.com/problemset/problem/459/A>
89. CF 461A. Appleman and Toastman - <https://codeforces.com/problemset/problem/461/A>
90. CF 462A. Appleman and Easy Task - <https://codeforces.com/problemset/problem/462/A>
91. CF 463A. Caisa and Sugar - <https://codeforces.com/problemset/problem/463/A>
92. CF 465A. inc ARG - <https://codeforces.com/problemset/problem/465/A>
93. CF 466A. Cheap Travel - <https://codeforces.com/problemset/problem/466/A>
94. CF 467A. George and Accommodation - <https://codeforces.com/problemset/problem/467/A>
95. CF 469A. I Wanna Be the Guy - <https://codeforces.com/problemset/problem/469/A>
96. CF 471A. MUH and Sticks - <https://codeforces.com/problemset/problem/471/A>
97. CF 472A. Design Tutorial: Learn from Math - <https://codeforces.com/problemset/problem/472/A>

- 98. CF 476A. Dreamoon and Stairs - <https://codeforces.com/problemset/problem/476/A>
- 99. CF 478A. Initial Bet - <https://codeforces.com/problemset/problem/478/A>
- 100. CF 483A. Counterexample - <https://codeforces.com/problemset/problem/483/A>

洛谷 (Luogu):

- 101. P1177 **【模板】快速排序** - <https://www.luogu.com.cn/problem/P1177>
- 102. P1271 **【深基 9. 例 1】选举学生会** - <https://www.luogu.com.cn/problem/P1271>
- 103. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- 104. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- 105. P1059 [NOIP2006 普及组] 明明的随机数 - <https://www.luogu.com.cn/problem/P1059>
- 106. P1093 [NOIP2007 普及组] 奖学金 - <https://www.luogu.com.cn/problem/P1093>
- 107. P1152 欢乐的跳 - <https://www.luogu.com.cn/problem/P1152>
- 108. P1177 **【模板】快速排序** - <https://www.luogu.com.cn/problem/P1177>
- 109. P1271 **【深基 9. 例 1】选举学生会** - <https://www.luogu.com.cn/problem/P1271>
- 110. P1781 宇宙总统 - <https://www.luogu.com.cn/problem/P1781>
- 111. P2888 [USACO07NOV]Cow Hurdles S - <https://www.luogu.com.cn/problem/P2888>
- 112. P3913 车的攻击 - <https://www.luogu.com.cn/problem/P3913>
- 113. P4053 [JSOI2007]建筑抢修 - <https://www.luogu.com.cn/problem/P4053>
- 114. P4447 [AHOI2018 初中组]分组 - <https://www.luogu.com.cn/problem/P4447>
- 115. P5143 攀爬者 - <https://www.luogu.com.cn/problem/P5143>
- 116. P5683 [CSP-J2019 江西] 道路拆除 - <https://www.luogu.com.cn/problem/P5683>

POJ:

- 117. POJ 2388. Who's in the Middle - <http://poj.org/problem?id=2388>
- 118. POJ 2299. Ultra-QuickSort - <http://poj.org/problem?id=2299>
- 119. POJ 1007. DNA Sorting - <http://poj.org/problem?id=1007>
- 120. POJ 1804. Brainman - <http://poj.org/problem?id=1804>
- 121. POJ 2017. Speed Limit - <http://poj.org/problem?id=2017>
- 122. POJ 2136. Vertical Histogram - <http://poj.org/problem?id=2136>
- 123. POJ 2159. Ancient Cipher - <http://poj.org/problem?id=2159>
- 124. POJ 2190. ISBN - <http://poj.org/problem?id=2190>
- 125. POJ 2362. Square - <http://poj.org/problem?id=2362>
- 126. POJ 2371. Questions and answers - <http://poj.org/problem?id=2371>
- 127. POJ 2403. Hay Points - <http://poj.org/problem?id=2403>
- 128. POJ 2407. Relatives - <http://poj.org/problem?id=2407>
- 129. POJ 2453. An Easy Problem - <http://poj.org/problem?id=2453>
- 130. POJ 2498. Stupid - <http://poj.org/problem?id=2498>
- 131. POJ 2509. Peter's smokes - <http://poj.org/problem?id=2509>
- 132. POJ 2521. How much did the businessman lose - <http://poj.org/problem?id=2521>
- 133. POJ 2562. Primary Arithmetic - <http://poj.org/problem?id=2562>
- 134. POJ 2608. Soundex - <http://poj.org/problem?id=2608>
- 135. POJ 2739. Sum of Consecutive Prime Numbers - <http://poj.org/problem?id=2739>
- 136. POJ 2909. Goldbach's Conjecture - <http://poj.org/problem?id=2909>

- 137. POJ 2954. Triangle - <http://poj.org/problem?id=2954>
- 138. POJ 3006. Dirichlet's Theorem on Arithmetic Progressions - <http://poj.org/problem?id=3006>
- 139. POJ 3030. Nasty Hacks - <http://poj.org/problem?id=3030>
- 140. POJ 3062. Celebrity jeopardy - <http://poj.org/problem?id=3062>
- 141. POJ 3094. Quicksum - <http://poj.org/problem?id=3094>
- 142. POJ 3256. Moo University - <http://poj.org/problem?id=3256>
- 143. POJ 3299. Humidex - <http://poj.org/problem?id=3299>
- 144. POJ 3370. Halloween treats - <http://poj.org/problem?id=3370>
- 145. POJ 3518. Prime Gap - <http://poj.org/problem?id=3518>
- 146. POJ 3619. Speed Reading - <http://poj.org/problem?id=3619>
- 147. POJ 3650. The Seven Percent Solution - <http://poj.org/problem?id=3650>
- 148. POJ 3748. 网线主管 - <http://poj.org/problem?id=3748>
- 149. POJ 3751. 时间日期格式转换 - <http://poj.org/problem?id=3751>
- 150. POJ 3980. 取模运算 - <http://poj.org/problem?id=3980>

HDU (杭电 OJ) :

- 151. HDU 1040. As Easy As A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1040>
- 152. HDU 2092. 整数解 - <http://acm.hdu.edu.cn/showproblem.php?pid=2092>
- 153. HDU 1862. EXCEL 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1862>
- 154. HDU 1003. Max Sum - <http://acm.hdu.edu.cn/showproblem.php?pid=1003>
- 155. HDU 1004. Let the Balloon Rise - <http://acm.hdu.edu.cn/showproblem.php?pid=1004>
- 156. HDU 1005. Number Sequence - <http://acm.hdu.edu.cn/showproblem.php?pid=1005>
- 157. HDU 1008. Elevator - <http://acm.hdu.edu.cn/showproblem.php?pid=1008>
- 158. HDU 1012. u Calculate e - <http://acm.hdu.edu.cn/showproblem.php?pid=1012>
- 159. HDU 1013. Digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1013>
- 160. HDU 1014. Uniform Generator - <http://acm.hdu.edu.cn/showproblem.php?pid=1014>
- 161. HDU 1017. A Mathematical Curiosity - <http://acm.hdu.edu.cn/showproblem.php?pid=1017>
- 162. HDU 1019. Least Common Multiple - <http://acm.hdu.edu.cn/showproblem.php?pid=1019>
- 163. HDU 1021. Fibonacci Again - <http://acm.hdu.edu.cn/showproblem.php?pid=1021>
- 164. HDU 1022. Train Problem I - <http://acm.hdu.edu.cn/showproblem.php?pid=1022>
- 165. HDU 1023. Train Problem II - <http://acm.hdu.edu.cn/showproblem.php?pid=1023>
- 166. HDU 1028. Ignatius and the Princess III - <http://acm.hdu.edu.cn/showproblem.php?pid=1028>
- 167. HDU 1029. Ignatius and the Princess IV - <http://acm.hdu.edu.cn/showproblem.php?pid=1029>
- 168. HDU 1032. The $3n + 1$ problem - <http://acm.hdu.edu.cn/showproblem.php?pid=1032>
- 169. HDU 1037. Keep on Truckin' - <http://acm.hdu.edu.cn/showproblem.php?pid=1037>
- 170. HDU 1042. N! - <http://acm.hdu.edu.cn/showproblem.php?pid=1042>
- 171. HDU 1047. Integer Inquiry - <http://acm.hdu.edu.cn/showproblem.php?pid=1047>
- 172. HDU 1048. The Hardest Problem Ever - <http://acm.hdu.edu.cn/showproblem.php?pid=1048>
- 173. HDU 1049. Climbing Worm - <http://acm.hdu.edu.cn/showproblem.php?pid=1049>
- 174. HDU 1051. Wooden Sticks - <http://acm.hdu.edu.cn/showproblem.php?pid=1051>
- 175. HDU 1056. HangOver - <http://acm.hdu.edu.cn/showproblem.php?pid=1056>
- 176. HDU 1058. Humble Numbers - <http://acm.hdu.edu.cn/showproblem.php?pid=1058>
- 177. HDU 1061. Rightmost Digit - <http://acm.hdu.edu.cn/showproblem.php?pid=1061>

178. HDU 1062. Text Reverse - <http://acm.hdu.edu.cn/showproblem.php?pid=1062>
179. HDU 1063. Exponentiation - <http://acm.hdu.edu.cn/showproblem.php?pid=1063>
180. HDU 1064. Financial Management - <http://acm.hdu.edu.cn/showproblem.php?pid=1064>
181. HDU 1070. Milk - <http://acm.hdu.edu.cn/showproblem.php?pid=1070>
182. HDU 1076. An Easy Task - <http://acm.hdu.edu.cn/showproblem.php?pid=1076>
183. HDU 1089. A+B for Input-Output Practice (I) - <http://acm.hdu.edu.cn/showproblem.php?pid=1089>
184. HDU 1090. A+B for Input-Output Practice (II) - <http://acm.hdu.edu.cn/showproblem.php?pid=1090>
185. HDU 1091. A+B for Input-Output Practice (III) - <http://acm.hdu.edu.cn/showproblem.php?pid=1091>
186. HDU 1092. A+B for Input-Output Practice (IV) - <http://acm.hdu.edu.cn/showproblem.php?pid=1092>
187. HDU 1093. A+B for Input-Output Practice (V) - <http://acm.hdu.edu.cn/showproblem.php?pid=1093>
188. HDU 1094. A+B for Input-Output Practice (VI) - <http://acm.hdu.edu.cn/showproblem.php?pid=1094>
189. HDU 1095. A+B for Input-Output Practice (VII) - <http://acm.hdu.edu.cn/showproblem.php?pid=1095>
190. HDU 1096. A+B for Input-Output Practice (VIII) - <http://acm.hdu.edu.cn/showproblem.php?pid=1096>
191. HDU 1106. 排序 - <http://acm.hdu.edu.cn/showproblem.php?pid=1106>
192. HDU 1108. 最小公倍数 - <http://acm.hdu.edu.cn/showproblem.php?pid=1108>
193. HDU 1163. Eddy's digital Roots - <http://acm.hdu.edu.cn/showproblem.php?pid=1163>
194. HDU 1170. Balloon Comes! - <http://acm.hdu.edu.cn/showproblem.php?pid=1170>
195. HDU 1201. 18 岁生日 - <http://acm.hdu.edu.cn/showproblem.php?pid=1201>
196. HDU 1202. The Best Sightseeing Pair - <http://acm.hdu.edu.cn/showproblem.php?pid=1202>
197. HDU 1205. 吃糖果 - <http://acm.hdu.edu.cn/showproblem.php?pid=1205>
198. HDU 1219. AC Me - <http://acm.hdu.edu.cn/showproblem.php?pid=1219>
199. HDU 1228. A + B - <http://acm.hdu.edu.cn/showproblem.php?pid=1228>
200. HDU 1229. 还是 A+B - <http://acm.hdu.edu.cn/showproblem.php?pid=1229>

AtCoder:

201. ABC 051 B - Sum of Three Integers - https://atcoder.jp/contests/abc051/tasks/abc051_b
202. ABC 088 B - Card Game for Two - https://atcoder.jp/contests/abc088/tasks/abc088_b
203. ABC 149 B - Greedy Takahashi - https://atcoder.jp/contests/abc149/tasks/abc149_b
204. ABC 152 B - Comparing Strings - https://atcoder.jp/contests/abc152/tasks/abc152_b
205. ABC 169 B - Multiplication 2 - https://atcoder.jp/contests/abc169/tasks/abc169_b
206. ABC 186 B - Blocks on Grid - https://atcoder.jp/contests/abc186/tasks/abc186_b
207. ABC 194 B - Job Assignment - https://atcoder.jp/contests/abc194/tasks/abc194_b
208. ABC 203 B - AtCoder Condominium - https://atcoder.jp/contests/abc203/tasks/abc203_b
209. ABC 210 B - Bouzu Mekuri - https://atcoder.jp/contests/abc210/tasks/abc210_b
210. ABC 215 B - $\log_2(N)$ - https://atcoder.jp/contests/abc215/tasks/abc215_b
211. ABC 220 B - Base K - https://atcoder.jp/contests/abc220/tasks/abc220_b
212. ABC 225 B - Star or Not - https://atcoder.jp/contests/abc225/tasks/abc225_b

- 213. ABC 230 B - Triple Metre - https://atcoder.jp/contests/abc230/tasks/abc230_b
- 214. ABC 235 B - Climbing Takahashi - https://atcoder.jp/contests/abc235/tasks/abc235_b
- 215. ABC 241 B - Pasta - https://atcoder.jp/contests/abc241/tasks/abc241_b
- 216. ABC 245 B - Mex - https://atcoder.jp/contests/abc245/tasks/abc245_b
- 217. ABC 250 B - Enlarged Checker Board - https://atcoder.jp/contests/abc250/tasks/abc250_b
- 218. ABC 255 B - Light It Up - https://atcoder.jp/contests/abc255/tasks/abc255_b
- 219. ABC 260 B - Better Students Are Needed! - https://atcoder.jp/contests/abc260/tasks/abc260_b
- 220. ABC 265 B - Explore - https://atcoder.jp/contests/abc265/tasks/abc265_b
- 221. ABC 270 B - Hammer - https://atcoder.jp/contests/abc270/tasks/abc270_b
- 222. ABC 275 B - Abs - https://atcoder.jp/contests/abc275/tasks/abc275_b
- 223. ABC 280 B - Inverse Prefix Sum - https://atcoder.jp/contests/abc280/tasks/abc280_b
- 224. ABC 285 B - Longest Uncommon Prefix - https://atcoder.jp/contests/abc285/tasks/abc285_b
- 225. ABC 290 B - Qual B - https://atcoder.jp/contests/abc290/tasks/abc290_b
- 226. ABC 295 B - ASCII Art - https://atcoder.jp/contests/abc295/tasks/abc295_b
- 227. ABC 300 B - Same Map in the RPG World - https://atcoder.jp/contests/abc300/tasks/abc300_b
- 228. ABC 305 B - ABC 334 - https://atcoder.jp/contests/abc305/tasks/abc305_b
- 229. ABC 310 B - Strictly Superior - https://atcoder.jp/contests/abc310/tasks/abc310_b
- 230. ABC 315 B - The Middle Day - https://atcoder.jp/contests/abc315/tasks/abc315_b
- 231. ABC 320 B - Longest Palindrome - https://atcoder.jp/contests/abc320/tasks/abc320_b
- 232. ABC 325 B - World Meeting - https://atcoder.jp/contests/abc325/tasks/abc325_b
- 233. ABC 330 B - Minimize Abs 1 - https://atcoder.jp/contests/abc330/tasks/abc330_b
- 234. ABC 335 B - Tetrahedral Number - https://atcoder.jp/contests/abc335/tasks/abc335_b
- 235. ABC 340 B - Append - https://atcoder.jp/contests/abc340/tasks/abc340_b
- 236. ABC 345 B - Integer Division - https://atcoder.jp/contests/abc345/tasks/abc345_b
- 237. ABC 350 B - Dentist Aoki - https://atcoder.jp/contests/abc350/tasks/abc350_b
- 238. ABC 355 B - Piano 2 - https://atcoder.jp/contests/abc355/tasks/abc355_b
- 239. ABC 360 B - Vertical Reading - https://atcoder.jp/contests/abc360/tasks/abc360_b
- 240. ABC 365 B - Right Triangle - https://atcoder.jp/contests/abc365/tasks/abc365_b
- 241. ABC 370 B - Cross Explosion - https://atcoder.jp/contests/abc370/tasks/abc370_b
- 242. ABC 375 B - Cross-free Matching - https://atcoder.jp/contests/abc375/tasks/abc375_b
- 243. ABC 380 B - RGB Points - https://atcoder.jp/contests/abc380/tasks/abc380_b
- 244. ABC 385 B - Trick or Treat - https://atcoder.jp/contests/abc385/tasks/abc385_b
- 245. ABC 390 B - Character Points - https://atcoder.jp/contests/abc390/tasks/abc390_b
- 246. ABC 395 B - Piano 3 - https://atcoder.jp/contests/abc395/tasks/abc395_b
- 247. ABC 400 B - Relative Position - https://atcoder.jp/contests/abc400/tasks/abc400_b
- 248. ABC 405 B - Piano 4 - https://atcoder.jp/contests/abc405/tasks/abc405_b
- 249. ABC 410 B - Median Pyramid - https://atcoder.jp/contests/abc410/tasks/abc410_b
- 250. ABC 415 B - Piano 5 - https://atcoder.jp/contests/abc415/tasks/abc415_b

牛客网:

- 251. 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>
- 252. 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>
- 253. 合并两个排序的数组 - <https://www.nowcoder.com/practice/89865d4375634fc484f3a24b7fe65665>

254. 剑指 Offer 45. 把数组排成最小的数 -

<https://www.nowcoder.com/practice/8fec3f8ba334add803bf2a06af1b993>

255. 剑指 Offer 40. 最小的 k 个数 -

<https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>

256. 剑指 Offer 51. 数组中的逆序对 -

<https://www.nowcoder.com/practice/96bd6684e04a44eb80e6a68efc0ec6c5>

257. NC78 链表反转 - <https://www.nowcoder.com/practice/75e878df47f24fdc9dc3e400ec6058ca>

258. NC45 实现二叉树先序，中序和后序遍历 -

<https://www.nowcoder.com/practice/a9fec6c46a684ad5a3abd4e365a9d362>

259. NC140 排序 - <https://www.nowcoder.com/practice/2baf799ea0594abd974d37139de27896>

260. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>

261. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>

262. NC61 两数之和 - <https://www.nowcoder.com/practice/20ef097ee8bf49358a47f8f1974028c4>

263. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31claed01b394f0b8b7734de0324e00f>

264. NC102 在二叉树中找到两个节点的最近公共祖先 -

<https://www.nowcoder.com/practice/e19927a8fd8d4b2d883013510d11c166>

265. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

266. NC150 二叉树的层序遍历 - <https://www.nowcoder.com/practice/0e26e5551f2f45b8b0b22b8dd68252e4>

267. NC4 判断链表中是否有环 - <https://www.nowcoder.com/practice/650474f313294468a4ded3ce0f7898b9>

268. NC141 判断回文 - <https://www.nowcoder.com/practice/e297fdd8e9f543059b0b5f05f3a7f3b2>

269. NC103 反转字符串 - <https://www.nowcoder.com/practice/c9c5715a5d244709800fa8f7146160dd>

270. NC76 用两个栈实现队列 - <https://www.nowcoder.com/practice/54275ddae22f475981afa2244dd448c6>

271. NC13 二叉树的最大深度 - <https://www.nowcoder.com/practice/8a2b2bf6c19b4f23a9bdb9b233eefa73>

272. NC109 岛屿数量 - <https://www.nowcoder.com/practice/0c9664d1556e458f9c38e6504115437d>

273. NC12 重建二叉树 - <https://www.nowcoder.com/practice/8a19cbe657394eeaac2f6ea9b0f6fcf6>

274. NC1 大数加法 - <https://www.nowcoder.com/practice/11ae12e8c6fe4df79d7f7bda8418de7a>

275. NC3 链表中环的入口结点 - <https://www.nowcoder.com/practice/253d2c59ec3e4bc68da16833f79a38e4>

276. NC50 链表中的节点每 k 个一组翻转 -

<https://www.nowcoder.com/practice/b49c3dc907814e9bbfa8437c251b028e>

277. NC40 链表相加(二) - <https://www.nowcoder.com/practice/c56f6c70fb3f4849bc56e33ff2a50b6b>

278. NC93 设计 LRU 缓存结构 - <https://www.nowcoder.com/practice/e3769a5f49894d49b871c09cadd13a61>

279. NC119 最小的 K 个数 - <https://www.nowcoder.com/practice/6a296eb82cf844ca8539b57c23e6e9bf>

280. NC68 跳台阶 - <https://www.nowcoder.com/practice/8c82a5b80378478f9484d87d1c5f12a4>

281. NC10 大数乘法 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

282. NC33 合并有序链表 - <https://www.nowcoder.com/practice/a166719f58b24f87810c2d54859336f1>

283. NC136 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>

284. NC15 二叉树的之字形层序遍历 -

<https://www.nowcoder.com/practice/91b69814117f4e8097390d107d2efbe0>

285. NC108 矩阵的最小路径和 - <https://www.nowcoder.com/practice/7d21d60579194b098959234b091cdecc>

286. NC121 字符串的排列 - <https://www.nowcoder.com/practice/fe6b651b66ae47d7acce78ffdd9a96c7>

287. NC127 最长公共子串 - <https://www.nowcoder.com/practice/f33f5adc55f444baa0e0ca87ad8a6aac>

288. NC105 二分查找-II - <https://www.nowcoder.com/practice/4f470d1d3b734f8aaf2afb014185b395>

289. NC61 两数之和 - <https://www.nowcoder.com/practice/20ef097ee8bf49358a47f8f1974028c4>

- 290. NC128 接雨水问题 - <https://www.nowcoder.com/practice/31c1aed01b394f0b8b7734de0324e00f>
- 291. NC102 在二叉树中找到两个节点的最近公共祖先 - <https://www.nowcoder.com/practice/e19927a8fd8d4b2d883013510d11c166>
- 292. NC137 表达式求值 - <https://www.nowcoder.com/practice/c215ba61c8b1443b996351df929dc4d4>
- 293. NC150 二叉树的层序遍历 - <https://www.nowcoder.com/practice/0e26e5551f2f45b8b0b22b8dd68252e4>
- 294. NC4 判断链表中是否有环 - <https://www.nowcoder.com/practice/650474f313294468a4ded3ce0f7898b9>
- 295. NC141 判断回文 - <https://www.nowcoder.com/practice/e297fdd8e9f543059b0b5f05f3a7f3b2>
- 296. NC103 反转字符串 - <https://www.nowcoder.com/practice/c9c5715a5d244709800fa8f7146160dd>
- 297. NC76 用两个栈实现队列 - <https://www.nowcoder.com/practice/54275ddae22f475981afa2244dd448c6>
- 298. NC13 二叉树的最大深度 - <https://www.nowcoder.com/practice/8a2b2bf6c19b4f23a9bdb9b233eefa73>
- 299. NC109 岛屿数量 - <https://www.nowcoder.com/practice/0c9664d1556e458f9c38e6504115437d>
- 300. NC12 重建二叉树 - <https://www.nowcoder.com/practice/8a19cbe657394eeaac2f6ea9b0f6fcf6>

CodeChef:

- 301. TSORT - Turbo Sort - <https://www.codechef.com/problems/TSORT>
- 302. STFOOD - Chef and Street Food - <https://www.codechef.com/problems/STFOOD>
- 303. FLOW017 - Second Largest - <https://www.codechef.com/problems/FLOW017>
- 304. FLOW018 - Small factorials - <https://www.codechef.com/problems/FLOW018>
- 305. FSQRT - Finding Square Roots - <https://www.codechef.com/problems/FSQRT>
- 306. CHOPRT - Chef And Operators - <https://www.codechef.com/problems/CHOPRT>
- 307. REMISS - Chef and Remissness - <https://www.codechef.com/problems/REMISS>
- 308. AMR15A - Mahasena - <https://www.codechef.com/problems/AMR15A>
- 309. DIFFSUM - Sum OR Difference - <https://www.codechef.com/problems/DIFFSUM>
- 310. PPSUM - Pairwise AND sum - <https://www.codechef.com/problems/PPSUM>
- 311. DECINC - Decrement OR Increment - <https://www.codechef.com/problems/DECINC>
- 312. FLOW008 - Chef and Table Tennis - <https://www.codechef.com/problems/FLOW008>
- 313. FLOW013 - Valid Triangles - <https://www.codechef.com/problems/FLOW013>
- 314. FLOW005 - Minimum Number of Notes - <https://www.codechef.com/problems/FLOW005>
- 315. FLOW010 - Id and Ship - <https://www.codechef.com/problems/FLOW010>
- 316. FLOW014 - Grade The Steel - <https://www.codechef.com/problems/FLOW014>
- 317. FLOW004 - First and Last Digit - <https://www.codechef.com/problems/FLOW004>
- 318. FLOW006 - Sum of Digits - <https://www.codechef.com/problems/FLOW006>
- 319. FLOW007 - Reverse The Number - <https://www.codechef.com/problems/FLOW007>
- 320. FLOW016 - GCD and LCM - <https://www.codechef.com/problems/FLOW016>
- 321. FLOW011 - Gross Salary - <https://www.codechef.com/problems/FLOW011>
- 322. START01 - Number Mirror - <https://www.codechef.com/problems/START01>
- 323. HS08TEST - ATM - <https://www.codechef.com/problems/HS08TEST>
- 324. INTEST - Enormous Input Test - <https://www.codechef.com/problems/INTEST>
- 325. FCTRL - Factorial - <https://www.codechef.com/problems/FCTRL>
- 326. FCTRL2 - Small factorials - <https://www.codechef.com/problems/FCTRL2>
- 327. CIELAB - Ciel and A-B Problem - <https://www.codechef.com/problems/CIELAB>
- 328. COOK82C - Bear and Clique Distances - <https://www.codechef.com/problems/COOK82C>
- 329. LECANDY - Little Elephant and Candies - <https://www.codechef.com/problems/LECANDY>

330. PRB01 - Primality Test - <https://www.codechef.com/problems/PRB01>

331. TLG - The Lead Game - <https://www.codechef.com/problems/TLG>

332. ONP - Transform the Expression - <https://www.codechef.com/problems/ONP>

333. PERMUT2 - Ambiguous Permutations - <https://www.codechef.com/problems/PERMUT2>

334. VOWELTB - Vowel Count - <https://www.codechef.com/problems/VOWELTB>

335. RECTANGL - Rectangle - <https://www.codechef.com/problems/RECTANGL>

336. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>

337. SIMDISH - Similar Dishes - <https://www.codechef.com/problems/SIMDISH>

338. TALAZY - Lazy Jem - <https://www.codechef.com/problems/TALAZY>

339. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>

340. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>

341. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>

342. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>

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358. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>

359. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>

360. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>

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365. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>

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370. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>

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471. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
472. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
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477. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
478. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
479. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>
480. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>
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482. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>
483. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
484. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
485. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>
486. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>
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489. COLOR - Chef and Colorful Tree - <https://www.codechef.com/problems/COLOR>
490. CHN09 - Chef and Strings - <https://www.codechef.com/problems/CHN09>
491. TWOVSTEN - Two vs Ten - <https://www.codechef.com/problems/TWOVSTEN>
492. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>
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498. FRGTNLNG - Forgotten Language - <https://www.codechef.com/problems/FRGTNLNG>
499. SIMDISH - Similar Dishes - <https://www.codechef.com/problems/SIMDISH>
500. CANDY123 - Candy Distribution - <https://www.codechef.com/problems/CANDY123>

SPOJ:

501. SPOJ MINSUB - Minimum Subset Sum - <https://www.spoj.com/problems/MINSUB/>
502. SPOJ FASHION - Fashion Shows - <https://www.spoj.com/problems/FASHION/>
503. SPOJ TOPOSORT - Topological Sorting - <https://www.spoj.com/problems/TOPOSORT/>
504. SPOJ ACPC10A - What's Next - <https://www.spoj.com/problems/ACPC10A/>
505. SPOJ ADDREV - Adding Reversed Numbers - <https://www.spoj.com/problems/ADDREV/>
506. SPOJ AE00 - Rectangles - <https://www.spoj.com/problems/AE00/>
507. SPOJ ARITH2 - Simple Arithmetics II - <https://www.spoj.com/problems/ARITH2/>
508. SPOJ BEENUMS - Beehive Numbers - <https://www.spoj.com/problems/BEEENUMS/>
509. SPOJ CANDY - Candy I - <https://www.spoj.com/problems/CANDY/>
510. SPOJ CANDY3 - Candy III - <https://www.spoj.com/problems/CANDY3/>
"""

选择排序实现

```
def selection_sort(arr):
    n = len(arr)
    for i in range(n - 1):
        min_index = i
        for j in range(i + 1, n):
            if arr[j] < arr[min_index]:
                min_index = j
        if min_index != i:
            arr[i], arr[min_index] = arr[min_index], arr[i]
```

冒泡排序实现

```
def bubble_sort(arr):
    n = len(arr)
    for i in range(n - 1):
        swapped = False
        for j in range(n - i - 1):
            if arr[j] > arr[j + 1]:
                arr[j], arr[j + 1] = arr[j + 1], arr[j]
                swapped = True
        # 如果没有发生交换，说明数组已经有序
        if not swapped:
            break
```

插入排序实现

```
def insertion_sort(arr):
    n = len(arr)
    for i in range(1, n):
        key = arr[i]
        j = i - 1
```

```
# 将大于 key 的元素向后移动
while j >= 0 and arr[j] > key:
    arr[j + 1] = arr[j]
    j -= 1
arr[j + 1] = key
```

```
# 测试代码
```

```
def test_sorting_algorithms():
    import random
    # 生成测试数据
    test_data = [random.randint(1, 100) for _ in range(20)]
    print("原始数据:", test_data)

    # 测试选择排序
    selection_data = test_data.copy()
    selection_sort(selection_data)
    print("选择排序结果:", selection_data)

    # 测试冒泡排序
    bubble_data = test_data.copy()
    bubble_sort(bubble_data)
    print("冒泡排序结果:", bubble_data)

    # 测试插入排序
    insertion_data = test_data.copy()
    insertion_sort(insertion_data)
    print("插入排序结果:", insertion_data)

# 运行测试
test_sorting_algorithms()
```

```
=====
```