

## Hints for Task D of Game 1024

Task D (20 points)

Include EVERY constructor and method of Board.cpp. Submit only Board.cpp.

**For test purpose**, set `srand(1);` in constructors of Board.cpp before submitting to gradescope for grading. Otherwise, the random sequence differs in different running time and gradescope scripts cannot handle it.

Key to finish start method

Define code to play a game, that is, define start method in Board.cpp.

```
void Board::start()
{
    int round = 1;

    //TODO: call selectRandomCell twice to generate two values

    char ch;
    while (true)
    {
        if (max >= target) //in case goal is not a power of 2,
        we check for max > goal.
        {
            cout << "Congratulation!" << endl;
            break;
        }

        //https://stackoverflow.com/questions/10463201/getch-and-arrow-
        codes
        //cannot replace getchar by getch
        //When encountering letter S, even if the
        //project does not finish running yet,
        //can leave while (true) loop.
        //Add this line to stop time out exception.
        ch = getchar();
        if (ch == 'S')
            break;

        if (ch == '\033') { // if the first value is esc
            getchar(); // skip the [
            switch(getchar()) { // the real value
            case 'A':
```

```

        // code for arrow up
        cout << "Round " << setw(4) << round << ": ";
        cout << "Press UP. "
             << "Goal: " << target << endl;
        pressUp();
        round++;
        break;

        //TODO: finish the rest of code.
    }
}
}

```

In TestBoard.cpp, create Board object using different constructors and use setTarget method to change target (you need to implement setTarget method) and call start method to see how your code works.

An example of TestBoard.cpp is as follows.

```


#include <iostream>
#include "Board.hpp"
using namespace std;

int main()
{
    Board game(4, 4); //create a Board object with 4 rows and 4 columns.
    game.start();
    return 0;
}

```

[Test your code in online gdb](#)

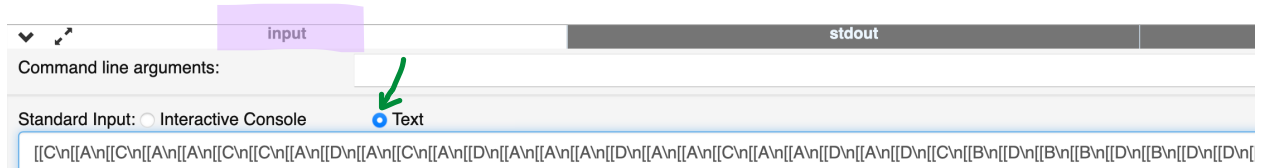
Warning: due to different random sequence generated by different operating systems, the following random sequence does not apply to Mac environment.

- (1) Open online gdb [https://www.onlinegdb.com/online\\_c++\\_compiler#](https://www.onlinegdb.com/online_c++_compiler#).
- (2) Comment or remove main function from the default main.cpp in online gdb.
- (3) Upload Board.hpp, Board.cpp, and TestBoard.cpp to online gdb using , which is left to run (green triangle) button of online gdb.
- (4) Run the project by two ways,
  - (a) Input interactively by pressing arrow keys from keyboard.

- (b) Or, you can test the following sequence using text file. To do so, you need to comment \033 by [ in line `if (ch == '\033')`. That is, to take input from text file, need to update \033 by \[. The reason is that \033 as a control character cannot be typed in plain text. That is, to test input from text mode, use

```
if (ch == '[')
```

- (c) Choose text button in input panel. Click Text radio button.



- (d) Enter the following sequence. I add S in the end to leave the project in case your code does not generate the expected output and stuck in endless while (true) loop.

```
[[C\n[[A\n[[C\n[[A\n[[A\n[[C\n[[C\n[[A\n[[D\n[[A\n[[C\n[[A\n[[D\n[[A\n[[A\n[[A\n[[D\n[[A\n[[A\n[[C\n[[A\n[[A\n[[D\n[[A\n[[D\n[[C\n[[B\n[[D\n[[B\n[[B\n[[D\n[[B\n[[D\n[[D\n[[B\n[[B\n[[C\n[[B\n[[B\n[[C\n[[A\n[[D\n[[D\n[[A\n[[D\nS
```

This is the expected output in online gdb for a 4 x 4 board when running code in online gdb.

```
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
|   |   |   |   1 |
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
|   |   1 |   |   |
+---+---+---+---+
|   |   |   |   1 |
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
```

Round 1: Press RIGHT. Goal: 32

```
+---+---+---+---+
|   |   |   |   1 |
+---+---+---+---+
|   |   |   |   1 |
+---+---+---+---+
|   |   |   |   1 |
```


Round 2: Press UP. Goal: 32

			2
		1	1

Round 3: Press RIGHT. Goal: 32

	1		2
			2

Round 4: Press UP. Goal: 32

	1		4
	1		

Round 5: Press UP. Goal: 32

	2		4
1			

Round 6: Press RIGHT. Goal: 32

		2	4
	1		

			1
--	--	--	---

Round 7: Press RIGHT. Goal: 32

		2	4
			1
1			1

Round 8: Press UP. Goal: 32

1		2	4
1			2

Round 9: Press LEFT. Goal: 32

1	2	4	
1	2		
	1		

Round 10: Press UP. Goal: 32

2	4	4	
	1		
			1

Round 11: Press RIGHT. Goal: 32

		2	8
1			1
			1


Round 12: Press UP. Goal: 32

1		2	8
			2
			1

Round 13: Press LEFT. Goal: 32

1	2	8	
2			
1			
1			

Round 14: Press UP. Goal: 32

1	2	8	
2			
2	1		

Round 15: Press UP. Goal: 32

1	2	8	
4	1		
		1	

Round 16: Press UP. Goal: 32

1	2	8	
4	1	1	

1			
---	--	--	--

Round 17: Press LEFT. Goal: 32

1	2	8	
4	2		1
1			

Round 18: Press UP. Goal: 32

1	4	8	1
4			
1			
1			

Round 19: Press UP. Goal: 32

1	4	8	1
4		1	
2			

Round 20: Press RIGHT. Goal: 32

1	4	8	1
		4	1
			2
			1

Round 21: Press UP. Goal: 32

1	4	8	2
		4	2
			1

		1		
--	--	---	--	--

Round 22: Press UP. Goal: 32

1	4	8	4
	1	4	1
	1		

Round 23: Press LEFT. Goal: 32

1	4	8	4
1	4	1	
1		1	

Round 24: Press UP. Goal: 32

2	8	8	4
1	1	2	

Round 25: Press LEFT. Goal: 32

2	16	4	1
2	2		

Round 26: Press RIGHT. Goal: 32

2	16	4	1
			4



				1

Round 27: Press DOWN. Goal: 32

				1
	1			4
	2	16	4	1

Round 28: Press LEFT. Goal: 32

		1		
1				
1	4			
2	16	4	1	

Round 29: Press DOWN. Goal: 32

		1	1	
2	4			
2	16	4	1	

Round 30: Press DOWN. Goal: 32

1				
		1		
		4	1	
4	16	4	1	

Round 31: Press LEFT. Goal: 32

1				
1				
4	1	1		

4	16	4	1	

Round 32: Press DOWN. Goal: 32

				1
2	1	1		
8	16	4	1	

Round 33: Press LEFT. Goal: 32

1				
			1	
2	2			
8	16	4	1	

Round 34: Press LEFT. Goal: 32

1				
1	1			
4				
8	16	4	1	

Round 35: Press DOWN. Goal: 32

	1			
2				
4	1			
8	16	4	1	

Round 36: Press DOWN. Goal: 32

2				
4	2	1		

8	16	4	1

Round 37: Press RIGHT. Goal: 32

			1
			2
	4	2	1
8	16	4	1

Round 38: Press DOWN. Goal: 32

		1	
			1
	4	2	2
8	16	4	2

Round 39: Press DOWN. Goal: 32

	1	1	
	4	2	1
8	16	4	4

Round 40: Press RIGHT. Goal: 32

1			
			2
	4	2	1
	8	16	8

Round 41: Press UP. Goal: 32

1	4	2	2
	8	16	1
			8

```

+---+---+---+---+
|   |   1|   |   |
+---+---+---+---+
Round  42: Press LEFT. Goal: 32
+---+---+---+---+
|  1|  4|  4|   |
+---+---+---+---+
|  8| 16|  1|   |
+---+---+---+---+
|  8|   |   |   |
+---+---+---+---+
|  1|   |   |  1|
+---+---+---+---+
Round  43: Press LEFT. Goal: 32
+---+---+---+---+
|  1|  8|   |   |
+---+---+---+---+
|  8| 16|  1|   |
+---+---+---+---+
|  8|   |   |  1|
+---+---+---+---+
|  2|   |   |   |
+---+---+---+---+
Round  44: Press UP. Goal: 32
+---+---+---+---+
|  1|  8|  1|  1|
+---+---+---+---+
| 16| 16|   |   |
+---+---+---+---+
|  2|   |   |  1|
+---+---+---+---+
|   |   |   |   |
+---+---+---+---+
Round  45: Press LEFT. Goal: 32
+---+---+---+---+
|  1|  8|  2|   |
+---+---+---+---+
| 32|   |   |   |
+---+---+---+---+
|  2|  1|   |   |
+---+---+---+---+
|   |   |  1|   |
+---+---+---+---+
Congratulation!

```

Here is another test sequence for a **3 x 3** board. Change the parameter in TestBoard.cpp.

[[A\n[[D\n[[A\n[[D\n[[D\n[[A\n[[D\n[[C\n[[B\n[[D\n[[B\n[[A\n[[D\n[[D\n[[A\n[[D\n[[A\n[[A\n[[  
D\n[[B\n[[D\n[[B\n[[B\n[[D\n[[D\n[[A\n[[A\n[[D\n[[A\n[[A\n[[B\n[[C\n[[A\n[[D\n[[B\n[[A\n[[A\  
n[[C\n[[B\n[[D\n[[D\nS

Expected output

```
+-----+-----+-----+
|      |      1|      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
+-----+-----+-----+
|      |      1|      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
|      |      1|      |
+-----+-----+-----+
```

Round 1: Press UP. Goal: 32

```
+-----+-----+-----+
|      |      2|      1|
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
```

Round 2: Press LEFT. Goal: 32

```
+-----+-----+-----+
|      2|      1|      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
|      |      1|      |
+-----+-----+-----+
```

Round 3: Press UP. Goal: 32

```
+-----+-----+-----+
|      2|      2|      |
+-----+-----+-----+
|      1|      |      |
+-----+-----+-----+
|      |      |      |
+-----+-----+-----+
```

Round 4: Press LEFT. Goal: 32

```
+-----+-----+-----+
|      4|      |      |
+-----+-----+-----+
|      1|      |      1|
+-----+-----+-----+
```

--	--	--	--

Round 5: Press LEFT. Goal: 32

4			
2			1

Round 6: Press UP. Goal: 32

4	1	1	
2			

Round 7: Press LEFT. Goal: 32

4	2		
2			
1			

Round 8: Press RIGHT. Goal: 32

	4	2	
1		2	
		1	

Round 9: Press DOWN. Goal: 32

			1
			4
1	4	1	

Round 10: Press LEFT. Goal: 32

1			
4			1
1	4	1	

Round 11: Press DOWN. Goal: 32

1		
4	1	
1	4	2

Round 12: Press UP. Goal: 32

1	1	2
4	4	
1	1	

Round 13: Press LEFT. Goal: 32

2	2	
8		
2	1	

Round 14: Press LEFT. Goal: 32

4		1
8		
2	1	

Round 15: Press UP. Goal: 32

4	1	1
8	1	
2		

Round 16: Press LEFT. Goal: 32

4	2	
8	1	
2	1	

Round 17: Press UP. Goal: 32

--	--	--

	4	2	1
+	-----	+	-----
	8	2	
+	-----	+	-----
	2		
+	-----	+	-----

Round 18: Press UP. Goal: 32

+	-----	+	-----
	4	4	1
+	-----	+	-----
	8	1	
+	-----	+	-----
	2		
+	-----	+	-----

Round 19: Press LEFT. Goal: 32

+	-----	+	-----
	8	1	
+	-----	+	-----
	8	1	
+	-----	+	-----
	2		1
+	-----	+	-----

Round 20: Press DOWN. Goal: 32

+	-----	+	-----
+	-----	+	-----
	16	1	
+	-----	+	-----
	2	2	1
+	-----	+	-----

Round 21: Press LEFT. Goal: 32

+	-----	+	-----
			1
+	-----	+	-----
	16	1	
+	-----	+	-----
	4	1	
+	-----	+	-----

Round 22: Press DOWN. Goal: 32

+	-----	+	-----
+	-----	+	-----
	16		1
+	-----	+	-----
	4	2	1
+	-----	+	-----

Round 23: Press DOWN. Goal: 32

+	-----	+	-----
			1
+	-----	+	-----



	16		
+	-----+	-----+	-----+
	4	2	2
+	-----+	-----+	-----+

Round 24: Press LEFT. Goal: 32

+	-----+	-----+	-----+
	1	1	
+	-----+	-----+	-----+
	16		
+	-----+	-----+	-----+
	4	4	
+	-----+	-----+	-----+

Round 25: Press LEFT. Goal: 32

+	-----+	-----+	-----+
	2		
+	-----+	-----+	-----+
	16	1	
+	-----+	-----+	-----+
	8		
+	-----+	-----+	-----+

Round 26: Press UP. Goal: 32

+	-----+	-----+	-----+
	2	1	
+	-----+	-----+	-----+
	16		
+	-----+	-----+	-----+
	8	1	
+	-----+	-----+	-----+

Round 27: Press UP. Goal: 32

+	-----+	-----+	-----+
	2	2	
+	-----+	-----+	-----+
	16		1
+	-----+	-----+	-----+
	8		
+	-----+	-----+	-----+

Round 28: Press LEFT. Goal: 32

+	-----+	-----+	-----+
	4	1	
+	-----+	-----+	-----+
	16	1	
+	-----+	-----+	-----+
	8		
+	-----+	-----+	-----+

Round 29: Press UP. Goal: 32

+	-----+	-----+	-----+
	4	2	
+	-----+	-----+	-----+
	16		
+	-----+	-----+	-----+

	8		1
+	-----	+	-----

Round 30: Press UP. Goal: 32

	4	2	1
+	-----	+	-----

	16		
+	-----	+	-----

	8	1	
+	-----	+	-----

Round 31: Press DOWN. Goal: 32

	4	1	
+	-----	+	-----

	16	2	
+	-----	+	-----

	8	1	1
+	-----	+	-----

Round 32: Press RIGHT. Goal: 32

	1	4	1
+	-----	+	-----

		16	2
+	-----	+	-----

		8	2
+	-----	+	-----

Round 33: Press UP. Goal: 32

	1	4	1
+	-----	+	-----

		16	4
+	-----	+	-----

		8	1
+	-----	+	-----

Round 34: Press LEFT. Goal: 32

	1	4	1
+	-----	+	-----

	16	4	
+	-----	+	-----

	8	1	1
+	-----	+	-----

Round 35: Press DOWN. Goal: 32

	1		1
+	-----	+	-----

	16	8	
+	-----	+	-----

	8	1	2
+	-----	+	-----

Round 36: Press UP. Goal: 32

```
+---+---+---+
|  1|  8|  1|
+---+---+---+
| 16|  1|  2|
+---+---+---+
|  8|  1|   |
+---+---+---+
```

Round 37: Press UP. Goal: 32

```
+---+---+---+
|  1|  8|  1|
+---+---+---+
| 16|  2|  2|
+---+---+---+
|  8|   |  1|
+---+---+---+
```

Round 38: Press RIGHT. Goal: 32

```
+---+---+---+
|  1|  8|  1|
+---+---+---+
|  1| 16|  4|
+---+---+---+
|   |  8|  1|
+---+---+---+
```

Round 39: Press DOWN. Goal: 32

```
+---+---+---+
|   |  8|  1|
+---+---+---+
|  1| 16|  4|
+---+---+---+
|  2|  8|  1|
+---+---+---+
```

Round 40: Press LEFT. Goal: 32

```
+---+---+---+
|  8|  1|  1|
+---+---+---+
|  1| 16|  4|
+---+---+---+
|  2|  8|  1|
+---+---+---+
```

Round 41: Press LEFT. Goal: 32

```
+---+---+---+
|  8|  2|  1|
+---+---+---+
|  1| 16|  4|
+---+---+---+
|  2|  8|  1|
+---+---+---+
```

Game over. Try again.

