Public transport

Submission deadline:	**2021-12-19 23:59:59**
Late submission with malus:	**2022-02-01 23:59:59** (Late submission malus: 100.0000 %)
Evaluation:	**10.0200**
Max. assessment:	**1.0000** (Without bonus points)
Submissions:	16 / -
Advices:	0 / 0

Statistics from recent years are relentless. Every year, the number of passengers who travel in Prague's public transport without a valid ticket decreases. In 2020, traffic checks detected 204,582 passengers in breach of transport conditions, a decrease of 17.2% compared to 2019 [1]. The fact that 2020 was a covid year certainly has a share in this, however, the statistics from previous years also show a decline [2,3,4]. However, the number of black passengers is still double, for example compared to Vienna, where, according to statistics, passengers are the most disciplined in Europe [5].

The management of the transport company has decided to use the time when the transport company's cars are full of cameras, sensors and other smart devices to prepare a better strategy for ticket checks. Rather, it has entrusted this task to the Transport Control Department.

The staff first decided to find out what data they were able to obtain. The analysis showed that the transport company has information on how many people averagely use public transport from station `A` to station `B`. The team of analysts also found interesting information from the data about the inspectors themselves. Although the number of passengers without a valid ticket is declining from year to year, the aggressiveness of those caught is significantly increasing.

The result is as follows. Due to the growing number of incidents, a black passenger will be identified and fined if he get caught. But he will be able to continue driving. Thanks to the confirmation with the destination station obtained from inspector, it also does not happen that he gets fined repeatedly during the next check on the same route. Due to the small number of inspectors, the transport company would like to select a small number of sections for each line (always between two stations) such that the largest possible number of passengers will be checked during the transport inspection performed on this section. The latest news then says that each inspector can perform an inspection on just one section of the route. This is mainly in order to protect the health of the auditors.

The last thing you need to do before starting a new system is to create an algorithm that finds such sections. Fortunately, a couple of clever heads got together and thought that they could enter it as a project of cooperation with industry at FIT CTU. It is said that students program it there almost for a free...

Thus, your goal is to find sections for the specified line that will be checked by inspectors so that as many people as possible are checked.

Input format

- Input begins with three numbers C , S , P , which in turn represent the number of inspectors, the number of stops and the number of passenger records. $1 \leq C$, $P \leq 10000$ and $2 \leq S \leq 10000$.
- This is followed by P lines with information about transported passengers. Each of these lines has the form `from to count`, where `from` represents the departure station, `to` represents the exit station, and `count` is the number of passengers we expect to travel between these stops. Valid `0 ≤ from < to ≤ S-1` and `count ≤ 10⁹`.
- Input is always valid and does not need to be checked.

Output format

- The first line of output shows the maximum number of passengers that can be checked by C inspectors.
- The second line is a sequence of sections describing which stops should be checked. Each section has the form [x;y] and sections are separated by commas.

Point-conditions

- To get a 1 point, you need to properly resolve instances with $C = 1$ and $S \leq 15$.
- To get 3 points, you need to properly resolve instances with $C \leq 5$ and $S \leq 15$.
- To get 5 points, you need to correctly and quickly resolve instances with $C \leq 15$ > a $S \leq 50$.
- To get 10 points, you need to correctly and quickly resolve instances with $C \leq 1000$ > a $S \leq 1000$.
- To get 13 points, you need to correctly and quickly resolve any instances that match the assignment.

Sample data

Input 1

```
1 5 5
1 4 2
1 2 2
```

```
2 3 6
2 4 3
3 4 5
```

Output 1

```
11
[2;3]
```

Input 2

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

Output 2

```
18
[2;3],[3;4]
```

Notes

- You can think of the public transport line you're addressing as a straight line. The first stop on the route is called `0`, the second `1`, until the last stop is marked as `S-1`
- You will be limited by runtime in all tests. You can see the limits in the reference solution.
- The quest offers a bonus speed test for which you can earn up to 3 extra points. To meet it, it is necessary to well implement an effective algorithm solving the given problem. The bonus speed test cannot be consulted with teachers.

References

- [1] DOPRAVNÍ PODNIK HL. M. PRAHY. Annual Report 2020 [online]. Prague: Dopravní podnik hl. m. Prahy, duben 2021. Available from: **https://www.dpp.cz/cs/data/V%C3%BDro%C4%8Dn%C3%AD%20zpr%C3%A1vy/Annual%20report/DPP_ANNUAL_REPORT_2020.pdf**
- [2] DOPRAVNÍ PODNIK HL. M. PRAHY. Annual Report 2019 [online]. Prague: Dopravní podnik hl. m. Prahy, April 2020. Available from: **https://www.dpp.cz/cs/data/V%C3%BDro%C4%8Dn%C3%AD%20zpr%C3%A1vy/Annual%20report/DPP_ANNUAL_REPORT_2019.pdf**
- [3] DOPRAVNÍ PODNIK HL. M. PRAHY. Annual Report 2018 [online]. Prague: Dopravní podnik hl. m. Prahy, April 2019. Available from: **https://www.dpp.cz/cs/data/V%C3%BDro%C4%8Dn%C3%AD%20zpr%C3%A1vy/Annual%20report/DPP_ANNUAL_REPORT_2018.pdf**
- [4] DOPRAVNÍ PODNIK HL. M. PRAHY. Annual Report 2017 [online]. Prague: Dopravní podnik hl. m. Prahy, duben 2018. Available from: **https://www.dpp.cz/cs/data/V%C3%BDro%C4%8Dn%C3%AD%20zpr%C3%A1vy/Annual%20report/DPP_ANNUAL_REPORT_2017.pdf**
- [5] ŠINDELÁŘ, Jan. Černých pasažérů v Praze ubývá, stále jich je ale dvakrát více než ve Vídni. Zdopravy.cz [online]. Prague: Avizer Z, 2019, January 19, 2019. ISSN 2570-7868. Available from: **https: //zdopravy.cz/cernych-pasazeru-v-praze-ubyva-stale-jich-je-ale-dvakrat-vice-nez-ve-vidni-22277/**

Submit:	Choose File	**Submit**

☐ **Reference**

16	**2021-12-16 00:34:01**	**Download**
Submission status:	Evaluated	
Evaluation:	10.0200	

- **Evaluator: computer**
  - Program compiled
  - Test 'Easy peasy test': success
    - result: 100.00 %, required: 100.00 %
    - Max. run time: 0.026 s (limit: 2.000 s)
    - Total run time: 0.562 s
    - Mandatory test success, evaluation: 100.00 %
  - Test 'Small data': success
    - result: 100.00 %, required: 100.00 %
    - Max. run time: 0.007 s (limit: 2.000 s)
    - Total run time: 0.143 s (limit: 2.000 s)
    - Bonus test - success, evaluation: 300.00 %