
DEVOIR MAISON

À rendre le Lundi 23 février 2026

```
1 import random
2
3
4 def est_possible(position):
5     for i in range(len(position)-1):
6         if position[i] < position[i+1]:
7             return False
8     return True
9
10
11 def coups_possibles(position):
12     n = max(position)
13     p = len(position)
14     liste = []
15     for c in range(p):
16         for l in range(position[c]):
17             liste.append((l, c))
18     return liste
19
20
21 def jouer_coup(position, coup):
22     p = len(position)
23     (l, c) = coup
24     if not (c < p and l < position[c]):
25         return None
26
27     nouvelle_position = []
28     for k in range(p):
29         if k >= c and position[k] > l:
30             nouvelle_position.append(l)
31         else:
32             nouvelle_position.append(position[k])
33     return nouvelle_position
34
35
36 def positions_possibles(position):
37     n = max(position)
38     p = len(position)
39     liste = []
40     for c in range(p):
41         for l in range(position[c]):
42             liste.append(jouer_coup(position, (l, c)))
43     return liste
44
45
46 def est_gagnante(position):
47     if sum(position) == 0:
48         return True
49
50     liste = positions_possibles(position)
51     for p in liste:
52         if not est_gagnante(p):
53             return True
54
55     return False
```

```

1 D = {}
2
3 def est_gagnante_memo(position):
4     if tuple(position) in D:
5         return D[tuple(position)]
6
7     if sum(position) == 0:
8         D[tuple(position)] = True
9         return True
10
11     liste = positions_possibles(position)
12     for p in liste:
13         if not est_gagnante_memo(p):
14             D[tuple(position)] = True
15             return True
16
17     D[tuple(position)] = False
18     return False
19
20
21 def coup_gagnant(position):
22     liste = coups_possibles(position)
23     for coup in liste:
24         nouvelle_position = jouer_coup(position, coup)
25         if not est_gagnante_memo(nouvelle_position):
26             return coup
27     return random.choice(liste)
28
29
30 def jeu(n, p):
31     position = p * [n]
32
33     while sum(position) > 0:
34         # Coup joueur
35         print(position)
36         coup = input("Entrez votre coup : ")
37         coup = coup.split(",")
38         l = int(coup[0])
39         c = int(coup[1])
40         position = jouer_coup(position, (l, c))
41
42         if sum(position) == 0:
43             print("Désolé ! Tu as perdu...")
44             return None
45
46         # Coup ordi
47         print(position)
48         (l, c) = coup_gagnant(position)
49         print(f"Je joue le coup {(l, c)}")
50         position = jouer_coup(position, (l, c))
51
52     print("Bravo ! Tu as gagné !!")

```