2020 ECNU Campus Online Invitational Contest

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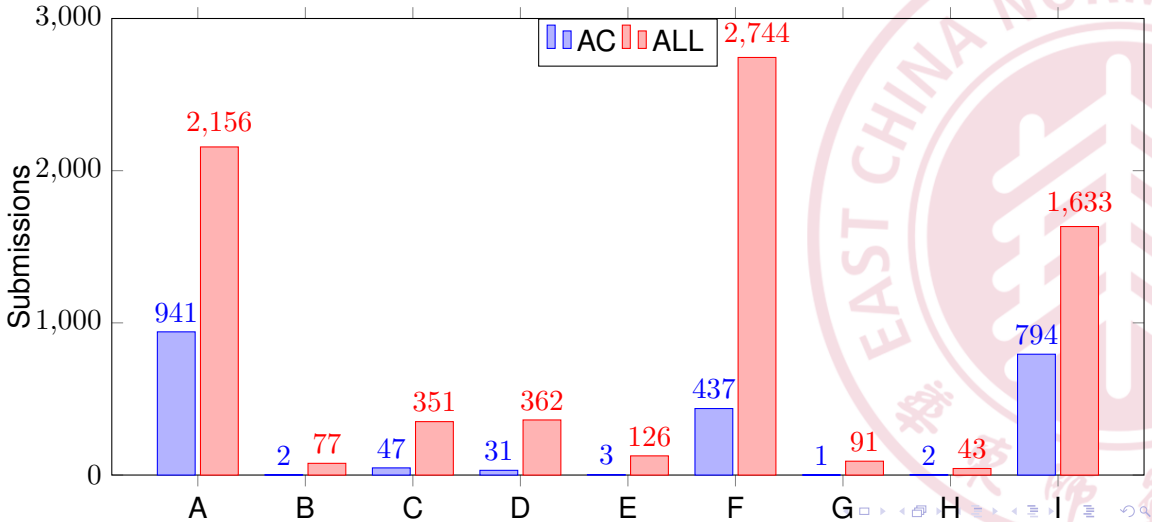
Judges' Anticipation

- Very easy: A
- Easy: F, I
- Medium easy: D, E, H
- Medium hard: C, G
- Hard: B

Summary


AC
ALL
Submissions
3,000
2,000
1,000
0
941
2,156
2
77
47
351
31
362
3
126
437
2,744
1
91
2
43
794
1,633
A
B
C
D
E
F
G
H
I

Congratulate Top-10 Competitor

#		=	罚时	A	B	C	D	E	F	G	H	I
1	lyx_cjz	7	796	+ 8	+ 152	+ 79	+4 185	-3	+ 29		+2 209	+ 12
2	interestingLSY	5	177	+ 8		+ 53		+ 75	+ 23			+ 16
3	gyz_gyz	5	244	+ 7		+1 123	+ 52	-4	+ 29			+ 12
4	BanFcc	5	298	+ 19		+ 87	+ 108		+ 48	-9		+1 14
5	12341231	5	355	+ 23		+ 149	+ 109	-4	+ 44			+ 29
6	跃迁引擎启动	5	419	+ 31		+ 145	+5 118		+ 18			+ 6
7	SuperSodaSea	5	491	+ 30		+2 184	+1 87	-2	+2 42			+ 46
8	jiedai	5	495	+ 21		+ 184	+2 127		+ 65			+1 35
9	Setsuna	5	503	+1 27		+2 150	+4 101		+ 48			+1 15
10	UniverseofHK	5	564	+1 27		+3 169	+2 119		+2 55			+1 12

A. Amateur Chess Players

Tags

Game Theory

Solutions

- Obviously, the optimal strategy is taking only one piece at a time.
- Therefore, the player with the more pieces wins no matter who takes first, otherwise the second player wins.

First Solved: Zhaoyang Li 00:06 (+1)

B. Binary String

Tags

Interactive, Mind

Solutions

- Obviously, the number of one of 0 and 1 must be $\leq \frac{n}{2}$, use binary search to determine their numbers.
- Suppose nunmber of 0 is less than 1.
- On one side of each 0, the number must satisfy $\leq \frac{n}{2}$, we can query this side to determine the position of 0.

B. Binary String

Solutions

- We can determine the position of 0 in turn, then the number of 1 must not decreasing in the left side.
- Each time, we try to increase the number of 1 in the left side of 0, and check if it is feasible.
- We will use totally $n + \log_2 n$ times query to answer the question.

First Solved: Yuxiang Luo 2:32 (+)

C. Coronavirus Battle

Tags

Divide and Conquer, Random Algorithms, Sorting

Solutions I

- The problem is called non-dominated sorting. It's a well-known problem with many research works.
- Using divide and conquer. Build non-dominated tree for former and latter half of the array, and merge them with iterative comparison.
- Refer to *An Efficient Non-dominated Sorting Method for Evolutionary Algorithms, Fang et al. (2008)* for details.

C. Coronavirus Battle

Solutions II

- As the data is randomly generated, intuitively, the number of rounds (layers) is not large (empirically about 100).
- Sort with some approximate criterion (like sum of x, y and z), and for each item in the sorted array, the smaller items must have appeared before. So we put the current item into an appropriate layer by sequentially checking whether the corresponding layer is satisfiable.
- The solution works empirically fast, but hard to prove.

First Solved: Shengyu Liu 00:53 (+)

D. Decay of Signals

Tags

Dynamic Programming, Tree

Solutions

- It is easy to prove that there are only the following situations:
  - A path consisting of x 1-value nodes, the value of path is $\frac{1}{x}$.
  - One x value node, the value of path is x .
  - A path consisting of $2x+1$ nodes where only the central node is of value 2 , all the rest are 1-value nodes, the value of path is $\frac{2}{2x+1}$.

First Solved: Yizhen Gu 00:52 (+)

E. Even Degree

Tags

Graph, Euler Circuit

Solutions

- Even degree will easily make you remind Euler circuit.
- First delete one edge randomly in each connecting graph.
- Then find an Euler path in the each connecting graph, and take turns to delete the outermost edge.

First Solved: Shengyu Liu 01:15 (+)

F. Find / -type f -or -type d

Tags

Sorting

Solutions

- Sort the list.
- Note that a file must not have its previous one as its prefix. A string without its next one being its prefix must be a file.
- Check the suffix of all found files.

First Solved: Junliang Yan 0:18(+)

G. Geralt of Rivia

Tags

Math, Tenary Search

Solutions

- The number of rounds must be an integer.
- Assume the number of rounds is x, the minimal damage is $f(x) = (x-1)(\frac{A}{x} + B)$, where A is always positive.

G. Geralt of Rivia

Solutions (Cont.)

- If $B \geq 0$, when x the smaller is x, $f(x)$ is smaller. If $B < 0$, when x is minimal or maximal, $f(x)$ reaches minimum. Note the range of x.
- Ternary search can also be used to get the minimal answer.
- Note the numerator/dominator of the answer may be larger than 2^{64}.

First solved: Chaoyang Wang 02:48 (+18)

H. Heat Pipes

Tags

Graph

Solutions

- For each connected component, the maximum number of different temperatures that can be tuned to is the graph diameter. It could be calculated by BFS.
- If there exists even cycle or $b - a + 1$ is larger than the sum of components' diameter, the answer is "No".
- Note the condition $a = b$.

First Solved: Yuxiang Luo 03:29 (+2)

I. Idiotic Suffix Array

Tags

Construction

Solutions

- There are many ways to construct, for example:

```
n, k = map(int, input().split())
print('a' + 'b' * (n - k) + 'a' * (k - 1))
```

First Solved: Junliang Yan 0:06(+)

End

Thanks for attention!