```
Problem 1:
Example 1 graph G1 is a Euler circuit: ['e', 'c', 'd', 'e', 'a', 'b', 'e']
Example 1 graph G2 is not a Euler circuit. The odd vertices are: {'c', 'd', 'a',
Example 1 graph G3 is not a Euler circuit. The odd vertices are: {'a', 'b'}
Bridge graph is not a Euler circuit. The odd vertices are: {'a', 'd'}
Problem 1b graph is a Euler circuit: ['c', 'b', 'a', 'd', 'e', 'h', 'g', 'd', 'b',
'e', 'f', 'h', 'i', 'f', 'c']
Problem 2:
Example 5 graph G1 does not satisfy Dirac's condition and may be a Hamilton circuit
Example 5 graph G2 does not satisfy Dirac's condition and may be a Hamilton circuit
Example 5 graph G3 does not satisfy Dirac's condition and may be a Hamilton circuit
Test case 2 graph does not satisfy Dirac's condition and may be a Hamilton circuit
Problem 3:
Example 5 graph G1 satisfies Ore's condition and is a Hamilton circuit
Example 5 graph G2 does not satisfy Ore's condition and may be a Hamilton circuit
Example 5 graph G3 does not satisfy Ore's condition and may be a Hamilton circuit
Test case 2 graph does not satisfy Ore's condition and may be a Hamilton circuit
Problem 4:
Ouestion 4a:
Piles: 2, 2, 1, Player: Max, Value: 1
      Piles: 1, 2, 1, Player: Min, Value: -1
            Piles: 0, 2, 1, Player: Max, Value: 1
                   Piles: 0, 1, 1, Player: Min, Value: -1
                         Piles: 0, 0, 1, Player: Max, Value: -1
                         Piles: 0, 1, 0, Player: Max, Value: -1
                   Piles: 0, 0, 1, Player: Min, Value: 1
                   Piles: 0, 2, 0, Player: Min, Value: -1
                         Piles: 0, 1, 0, Player: Max, Value: -1
            Piles: 1, 1, 1, Player: Max, Value: -1
                   Piles: 0, 1, 1, Player: Min, Value: -1
                         Piles: 0, 0, 1, Player: Max, Value: -1
Piles: 0, 1, 0, Player: Max, Value: -1
                   Piles: 1, 0, 1, Player: Min, Value: -1
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                         Piles: 1, 0, 0, Player: Max, Value: -1
                   Piles: 1, 1, 0, Player: Min, Value: -1
                         Piles: 0, 1, 0, Player: Max, Value: -1
                         Piles: 1, 0, 0, Player: Max, Value: -1
            Piles: 1, 0, 1, Player: Max, Value: 1
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                   Piles: 1, 0, 0, Player: Min, Value: 1
            Piles: 1, 2, 0, Player: Max, Value: 1
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                         Piles: 0, 1, 0, Player: Max, Value: -1
                   Piles: 1, 1, 0, Player: Min, Value: -1
                         Piles: 0, 1, 0, Player: Max, Value: -1
Piles: 1, 0, 0, Player: Max, Value: -1
                   Piles: 1, 0, 0, Player: Min, Value: 1
      Piles: 0, 2, 1, Player: Min, Value: -1
            Piles: 0, 1, 1, Player: Max, Value: 1
                   Piles: 0, 0, 1, Player: Min, Value: 1
                   Piles: 0, 1, 0, Player: Min, Value: 1
            Piles: 0, 0, 1, Player: Max, Value: -1
            Piles: 0, 2, 0, Player: Max, Value: 1
                   Piles: 0, 1, 0, Player: Min, Value: 1
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            Piles: 1, 1, 1, Player: Max, Value: -1
                  Piles: 0, 1, 1, Player: Min, Value: -1
                        Piles: 0, 0, 1, Player: Max, Value: -1
                        Piles: 0, 1, 0, Player: Max, Value: -1
                  Piles: 1, 0, 1, Player: Min, Value: -1
                        Piles: 0, 0, 1, Player: Max, Value: -1
                        Piles: 1, 0, 0, Player: Max, Value: -1
                  Piles: 1, 1, 0, Player: Min, Value: -1
                        Piles: 0, 1, 0, Player: Max, Value: -1
                        Piles: 1, 0, 0, Player: Max, Value: -1
            Piles: 0, 1, 1, Player: Max, Value: 1
                  Piles: 0, 0, 1, Player: Min, Value: 1
                  Piles: 0, 1, 0, Player: Min, Value: 1
            Piles: 2, 0, 1, Player: Max, Value: 1
                 Piles: 1, 0, 1, Player: Min, Value: -1
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                        Piles: 1, 0, 0, Player: Max, Value: -1
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                  Piles: 2, 0, 0, Player: Min, Value: -1
           Piles: 1, 0, 0, Player: Max, Value: -1
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                        Piles: 1, 0, 0, Player: Max, Value: -1
      Piles: 2, 0, 1, Player: Min, Value: -1
            Piles: 1, 0, 1, Player: Max, Value: 1
                  Piles: 0, 0, 1, Player: Min, Value: 1
                  Piles: 1, 0, 0, Player: Min, Value: 1
            Piles: 0, 0, 1, Player: Max, Value: -1
            Piles: 2, 0, 0, Player: Max, Value: 1
                  Piles: 1, 0, 0, Player: Min, Value: 1
      Piles: 2, 2, 0, Player: Min, Value: 1
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                        Piles: 1, 0, 0, Player: Max, Value: -1
                  Piles: 0, 1, 0, Player: Min, Value: 1
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                        Piles: 1, 0, 0, Player: Max, Value: -1
            Piles: 2, 0, 0, Player: Max, Value: 1
                  Piles: 1, 0, 0, Player: Min, Value: 1
Question 4b:
Piles: 1, 2, 3, Player: Max, Value: -1
      Piles: 0, 2, 3, Player: Min, Value: -1
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                  Piles: 0, 1, 0, Player: Max, Value: -1
            Piles: 0, 1, 1, Player: Min, Value: -1
                  Piles: 0, 0, 1, Player: Max, Value: -1
                  Piles: 0, 1, 0, Player: Max, Value: -1
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            Piles: 0, 0, 1, Player: Min, Value: 1
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                        Piles: 0, 1, 0, Player: Min, Value: 1
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           Piles: 0, 0, 2, Player: Min, Value: -1
Piles: 0, 0, 1, Player: Max, Value: -1
           Piles: 0, 2, 1, Player: Min, Value: -1
                  Piles: 0, 1, 1, Player: Max, Value: 1
                        Piles: 0, 0, 1, Player: Min, Value: 1
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      Piles: 0, 2, 0, Player: Max, Value: 1
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            Piles: 0, 1, 1, Player: Max, Value: 1
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            Piles: 0, 2, 1, Player: Min, Value: -1
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            Piles: 0, 2, 0, Player: Min, Value: -1
                  Piles: 0, 1, 0, Player: Max, Value: -1
      Piles: 1, 1, 2, Player: Max, Value: 1
            Piles: 0, 1, 2, Player: Min, Value: -1
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            Piles: 1, 0, 0, Player: Min, Value: 1
      Piles: 1, 2, 1, Player: Max, Value: 1
Piles: 0, 2, 1, Player: Min, Value: -1
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                  Piles: 0, 1, 0, Player: Max, Value: -1
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                         Piles: 0, 0, 1, Player: Max, Value: -1
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Question 4c:
Start: 2, 2, 1
Player B's turn: 0, 2, 1
Player A's turn: 0, 1, 1
Player B's turn:
                   0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn:
                   2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
                   0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                   2, 2, 0
                   1, 2, 0
Player A's turn:
Player B's turn:
                  1, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                   2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
                   0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn: 0, 2, 1
Player A's turn: 0, 1, 1
Player B's turn: 0, 1, 0
A is the winner
```

```
Start: 2, 2, 1
Player B's turn: 2, 2, 0
Player A's turn: 1, 2, 0
Player B's turn: 1, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 1, 2, 1
Player A's turn:
                 0, 2, 1
                 0, 2, 0
Player B's turn:
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 1, 1
Player A's turn: 0, 1, 1
Player B's turn: 0, 1, 0
A is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 0, 1
Player A's turn:
                 1, 0, 1
Player B's turn: 0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 1, 1
Player A's turn:
                 0, 1, 1
Player B's turn:
                 0, 1, 0
A is the winner
Start: 2, 2, 1
Player B's turn: 1, 2, 1
Player A's turn: 0, 2, 1
```

Ρ	Player B's turn: Player A's turn: B is the winner	0, 2, 0, 1,	
P P P	layer A's turn:	2, 0, 1, 0, 0, 0,	1
P P P	tart: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: A is the winner	2, 0, 1, 0, 1, 0,	1
P P P	ctart: 2, 2, 1 clayer B's turn: clayer A's turn: clayer B's turn: clayer A's turn: dis is the winner	2, 2, 1, 2, 0, 2, 0, 1,	0 0
P P P	start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 2, 2, 1, 0, 1,	0
P P P	tart: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 2, 2, 1, 0, 1,	0
P P P	start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 0,	0
P P P	start: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: A is the winner	2, 0, 1, 0, 1, 0,	1
P P P	start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 2, 2, 1, 0, 1,	0
P P P	start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 2, 2, 0, 1, 0,	0

```
Start: 2, 2, 1
Player B's turn: 2, 1, 1
Player A's turn: 0, 1, 1
Player B's turn: 0, 1, 0
A is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
                 2, 1, 0
Player B's turn:
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn: 0, 2, 1
Player A's turn:
                 0, 1, 1
Player B's turn:
                 0, 0, 1
A is the winner
Start: 2, 2, 1
Player B's turn:
                 0, 2, 1
Player A's turn:
                 0, 1, 1
                 0, 1, 0
Player B's turn:
A is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 1, 0
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 1, 1
Player A's turn:
                 0, 1, 1
Player B's turn:
                 0, 1, 0
A is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 0, 1
Player A's turn:
                 1, 0, 1
Player B's turn:
                 0, 0, 1
A is the winner
```

```
Start: 2, 2, 1
Player B's turn: 2, 2, 0
Player A's turn:
                 1, 2, 0
Player B's turn:
                  0, 2, 0
Player A's turn:
                  0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
Player B's turn: 2, 1, 0
Player A's turn:
                  0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
                 0, 2, 0
Player B's turn:
Player A's turn:
                  0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
                  1, 2, 0
Player B's turn:
Player A's turn:
                  1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                  1, 2, 1
                  0, 2, 1
Player A's turn:
                 0, 2, 0
Player B's turn:
Player A's turn:
                  0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
Player B's turn:
                  0, 2, 0
Player A's turn:
                  0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
Player B's turn:
                 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                  2, 1, 1
Player A's turn:
                  0, 1, 1
Player B's turn:
                  0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
```

```
Player B's turn: 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 0, 1
Player A's turn:
                 1, 0, 1
Player B's turn: 0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
                 0, 2, 0
Player B's turn:
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
                 2, 2, 0
Player A's turn:
Player B's turn: 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 1, 2, 1
Player A's turn:
                 0, 2, 1
Player B's turn:
                 0, 1, 1
Player A's turn:
                 0, 0, 1
B is the winner
```

```
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
                 2, 0, 0
Player B's turn:
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
                 1, 2, 0
Player B's turn:
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 2, 0
Player A's turn:
                 1, 2, 0
                 1, 1, 0
Player B's turn:
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 1, 1
Player A's turn:
                 0, 1, 1
Player B's turn:
                 0, 1, 0
A is the winner
Start: 2, 2, 1
Player B's turn: 1, 2, 1
Player A's turn: 0, 2, 1
                 0, 2, 0
Player B's turn:
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
```

Player A's turn: B is the winner	1,	Θ,	0
Start: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: A is the winner	1,	2, 2, 0,	0 0 0
Start: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: A is the winner	1, 0, 0,	2, 2, 0,	1 1 1
Start: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: A is the winner	1,	2, 2, 0,	0 0 0
Start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	1,	2, 2, 0,	0 0 0
Start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2, 2, 0,	2, 1, 1,	0 0 0
Start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2,	2, 1, 1,	0 0 0
Start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	1,	2, 2, 0,	0 0 0
Start: 2, 2, 1 Player B's turn: Player A's turn: Player B's turn: Player A's turn: B is the winner	0, 0,	2, 2, 2, 1,	1 1 0 0
Start: 2, 2, 1 Player A's turn: Player B's turn: Player A's turn: B is the winner	2,	2, 0, 0,	0 0 0

Start: 2, 2, 1

```
Player B's turn: 2, 1, 1
Player A's turn: 0, 1, 1
Player B's turn: 0, 1, 0
A is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 1, 2, 0
                 1, 0, 0
Player A's turn:
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 2, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 0, 2, 1
Player A's turn:
                 0, 1, 1
Player B's turn:
                 0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
Player A's turn: 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 0, 1
Player A's turn:
                 1, 0, 1
Player B's turn:
                 1, 0, 0
A is the winner
Start: 2, 2, 1
                 2, 2, 0
Player B's turn:
Player A's turn: 1, 2, 0
Player B's turn: 0, 2, 0
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 1, 2, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 0, 2, 0
Player A's turn:
                 0, 1, 0
B is the winner
```

```
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 1, 2, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 1, 2, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 1, 2, 1
Player A's turn: 0, 2, 1
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 1, 1
Player A's turn: 0, 1, 1
Player B's turn:
                 0, 1, 0
A is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn:
                 2, 0, 1
Player A's turn:
                 1, 0, 1
Player B's turn:
                 0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn:
                 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn: 2, 2, 0
Player A's turn:
                 1, 2, 0
Player B's turn:
                 1, 0, 0
A is the winner
Start: 2, 2, 1
Player A's turn:
                  2, 2, 0
Player B's turn:
                  2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player B's turn: 2, 2, 0
Player A's turn: 1, 2, 0
```

```
Player B's turn: 1, 1, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
                 2, 0, 0
Player B's turn:
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 2, 0, 0
Player A's turn:
                 1, 0, 0
B is the winner
Start: 2, 2, 1
Player A's turn:
                 2, 2, 0
Player B's turn: 2, 1, 0
Player A's turn:
                 0, 1, 0
B is the winner
Start: 2, 2, 1
Player B's turn: 1, 2, 1
Player A's turn: 0, 2, 1
Player B's turn: 0, 0, 1
A is the winner
Start: 2, 2, 1
Player A's turn: 2, 2, 0
Player B's turn: 0, 2, 0
Player A's turn: 0, 1, 0
B is the winner
```

Player A won 26 times, Player B won 74 times.