Introduction

Congratulations! You have been chosen to lead an expedition for the colony! You must scout the frozen tundra in search of new locations for expansion. You may choose your party to help you on this journey. You will be scouting in five locations as detailed below.

Maps

The maps will be provided in a `m × n` grid showing the landscape of each tile as follows:

```
map_size=3,5
S, S, I, I, I,
S, S, TS, TS, M,
S, M, TS, S, S
```

There are four different landscape types:

Symbol	Type	Travel difficulty
S	Snow	1
I	Ice	5
TS	Thick Snow	10
M	Mountain	15

You will be rewarded for making smart choices on behalf of your party. The points are based on the landscape type of the tile you move from and to. Calculating the travel score will be detailed at the end.

Step allowance:

This expedition is urgent and the inhospitable environment of Arctica forces your party to move fast. Each map will have a set step allowance. Should you exceed this allowance, instead of rewarding the points above, **they will be subtracted**.

The step allowance will be provided in the map file, like so:

```
Step_allowance=5
```

Movement

The expedition will always start inside the first tile in the top left corner of the map and end inside the last tile at the bottom right corner of the map. The travel difficulty of the starting tile is ignored.

Your party can only move left, right, up, and down. **No diagonal movement allowed.**

Party

Your party will consist of 0 to 2 members, per map, but you are not allowed to have more than one of the same proficiencies (i.e., Scout & Healer or Healer & Gatherer but not Scout & Scout).

Scout:

The scout is trained in navigating the treacherous landscapes of Arctica and thus will improve the speed of your party.

If a scout is present in your party, travel rewards are doubled, and travel penalties are halved

Healer:

The healer is knowledgeable in the scarce herbs and medicinal items of Arctica and will thus keep your party healthy during the journey.

If a healer is present in your party, the step allowance of each map is increased by 20 percent (rounded up)

Gatherer:

The gatherer is efficient at extracting the minimal resources that the Arctica landscape has to offer and thus will improve the resource gathering of your party.

If a gatherer is present in your party, you will gather double the amount from a resource block i.e. 2 coal instead of 1

Resources

The resource locations will be provided in a list with the number of resources in the map and the coordinates detailing their locations as follows:

```
Coal,2 // resource,number of occurences
0,1 // row,column
2,4

Fish,1
0,3

Scrap_metal,1
2,0
```

In frozen Arctica these resources carry tremendous value. Should your party return with some of these resources, you will be handsomely rewarded.

Coal: 200 points

Fish: 400 points

Scrap metal: 1000 points

Resources do not increase the travel difficulty of that tile. You automatically collect a resource when you move over the tile. You only collect the resource once. If you move over the same resource tile again, no resources will be collected.

Quota:

Each map will also have resource quotas. Should you meet the quotas for all resources (meaning, if you gather an amount of each resource, equal to or exceeded the map's quota for that resource), you will receive a resource score bonus.

The quota will be provided in the file, like so, along with the quota multiplier:

```
Quota=2,1,0 // coal, fish, scrap metal
Quota_multiplier=2
```

Input files

All this information will be provided in the `map.txt` file.

map.txt:

```
Step_allowance=5

Coal,2
0,1
2,4

Fish,1
0,3

Scrap_metal,1
2,0

Quota=2,1,0
Quota_multiplier=2

map_size=3x5
S,S,I,I,I
S,S,TS,TS,M
S,M,TS,S,S
```

Submissions

Submissions must be a **text** file with the content as **JSON**, for each map, as follows:

```
{
    "Party": ["Scout", "Gatherer"],
    "Path": [[0,0], [0,1], [0,2], [0,3], [1,3], [2,3], [2,4]]
}
```

NB:

1. Ensure that your party starts in the top left corner of the map
2. Ensure that your party reaches the bottom right corner of the map
3. Ensure that your party follows a continuous path
4. Ensure that your path consists of only up, down, left, and right movement
5. Ensure that your party does not consist of more than 2 members
6. Ensure that your party contains only valid members
7. Ensure that your party does not have more than one of the same members

Scoring

Scores start at 0. Scoring is calculated as follows:

1. The total travel score of the path is calculated with party member benefits and step allowance considered.
2. Any resources gathered are added to the score
3. If a quota is met, the resource score is multiplied by the map quota

The total scores of all the maps are added together to give the final score.

Example

Regard the following example:

map.txt:

```
map_size=3x5
Step_allowance = 5

Coal,2
0,1
2,4

Fish,1
0,3

Scrap_metal,1
2,0

Quota=2,1,0
Quota_multiplier=2

S,S,I,I,I
S,S,TS,TS,M
S,M,TS,S,S
```

with the following submission:

```
{
    "Party": ["Scout", "Gatherer"],
    "Path": [[0,0], [0,1], [0,2], [0,3], [1,3], [2,3], [2,4]]
}
```

The party has a scout therefore the step allowance penalty will be halved. The party also has a gatherer, so every resource gathered is doubled.

The formula to calculate the travel score is detailed as follows:

1. If the party is within the step allowance **without a scout**:

$$travel\ score\ +=\ \frac{\dfrac{150}{travel\ difficulty\ of\ tile}}{Erf^{*}(\dfrac{current\ step - 1}{step\ allowance}) + 1}$$

2. If the party is within the step allowance **with a scout**:

$$travel\ score\ +=\ \frac{2 \times \dfrac{150}{travel\ difficulty\ of\ tile}}{Erf(\dfrac{current\ step - 1}{step\ allowance}) + 1}$$

3. If the party has exceeded the step allowance **without a scout:**

$$travel\ score\ -=\ \frac{150}{travel\ difficulty\ of\ tile} \times (Erf(\frac{current\ step - step\ allowance}{step\ allowance}) + 1)$$

4. If the party has exceeded the step allowance **with a scout:**

$$travel\ score\ -=\ 0.5\ \times \frac{150}{travel\ difficulty\ of\ tile} \times (Erf(\frac{current\ step - step\ allowance}{step\ allowance}) + 1)$$

* Error function

The total travel score is calculated step-by-step, like so:

Step	Tile	Travel difficulty	Notes	Resources
[0,0]	Snow	0	The starting node does not count towards the score	0 x Coal 0 x Fish 0 x Scrap metal
[0,1]	Snow	0+300	The travel difficulty of snow is 1 so the reward is calculated as $travel\ score\ +=\dfrac{2\times\frac{150}{1}}{Erf(\frac{1-1}{5})+1}$	2 x Coal* 0 x Fish 0 x Scrap metal
[0,2]	Ice	300+245.358	The travel difficulty of ice is 5 so the reward is calculated as (only the final score is rounded) $travel\ score\ +=\dfrac{2\times\frac{150}{5}}{Erf(\frac{2-1}{5})+1}$	2 x Coal 0 x Fish 0 x Scrap metal
[0,3]	Ice	545.358+210.026	The travel difficulty of ice is 5 so the reward is calculated as $travel\ score\ +=\dfrac{2\times\frac{150}{5}}{Erf(\frac{3-1}{5})+1}$	2 x Coal 2 x Fish* 0 x Scrap metal
[1,3]	Thick Snow	755.384+187.049	The travel difficulty of thick snow is 10 so the reward is calculated as $travel\ score\ +=\dfrac{2\times\frac{150}{10}}{Erf(\frac{4-1}{5})+1}$	2 x Coal 2 x Fish 0 x Scrap metal
[2,3]	Snow	942.443+172.206	The travel difficulty of snow is 1 so the reward is calculated as $travel\ score\ +=\dfrac{2\times\frac{150}{1}}{Erf(\frac{5-1}{5})+1}$	
[2,4]	Snow	1114.649 – 91.703	The team has exceeded the step allowance, but they have a scout in the party The travel difficulty of snow is 1 so the penalty is calculated as $travel\ score\ -=0.5\times\frac{150}{1}\times Erf(\frac{6-5}{5})+1$	

* The party includes a gatherer, therefore all resources gathered are doubled

On this path the party gathered 2 coal and 2 fish thereby meeting the quota of 2 coal, 1 fish and 0 scrap metal.

The final score is therefore:

$$1023^{\dagger}+2(2(200)+2(400))^{\ddagger}=3423$$

$\dagger$ Total travel score

$\ddagger$ Resources collected multiplied by quota bonus

Freebie

Try the following pseudo code on map 1:

```
rows = 6
columns = 9
path = []

columnCount = 0
for row = 0 To rows-1
  add to path ([row, columnCount])
  add to path ([row+1, columnCount])
  column += 1

for column = columnCounter To columns
  add to path ([rows, column])

print {"Party":[],"Path": path}
```