

Euler's:

```
Graph 1: G1
{'a': ['b', 'e'], 'b': ['a', 'e'], 'c': ['d', 'e'], 'd': ['c', 'e'], 'e': ['a', 'b', 'c', 'd']}
The graph has an Euler circuit.
e-a-b-e-c-d-e

Graph 2: G2
{'a': ['b', 'd', 'e'], 'b': ['a', 'c', 'e'], 'c': ['b', 'd', 'e'], 'd': ['a', 'c', 'e'], 'e': ['a', 'b', 'c', 'd']}
The graph doesn't have an Euler circuit.
List of odd nodes: ['a', 'b', 'c', 'd']

Graph 3: G3
{'a': ['b', 'c', 'd'], 'b': ['a', 'd', 'e'], 'c': ['a', 'b', 'd'], 'd': ['a', 'b', 'c', 'e'], 'e': ['b', 'd']}
The graph doesn't have an Euler circuit.
List of odd nodes: ['a', 'b', 'c']

Graph 4: Konisberg's Bridge
{'a': ['b', 'b', 'c', 'c', 'd'], 'b': ['a', 'a', 'd'], 'c': ['a', 'a', 'd'], 'd': ['a', 'b', 'c']}
The graph doesn't have an Euler circuit.
List of odd nodes: ['a', 'b', 'c', 'd']

Graph 5: Test
{'a': ['b', 'd'], 'b': ['a', 'c', 'd', 'e'], 'c': ['b', 'f'], 'd': ['a', 'b', 'e', 'g'], 'e': ['b', 'd', 'f', 'h'], 'f': ['c', 'e', 'h', 'i'], 'g': ['d', 'h'], 'h': ['e', 'f', 'g', 'i'], 'i': ['f', 'h']}
The graph has an Euler circuit.
h-e-b-a-d-b-c-f-h-g-d-e-f-i-h
```

Hamilton:

```
Graph:  G1
Dirac's Theorem:  False
Ore's Theorem:   True
```

```
Graph:  G2
Dirac's Theorem:  False
Ore's Theorem:   False
```

```
Graph:  G3
Dirac's Theorem:  False
Ore's Theorem:   False
```

```
Graph:  test
Dirac's Theorem:  False
Ore's Theorem:   False
```

Nim min/max

```
[2, 2, 1]: min/max = 1
  [1, 2, 1]: min/max = -1
    [0, 2, 1]: min/max = 1
      [0, 1, 1]: min/max = 1
        [0, 0, 1]: min/max = 1
          [0, 0, 0]: min/max = 1
        [0, 0, 1]: min/max = -1
          [0, 0, 0]: min/max = -1
        [0, 2, 0]: min/max = -1
          [0, 1, 0]: min/max = 1
            [0, 0, 0]: min/max = 1
          [0, 0, 0]: min/max = -1
        [0, 0, 0]: min/max = -1
      [1, 1, 1]: min/max = 1
        [0, 1, 1]: min/max = 1
          [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
          [1, 0, 1]: min/max = -1
            [0, 0, 1]: min/max = -1
              [0, 0, 0]: min/max = -1
        [0, 2, 1]: min/max = -1
          [0, 1, 1]: min/max = -1
            [0, 0, 1]: min/max = -1
              [0, 0, 0]: min/max = -1
          [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
          [0, 2, 0]: min/max = 1
            [0, 1, 0]: min/max = -1
              [0, 0, 0]: min/max = -1
            [0, 0, 0]: min/max = 1
        [2, 2, 0]: min/max = 1
          [1, 2, 0]: min/max = 1
            [0, 2, 0]: min/max = -1
              [0, 1, 0]: min/max = 1
```



```
        [0, 0, 0]: min/max = 1
    [0, 1, 1]: min/max = 1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
    [0, 1, 0]: min/max = -1
        [0, 0, 0]: min/max = -1
[0, 0, 3]: min/max = 1
    [0, 0, 2]: min/max = -1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
        [0, 0, 0]: min/max = -1
    [0, 0, 1]: min/max = -1
        [0, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = 1
[0, 2, 2]: min/max = -1
    [0, 1, 2]: min/max = -1
        [0, 0, 2]: min/max = 1
            [0, 0, 1]: min/max = -1
                [0, 0, 0]: min/max = -1
            [0, 0, 0]: min/max = 1
        [0, 1, 1]: min/max = -1
            [0, 0, 1]: min/max = -1
                [0, 0, 0]: min/max = -1
        [0, 1, 0]: min/max = 1
            [0, 0, 0]: min/max = 1
    [0, 0, 2]: min/max = -1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
        [0, 0, 0]: min/max = -1
[0, 2, 1]: min/max = 1
    [0, 1, 1]: min/max = 1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
    [0, 0, 1]: min/max = -1
```

```
[0, 0, 0]: min/max = -1
[0, 2, 0]: min/max = -1
[0, 1, 0]: min/max = 1
    [0, 0, 0]: min/max = 1
[0, 0, 0]: min/max = -1
[0, 2, 0]: min/max = 1
[0, 1, 0]: min/max = -1
    [0, 0, 0]: min/max = -1
[0, 0, 0]: min/max = 1
[1, 1, 3]: min/max = -1
[0, 1, 3]: min/max = 1
    [0, 0, 3]: min/max = -1
        [0, 0, 2]: min/max = 1
            [0, 0, 1]: min/max = -1
                [0, 0, 0]: min/max = -1
            [0, 0, 0]: min/max = 1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
        [0, 0, 0]: min/max = -1
    [0, 1, 2]: min/max = -1
        [0, 0, 2]: min/max = 1
            [0, 0, 1]: min/max = -1
                [0, 0, 0]: min/max = -1
            [0, 0, 0]: min/max = 1
        [0, 1, 1]: min/max = -1
            [0, 0, 1]: min/max = -1
                [0, 0, 0]: min/max = -1
        [0, 1, 0]: min/max = 1
            [0, 0, 0]: min/max = 1
    [0, 1, 1]: min/max = 1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
    [0, 1, 0]: min/max = -1
        [0, 0, 0]: min/max = -1
[1, 1, 2]: min/max = 1
```

```
[0, 1, 2]: min/max = -1
  [0, 0, 2]: min/max = 1
    [0, 0, 1]: min/max = -1
      [0, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = 1
  [0, 1, 1]: min/max = -1
    [0, 0, 1]: min/max = -1
      [0, 0, 0]: min/max = -1
    [0, 1, 0]: min/max = 1
      [0, 0, 0]: min/max = 1
  [1, 1, 1]: min/max = -1
    [0, 1, 1]: min/max = -1
      [0, 0, 1]: min/max = -1
        [0, 0, 0]: min/max = -1
    [1, 1, 0]: min/max = 1
      [0, 1, 0]: min/max = 1
        [0, 0, 0]: min/max = 1
  [1, 1, 1]: min/max = 1
    [0, 1, 1]: min/max = 1
      [0, 0, 1]: min/max = 1
        [0, 0, 0]: min/max = 1
  [1, 1, 0]: min/max = -1
    [0, 1, 0]: min/max = -1
      [0, 0, 0]: min/max = -1
  [1, 0, 3]: min/max = -1
    [0, 0, 3]: min/max = 1
      [0, 0, 2]: min/max = -1
        [0, 0, 1]: min/max = 1
          [0, 0, 0]: min/max = 1
        [0, 0, 0]: min/max = -1
      [0, 0, 1]: min/max = -1
        [0, 0, 0]: min/max = -1
      [0, 0, 0]: min/max = 1
  [1, 0, 2]: min/max = 1
    [0, 0, 2]: min/max = -1
```

```
[0, 0, 1]: min/max = 1
    [0, 0, 0]: min/max = 1
    [0, 0, 0]: min/max = -1
[1, 0, 1]: min/max = 1
    [0, 0, 1]: min/max = 1
    [0, 0, 0]: min/max = 1
[1, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = -1
[1, 0, 1]: min/max = -1
    [0, 0, 1]: min/max = -1
    [0, 0, 0]: min/max = -1
[1, 0, 0]: min/max = 1
    [0, 0, 0]: min/max = 1
[1, 2, 2]: min/max = -1
    [0, 2, 2]: min/max = -1
    [0, 1, 2]: min/max = -1
    [0, 0, 2]: min/max = 1
    [0, 0, 1]: min/max = -1
    [0, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = 1
    [0, 1, 1]: min/max = -1
    [0, 0, 1]: min/max = -1
    [0, 0, 0]: min/max = -1
    [0, 1, 0]: min/max = 1
    [0, 0, 0]: min/max = 1
    [0, 0, 2]: min/max = -1
    [0, 0, 1]: min/max = 1
    [0, 0, 0]: min/max = 1
    [0, 0, 0]: min/max = -1
[1, 1, 2]: min/max = 1
    [0, 1, 2]: min/max = -1
    [0, 0, 2]: min/max = 1
    [0, 0, 1]: min/max = -1
    [0, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = 1
```

```
[0, 1, 1]: min/max = -1
    [0, 0, 1]: min/max = -1
        [0, 0, 0]: min/max = -1
    [0, 1, 0]: min/max = 1
        [0, 0, 0]: min/max = 1
[1, 1, 1]: min/max = -1
    [0, 1, 1]: min/max = -1
        [0, 0, 1]: min/max = -1
            [0, 0, 0]: min/max = -1
[1, 1, 0]: min/max = 1
    [0, 1, 0]: min/max = 1
        [0, 0, 0]: min/max = 1
[1, 0, 2]: min/max = 1
    [0, 0, 2]: min/max = -1
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
        [0, 0, 0]: min/max = -1
[1, 0, 1]: min/max = 1
    [0, 0, 1]: min/max = 1
        [0, 0, 0]: min/max = 1
[1, 0, 0]: min/max = -1
    [0, 0, 0]: min/max = -1
[1, 2, 1]: min/max = -1
    [0, 2, 1]: min/max = 1
        [0, 1, 1]: min/max = 1
            [0, 0, 1]: min/max = 1
                [0, 0, 0]: min/max = 1
        [0, 0, 1]: min/max = -1
            [0, 0, 0]: min/max = -1
[0, 2, 0]: min/max = -1
    [0, 1, 0]: min/max = 1
        [0, 0, 0]: min/max = 1
    [0, 0, 0]: min/max = -1
[1, 1, 1]: min/max = 1
    [0, 1, 1]: min/max = 1
```



```
        [0, 0, 1]: min/max = 1
            [0, 0, 0]: min/max = 1
[1, 0, 1]: min/max = -1
    [0, 0, 1]: min/max = -1
        [0, 0, 0]: min/max = -1
[1, 2, 0]: min/max = -1
    [0, 2, 0]: min/max = 1
        [0, 1, 0]: min/max = -1
            [0, 0, 0]: min/max = -1
                [0, 0, 0]: min/max = 1
[1, 1, 0]: min/max = -1
    [0, 1, 0]: min/max = -1
        [0, 0, 0]: min/max = -1
[1, 0, 0]: min/max = 1
    [0, 0, 0]: min/max = 1
```

Player 2 has higher chances to win