MISSION BRIEF

As a skilled engineer, you were called on to participate in a unique mission on a distant planet. Scientists, during previous missions on the planet, have discovered a new electromagnetic appliance that could control giant caterpillars on the planet's surface. The caterpillars are essential to collect a valuable resource known as spice, which was in high demand across the galaxy.

You arrived at the planet's mission control station, where you met the team of scientists who would support you throughout the mission. The scientists shared another incredible discovery with you. They had found that a 30 by 30 meter portion of the planet was replicated across the entire infinite surface.

However, the scientists also warned you about a strange phenomenon that occurred when the caterpillars crossed the boundary of a replicated area. The new area they entered would transform into a mirror image, across the boundary, of the previous area they had already visited in its original state.

They then showed you the new electromagnetic appliance, named the GECA, that would control the giant caterpillars on the planet. The appliance was designed to emit a signal that would allow the caterpillars to move in any directions, grow or shrink the length of the caterpillar.

You are tasked with implementing the caterpillar control system. Your job is to create a system that allows Riders to move the caterpillar in any direction: up, down, left, and right, grow or shrink the length of the caterpillar.

The GECA is also equipped with radar providing an image of 11 meters diameter, around the caterpillar’s head. As part of your solution, the control system should also provide a display of the radar image to ease the navigation of the Riders across the Planet. The display should also show the caterpillar and his segments the Head (H), the Tail (T) and intermediate segments (0). Each pixel of the display will represent 1 meter square of land.

The Rider will need to input the direction (U, D, L, R) and number of steps in the system and the caterpillar will execute. When the head or any segment of the caterpillar body hits a spice ($), it is ingested by the caterpillar and disappears from planet.

The caterpillar start size consists of only two segments, a Head (H) and a Tail (T). The Rider can choose to grow or shrink his caterpillar, by 1 segment, when any segment of the caterpillar covers a Booster (B), Booster is a mineral found on the planet surface. The booster will disappear from the planet only if consumed by the caterpillar. However, the caterpillar cannot grow more than 5 segments.

The caterpillar control system has to ensure that all commands were logged in a file for later analysis and that all commands could be undone or redone. The caterpillar control system also has to ensure that the caterpillar segments are moved relative to the direction of the head of the caterpillar. The caterpillar cannot move through obstacles, but it can collect spice and boosters. The caterpillars are very sensitive creatures, if any of its segment hits an obstacle, it disintegrates completely.

The scientists also inform you that caterpillar's grow and shrink capabilities, can apparently be modulated. For the time being, the scientists have only discovered the *LinearGrowth* mode. *LinearGrowth* mode would increase or decrease the length of the caterpillar by adding or removing a new segment at the end of the current caterpillar.

The scientists provide you with the plan of the 30 x 30 unique portion of the planet and a detailed instruction of how the segments of the caterpillar interacts. You are now equipped with all the necessary information to complete this mission-critical project.

Good Luck.

P.S You are expected to supply the control system source code in C# and as many automated tests as possible so that it is scrutinised by the Scientists before clearance is granted for production release.

CATERPILLAR SEGMENT MOVEMENT INSTRUCTIONS

Consider a caterpillar with 2 segments the head and the tail. If the head moves far enough away from the tail, the tail is pulled toward the head.

Then, by following the Rider's series of motions for the head, you can determine how the tail will move. In fact, the head (H) and tail (T) must always be touching (diagonally adjacent and even overlapping both count as touching):

```
....
.TH.
....

....
.H..
..T.
....

...
.H. (H covers T)
...
```

If the head is ever two steps directly up, down, left, or right from the tail, the tail must also move one step in that direction so it remains close enough:

```
.....    .....    .....
.TH.. -> .T.H. -> ..TH.
.....    .....    .....

...    ...    ...
.T.    .T.    ...
.H. -> ... -> .T.
...    .H.    .H.
...    ...    ...
```

Otherwise, if the head and tail aren't touching and aren't in the same row or column, the tail always moves one step diagonally to keep up:

```
.....    .....    .....
.....    ..H..    ..H..
..H.. -> ..... -> ..T..
.T...    .T...    .....
.....    .....    .....

.....    .....    .....
.....    .....    .....
..H.. -> ...H. -> ..TH.
.T...    .T...    .....
.....    .....    .....
```

You just need to work out where the tail goes as the head follows a series of motions. Assume the head and the tail both start at the same position, overlapping.

For example, if the Rider give the following instructions to the caterpillar:

R 4
U 4
L 3
D 1
R 4
D 1
L 5
R 2

This series of motions moves the head right four steps, then up four steps, then left three steps, then down one step, and so on. After each step, you'll need to update the position of the tail if the step means the head is no longer adjacent to the tail. Visually, these motions occur as follows (s marks the starting position as a reference point):

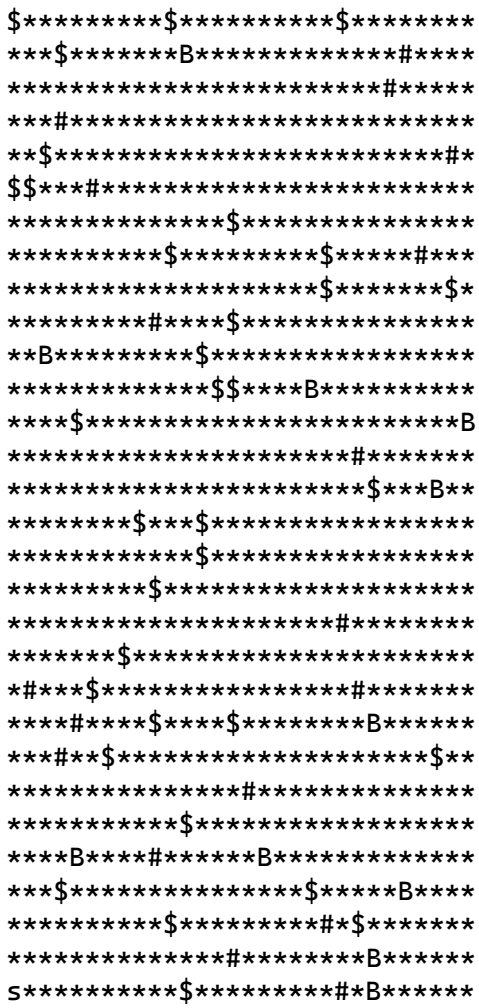
```
== Initial State ==

......
......
......
......
H.....  (H covers T, s)

== R 4 ==

......
......
......
......
TH....  (T covers s)

......
......
......
......
sTH...

......
......
......
......
s.TH..

......
......
......
......
s..TH.

== U 4 ==

......
......
......
....H.
s..T..

......
......
....H.
....T.
s.....

......
....H.
....T.
......
s.....

....H.
....T.
......
......
```

```
s.....

== L 3 ==

...H..
....T.
......
......
s.....

..HT..
......
......
......
s.....

.HT...
......
......
......
s.....

== D 1 ==

..T...
.H....
......
......
s.....

== R 4 ==

..T...
..H...
......
......
s.....

..T...
...H..
......
......
s.....

......
...TH.
......
......
s.....

......
....TH
......
......
s.....

== D 1 ==

......
....T.
.....H
......
```

```
s.....

== L 5 ==

......
....T.
....H.
......
s.....

......
....T.
...H..
......
s.....

......
......
..HT..
......
s.....

......
......
.HT...
......
s.....

......
......
HT....
......
s.....

== R 2 ==

......
......
.H....  (H covers T)
......
s.....

......
......
.TH...
......
s.....
```

30 x 30 SQUARE METER MAP

Each square meter of land is represented by as symbol as described in the Legend.



Legend

* Empty 1x1 square meter of land
$ Spice to be collected
B Booster
Obstacles
s Starting position of the worm HT