AInnovated Chick

The Reply Code Masters Team

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Resumen

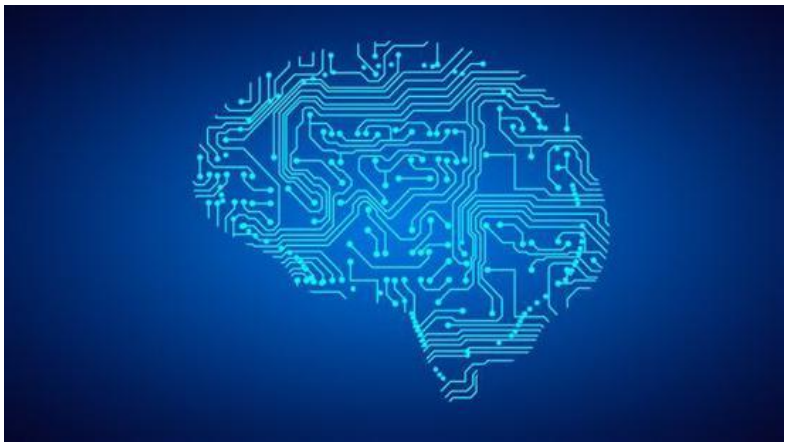
Chick Norris TV is Reply's global video platform specially designed to spread knowledge. It enables Replyers to share insights, lessons they've learned, comprehensive courses, and helpful *show me how* tips.

For the back story of how it all began, make sure you visit Chick Norris TV (**challenges.reply.com/about-CNTV**). And as April 2024 approaches, we're getting ready to celebrate our beloved Reply mascot's third anniversary, and what better way than with a Challenge that embodies our innovation-driven ethos.

Now, picture a future where Chick Norris TV broadcasts only AI-generated TV series, 24/7. Then imagine the potential for Replyers to craft groundbreaking content with the help of cutting-edge AI software.

The key to accomplishing this lies in crafting a neural network. A network of carefully sequenced tiles that seamlessly connect the global roster of available show schedules, which we'll refer to as *Golden Points*. But to achieve this requires both effective neural network training and an in-depth understanding of the most popular TV programmes, represented by the *Silver Points*.

As a specialist in Reply's AI domain, it falls on you to choose the optimal route. A route that uses the most concise sequence of tiles possible, but which interlinks all the Golden Points while passing through each Silver Point.



1. Problem statement

The goal is to identify the most efficient route between pairs of G Golden Points, while ensuring the highest attainable score by acquiring S Silver Points *en route*. Each Silver Point holds a designated value that contributes to the overall track score.

The players must use T Tiles to draw the path on the system grid represented by a WxH map. The T Tiles can be of different types and are represented in the Input section. Each type of Tile enables the players to chart a course in a specific direction.

Here's a reference list indicating the directions associated with each Tile ID:

- Tile 3:

  From left to right (*)

- Tile 5:

  From down to right (*)

- Tile 6:

  From left to down (*)

- Tile 7:
  - From left to right (*)
  - From left to down (*)
  - From down to right (*)

- Tile 9:

  From up to right (*)

- Tile A:

  From left to up (*)

- Tile B:
  - From left to right (*)
  - From left to up (*)
  - From up to right (*)

- Tile C:

  From up to down (*)

- Tile D:
  - From up to down (*)
  - From up to right (*)
  - From down to right (*)

- Tile E:

  - From left to up (*)
  - From left to down (*)
  - From up to down (*)
- Tile F:
  - From left to right (*)
  - From left to down (*)
  - From left to up (*)
  - From up to down (*)
  - From down to right (*)
  - From up to right (*)

(*) The opposite direction is admitted.

Every Tile carries an associated usage cost, which will be subtracted from the total points earned along the entire track.

It's important to keep in mind:

1. the primary goal is to identify the path with the lowest cost.
2. in cases where the entered Tile coordinates yield multiple routes with identical costs, only the route with the fewest scored points will be considered.

The final score is calculated by adding together the earned scores of all the minimum paths and then subtracting the total cost of the Tiles used.

2. Input format

The input file is a regular ASCII text file. Each line of the input file ends with a single $\backslash n$ character (UNIX-style). If a line has multiple data, each value is separated by a single space character.

The first row of the input file will be composed of 5 integer numbers:

1. The integer W, indicating the width (n. of columns) of the system grid
2. The integer H, indicating the height (n. of rows) of the system grid
3. The integer G_N, indicating the number of Golden Points
4. The integer S_M, indicating the number of Silver Points
5. The integer T_L, indicating the number of types of tiles available to players

The following rows represent in order:

- G_i (Golden Point) lines, where i=1...N. Each line consists of:
  1. an integer G_i^X, representing the X coordinate on the system grid
  2. an integer G_i^Y, representing the Y coordinate on the system grid
- S_j (Silver Point) lines, where j=1...M. Each line consists of:
  1. an integer S_j^X, representing the X coordinate on the system grid
  2. an integer S_j^Y, representing the Y coordinate on the system grid
  3. an integer S_j^{SC}, representing the associated score
- T_k (Tile) lines, where k=1...L. Each line consists of:
  1. a string T_k^{ID}, representing the Tile ID
  2. an integer T_k^C, representing the Tile Cost
  3. an integer T_k^N, representing the number of available Tiles

It's not mandatory to use all available Tiles.

It's important to keep in mind the:

1. X coordinate on the system grid moves horizontally from left to right
2. Y coordinate on the system grid moves vertically from up to down
3. $(0; 0)$ point is placed on the top left of the system grid

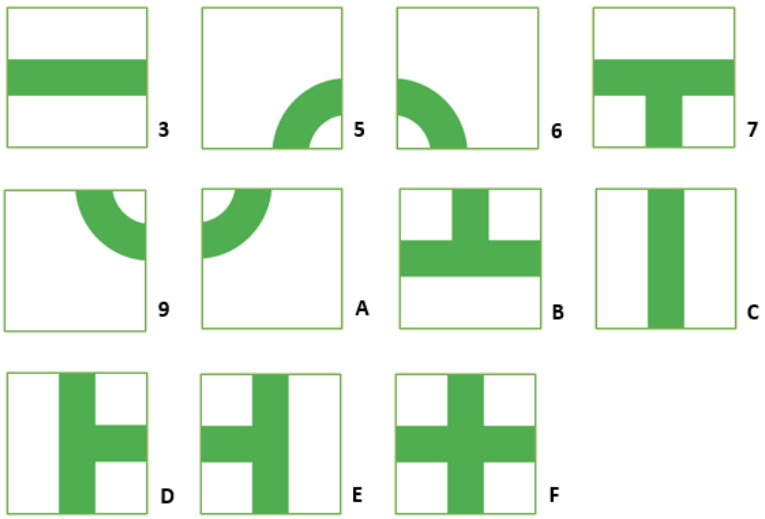


Figure:1 *This image shows the different types of Tiles.*

3. Output format

The output file must be a regular ASCII text file. Each line of the output file must end with a single $\backslash n$ character (UNIX-style). The i_{th} line of this file consists of the X coordinate and Y coordinate of the Tile, separated by a single space character.

Each line consists of:

1. a string T_k^{ID}, representing the Tile ID chosen
2. an integer T_k^X, representing the X coordinate on the system grid
3. an integer T_k^Y, representing the Y coordinate on the system grid

4. Scoring rules

Given a list of deployed T Tiles, the score is the result of:

$$\sum_{j=1}^{M} S_j^{SC}{}_{minP} - \sum_{k=1}^{L} T_k^C$$

where $S_j^{SC}{}_{minP}$ is the score of the Silver Points collected among every minimum path linking all the Golden Points pairs, and T_k^C is the cost of the Tile used on the system grid.

It's important to keep in mind that, for the final score, the Tile cost is subtracted once at the end of the scoring formula for each Tile used, even if said Tile is not used for any path.

If the resulting score value is less than 0 points, the final score will be counted as 0 points.

5. Constraints

- All the indices i, j, k mentioned above start from 0
- The Tile must be within the system grid: $0 \leq \mathrm{T}_k^X < W$
- The Tile must be within the system grid: $0 \leq \mathrm{T}_k^Y < H$
- The n. of chosen Tiles must not exceed the maximum available: n. $T_k^{ID} \leq \mathrm{T}_k^N$
- Tiles are not admitted in golden points: $T_k^X \neq \mathrm{G}_i^X$ and $T_k^Y \neq \mathrm{G}_i^Y$
- Multiple tiles not admitted in the same place: $T_k^X \neq \mathrm{T}_{k'}^X$ and $T_k^Y \neq \mathrm{T}_{k'}^Y$

6. Example

6.1. Input file example

```
10 7 3 4 11
2 4
7 2
6 6
4 4 100
4 2 100
6 0 150
7 5 150
3 6 4
5 2 6
6 2 6
7 8 5
9 2 7
A 2 7
B 8 5
C 6 5
D 8 5
E 8 5
F 15 3
```

The system grid is a matrix with 10 columns and 7 rows. The players can count on 3 Golden Points (golden cells) and 4 Silver Points (gray cells). The players have 11 available different Tiles, for a total of 58 Tiles.

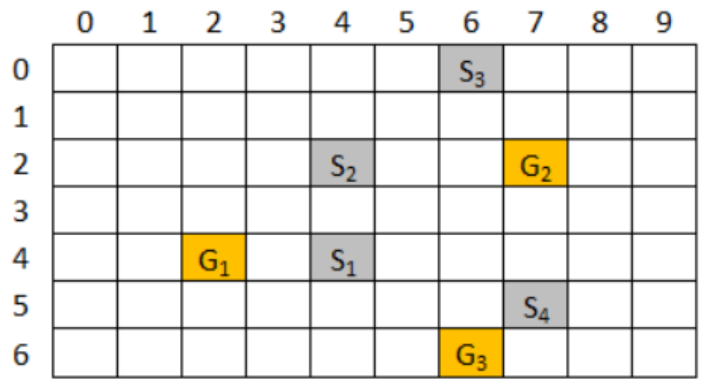


Figure:2 *This image shows an example of map provided*

6.2. Output file example

```
3 3 4
B 4 4
C 4 3
5 4 2
A 5 2
C 5 1
5 5 0
6 6 0
C 6 1
9 6 2
F 7 3
F 7 4
F 7 5
A 7 6
9 5 6
E 5 5
6 5 4
```

The players decided to start with Golden Point G_1. Firstly, they moved to the right of the system grid by using a Tile of type 3. Secondly, they used a Tile of type A, positioning it on the cell corresponding to the Silver Point S_1. And so on.

They decided to connect the Golden Point G_1 to the Golden Point G_2 by passing through the Silver Points S_1, S_2 and S_3. Furthermore, they decided to connect the Golden Point G_2 to the Golden Point G_3 by passing through the Silver Point S_4. Finally, they decided to connect the Golden Point G_3 to the Golden Point G_1 by passing through the Silver Point S_1.

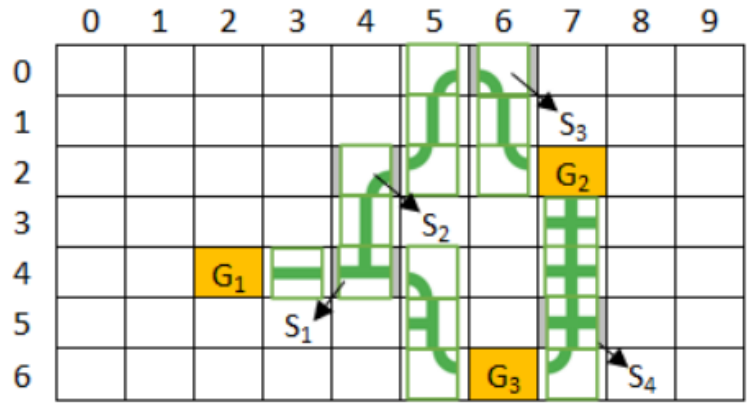


Figure:3 *This image shows an example of solution*

6.3. Scoring rules

In this example, the players designed two different paths to connect the Golden Point G_1 and the Golden Point G_2. The first one passes through the Silver Points S_1, S_2 and S_3. The second one passes through the Silver Points S_1, S_4 and the Golden Point G_3.

Similarly, they designed two different paths to connect the Golden Point G_1 and the Golden Point G_3. The first one passes through the Silver Point S_1. The second one passes through the Silver Points S_1, S_2, S_3, S_4 and the Golden Point G_2.

Similarly, they designed two different paths to connect the Golden Point G_2 and the Golden Point G_3. The first one passes through the Silver Point S_4. The second one passes through the Silver Points S_1, S_2 and S_3.

The first path to connect the Golden Point G_1 and the Golden Point G_2 passes through the Silver Points S_1 (100 points earned), S_2 (100 points earned) and S_3 (150 points earned). They used 10 Tiles:

- 1 Tile of type 3 (unitary cost of 6)
- 1 Tile of type B (unitary cost of 8)
- 3 Tiles of type C (unitary cost of 6)
- 2 Tiles of type 5 (unitary cost of 2)
- 1 Tile of type A (unitary cost of 2)
- 1 Tile of type 6 (unitary cost of 2)
- 1 Tile of type 9 (unitary cost of 2)

This path costs 6+8+18+4+2+2+2 = 42 points and earns 100+100+150 = 350 points.

The second path to connect the Golden Point G_1 and the Golden Point G_2 passes through the Silver Points S_1 (100 points earned), S_4 (150 points earned) and the Golden Point G_3. They used 9 Tiles:

- 1 Tile of type 3 (unitary cost of 6)
- 1 Tile of type B (unitary cost of 8)
- 1 Tile of type 6 (unitary cost of 2)
- 1 Tile of type E (unitary cost of 8)
- 1 Tile of type 9 (unitary cost of 2)
- 1 Tile of type A (unitary cost of 2)
- 3 Tiles of type F (unitary cost of 15)

This path costs 6+8+2+8+2+2+45 = 73 points and earns 100+150 = 250 points.

It's important to keep in mind:

1. the total player score is always valued on the cheapest paths
2. in case of same cost, the score considers the path with minimum earned points

The cheapest path is the first one, which costs 42 points, so the player earns 350 points to connect the Golden Point G_1 and the Golden Point G_2.

Similarly, the cheapest path to connect:

- the Golden Point G_1 and the Golden Point G_3 costs 26 points and earns 100 points
- the Golden Point G_2 and the Golden Point G_3 costs 47 points and earns 150 points

For the solution overall, they used the following Tiles:

- 1 Tile of type 3 (unitary cost of 6)
- 2 Tiles of type 5 (unitary cost of 2)
- 2 Tiles of type 6 (unitary cost of 2)
- 2 Tiles of type 9 (unitary cost of 2)
- 2 Tiles of type A (unitary cost of 2)
- 1 Tile of type B (unitary cost of 8)
- 3 Tiles of type C (unitary cost of 6)
- 1 Tile of type E (unitary cost of 8)
- 3 Tiles of type F (unitary cost of 15)

So, the total cost is 6 + 4 + 4 + 4 + 4 + 8 + 18 + 8 + 45 = 101 points.

Finally, the total score is 350 + 100 + 150 - 101 = 499 points.