PA4 - 4003 Discussion Thread

This question is extremely challenging. Due to the competitive nature of this question, the TA team will provide you **limited** help with this question. *For example, we would not tell you which method is the best way to solve this problem.* You can use all the knowledge you have learned in this course to solve this question, including the greedy algorithm, dynamic programming, sorting, divide and conquer, etc. Also, you are allowed to use the knowledge learned outside this course, such as Monte Carlo Sampling, Markov chain, Q-Learning, or some randomized algorithms, etc.

We have tested and ensured that only using the knowledge learned in this course could get a score of **more than 60%**. It is totally okay not AC this problem.

Good luck to everyone. Have fun!😊

T. S. P.

Description

For now, we are ready to work on an NP-hard problem, the TravelingSalesmanProblem. The problem is defined as :"Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city?" In this problem, you are provided with a graph, where vertices represents cites and edges represent the road connecting each pair of cities. The weight of each edge represents the distance between those two cities. You may try a combination of ways of what you have learned in the course.

Input

First line an integer n, denoting the number of vertices.

Next n lines, nxn adjacency matrix.

All edge weights are integers in [0,1000], which conform to $1000Beta(0.5, 0.5)$ distribution.

Output

n integers in one line, each integer represents the vertex id, denoting the traversal order. Note that you should output a cycle. The vertices id start from 1.

Note about test:There are only 3 graphs in total, and each graph contains 10 test cases (graph in these 10 cases are the same!). We will traverse the order you outputted, and see if your total cost is smaller than a certain number. Each test case will specifically judge whether your output is small enough.

The first graph has 50 vertices. To get credits for each test case, your output cost should be less than [25000,10000,5000,4000,3000,2000,1000,500,400,200], separately.

The second graph has 100 vertices. To get credits for each test case, your output cost should be less than [50000,5000,3500,3000,2500,2000,1500,1000,500,350,200], separately.

The third graph has 500 vertices. To get credits for each test case, your output cost should be less than [250000,80000,40000,30000,20000,12000,8000,4000,2000,1000], separately.

`programming`

Updated 22 days ago by Yining She (佘以宁)

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followup discussions *for lingering questions and comments*   **2 endorsed followup comments**

● Resolved   ○ Unresolved

彭 程 20 days ago
In the annoucement of PA4,
it is mentioned that *any submission that attempts to **hardcode** solution will be punished* .

I have implemented a approximation algorithm for this problem, which can get performance boost when parameters e.g. probability of accepting a local minimal, number of random starting points are adjusted based on the characteristics of the input.
I submitted the code multiple times to find the best value for the parameters.

I am wondering whether this is regarded as **hardcode the solution into the code**

helpful! | 2

张龙文 20 days ago   no
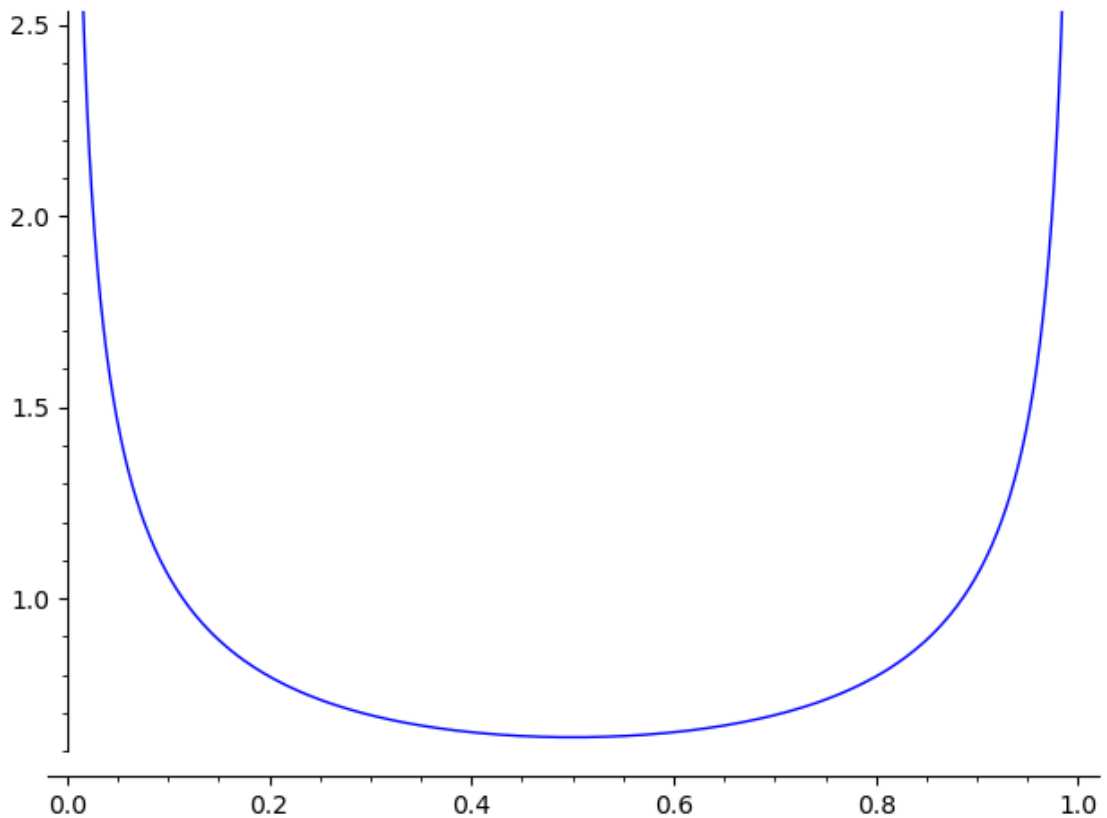
good comment | 0

● Resolved   ○ Unresolved

刘翊航   20 days ago
I didn't enroll Probability & Statistics in this semester, could you provide a brief explanation on Beta(0.5, 0.5)? Thanks a lot!

helpful! | 0

彭 程 20 days ago

helpful! | 1

刘翊航 20 days ago

Thanks!

helpful! | 0

彭 程 20 days ago

Suppose that $X \sim \mathrm{Beta}(1/2, 1/2)$ (read as: X has a beta distribution with paramters 0.5,0.5) we have the following helpful properties.

- $0 < X < 1$
- $P\left(\frac{1}{2} - t < X < \frac{1}{2}\right) = P\left(\frac{1}{2} < X < \frac{1}{2} + t\right)$.
  For all $0 < t < \frac{1}{2}$

-

helpful! | 3

彭 程 20 days ago

Some typical $1000\mathrm{Beta}(0.5, 0.5)$ samples:
Generated by `sagemath betavariate(0.5,0.5)`

```
def gen(): return int(1000*betavariate(0.5,0.5))

# l=[gen() for _ in range(50)]; print(l)
[780, 437, 442, 329, 769, 435, 16, 425, 819, 850, 263, 19, 670, 765, 939, 136, 308, 2
79, 140, 690, 494, 0, 23, 187, 438, 50, 826, 244, 961, 254, 999, 929, 206, 937, 345,
 979, 135, 711, 136, 44, 196, 275, 948, 931, 948, 419, 681, 120, 633, 533]

# l=[gen() for _ in range(50)]; print(l)
[770, 991, 83, 917, 328, 93, 977, 13, 774, 59, 399, 486, 7, 943, 320, 996, 977, 988,
 178, 304, 21, 74, 680, 962, 377, 0, 624, 46, 277, 213, 956, 531, 788, 974, 86, 79, 9
94, 442, 41, 51, 945, 996, 225, 173, 917, 388, 131, 965, 926, 63]
```

```
# l=[gen() for _ in range(1000)]; l.sort(); print(l[:50])
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 2, 2,
 2, 2, 2, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6]
```

run code snippet

helpful! | 1

龚 可 20 days ago
python `np.random.beta` is also helpful

helpful! | 3

◉ Resolved ○ Unresolved

陈 正 18 days ago
Is there a effective way using python to input

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

Thanks a lot.
helpful! | 0

龚 可 18 days ago

```
n = int(input())
a = []
for i in range(n):
    line = list(map(int, input().split()))
    a.append(line)
```

run code snippet

By the way, as has been discovered, numpy has not been installed on the judge system, so using Python may result in a huge loss in efficiency. It is not suggested to use Python when most people use C++, especially when efficiency matters.

helpful! | 0

◉ Resolved ○ Unresolved

丁弘毅 17 days ago Is it guaranteed that the input adjacency matrix is symmetric? (or are the edges directed or undirected)
helpful! | 0

Yining She (佘以宁) 17 days ago Yes, the matrix is symmetric

good comment | 0

◉ Resolved ○ Unresolved

陈 正 17 days ago
if distance[1][2]=0,is they are very close,or they are not connect?

helpful! 0

张龙文 17 days ago   distance is 0

good comment 0

◉ Resolved   ○ Unresolved

zhaoyao 12 days ago
Why does adding #include <iostream>   go wrong?
helpful! 0

zhaoyao 12 days ago

> **Compile Error**
>
> ⚠ /judger/run/0f5de9f9c8de405c8d89db11b9b852c3/main.c:1:10: fatal error: iostream: No such file or directory
>   1 | #include <iostream>
> | ^~~~~~~~~~
>   compilation terminated.

helpful! 0

zhaoyao 12 days ago   Sorry,I know why.

helpful! 0

龚可 12 days ago
You chose the wrong language.

helpful! 0

◉ Resolved   ○ Unresolved

Anonymous Helix 4 days ago
How would the final grade be computed? As the algorithm I use contains srand() and take the system time for the seed, the score of each of the submissions differs even when submitting the same code without any parameters changed. However after one submission with higher score, this score might not be retained for subsequent ones. So would the final score be the highest score one can get or it would just be taken according to the last submission?
helpful! 0

Yining She (佘以宁) 4 days ago   The last submission

good comment 0

◉ Resolved   ○ Unresolved

Huayu Wang 16 hours ago
Why do I keep receiving `system error` in submissions? My code ran normally locally. The Language I selected is indeed C++.
helpful! 0

龚可 14 hours ago
Maybe your output is incorrect. The output should consist of n distinct integers in $[1, n]$ which corresponds to a circle on the graph. No extra things should be printed. I guess the 'system error' has similar meaning to 'wrong answer', since this problem uses special-judge and wrong answer may cause error on the special-judge.

helpful! 0

Huayu Wang 18 minutes ago   Got it! Thanks

helpful! 0