

# Theory of Computer Games (Fall 2023)

## Homework 1

NTU CSIE

Due: 2023/10/19 14:20

# Outline

- 1 Game Description
- 2 Homework Requirements
- 3 Submission and Grading Policy

# Original game - EWN



# Our game

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 1  | 2  | 3  | 4  |
| 5  | 3  | 5  | 8  | 9  |
| 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 6  | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 |

- Single-player game
- The value of the dice is fixed
  - the dice sequence is cyclic
- A piece can move in 8 directions

# How to select a piece to move

- Assume the dice shows the number  $x$
- If the piece with number  $x$  still exists, then you can only choose  $x$ .
- If the piece with number  $x$  does not exist, then you can choose
  - a: the piece with the biggest number smaller than  $x$
  - b: the piece with the smallest number bigger than  $x$

# Homework Requirements

- Implement the program to find the fewest number of steps for one of the pieces to reach the goal (bottom right corner) within the time limit.
- Write a report

# Homework Requirements

- Input format

- $n, m$ : number of row and column ( $n, m \leq 9$ )
- initial board ( $n \times m$  integers)
- $p$ : the period of cyclic dice sequence ( $p \leq 18$ )
- the cyclic dice sequence ( $p$  integers)
- $s$ : the piece to reach goal, if  $s = 0$ , then you can choose any piece.

- Example:

```
5 5
1 0 0 0 0
0 3 5 0 0
0 0 0 0 0
0 0 6 0 0
0 0 0 0 0
6
6 3 5 2 1 4
0
```

# Homework Requirements

- Output format

- First line you should output the fewest number of steps. Here we assume the answer is  $k$ .
- Then output the sequence of moves  $(a_i, b_i)$  in the following  $k$  lines.
- $a_i$ : the number of piece
- $b_i$ : move direction
  - 0: 左上
  - 1: 上
  - 2: 右上
  - 3: 左
  - 4: 右
  - 5: 左下
  - 6: 下
  - 7: 右下



# Homework Requirements

- Output example:

3

6 7

3 4

6 4

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 1  | 2  | 3  | 4  |
| 5  | 3  | 5  | 8  | 9  |
| 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 6  | 18 | 19 |
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# Homework Requirements

- Test cases:
  - Case 1 (easy): Brute force (BFS, DFS, DFID)
  - Case 2 (medium): A\* algorithm with simple heuristics
  - Case 3 (tough): A\* algorithm with good heuristics
- Limitation:
  - Time limit is 5 sec.
  - We will run your code on csie workstations.

- Directory Hierarchy:
  - student\_id
    - Makefile
    - **src** // a folder contains all your codes
    - report.pdf
- Compress your folder into a zip file and submit to <https://www.csie.ntu.edu.tw/~tcg/2023/hw1.php>
- Due to server limitation, the file size is restricted to **2 MB**.
- Thread limit only **one**.
- You will get some penalty (-10 points) if you don't follow these rules.

- Your report should include but not limit to the following:
  - How to compile your code.
  - What algorithms and heuristics you've implemented.
  - Experiment results and findings of your implementation
- Your report should be named report.pdf.

- Test cases (80%)
  - score of each test case
    - case 1: (4%) \* 7 testcases
    - case 2: (4%) \* 7 testcases
    - case 3: (4%) \* 6 testcases
  - about non-optimal solution:

If your sequence of moves can solve the game but not the optimal solution, you can get partial points.

score =  $\min(1, q/p)$ ,  $p$ : your solution,  $q$ : optimal solution length.
- Report (20%)