Maze Router Testcases

Contents

Test Case 1 (One net)

- **Input:**

```
5, 5, 3, 10
OBS (1, 2, 2)
OBS (2, 2, 2)
net1 (1, 0, 0) (1, 4, 4)
```

- **Output:**

Net: **net1**

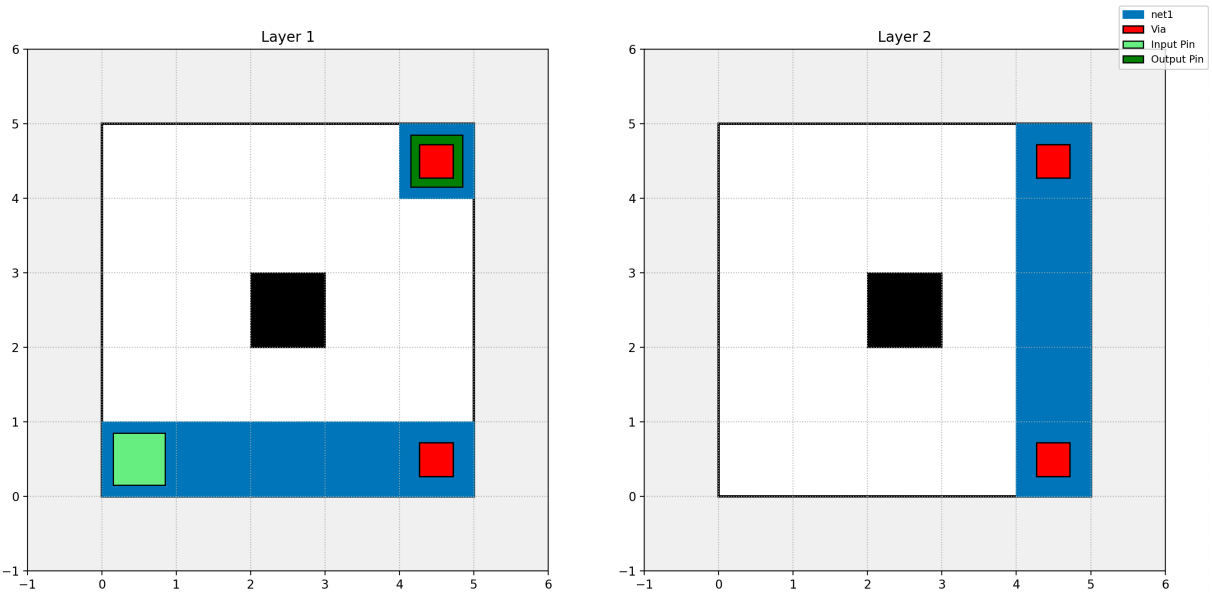
Vias: 2 | Preferred: 8 | Non-pref: 0

Total cost: 14

Path: (1, 0, 0) (1, 1, 0) (1, 2, 0) (1, 3, 0) (1, 4, 0) (2, 4, 0) (2, 4, 1) (2, 4, 2) (2, 4, 3) (2, 4, 4) (1, 4, 4)

- **Tracing:**
  - **net1**
    - **Path:**

      It starts on M1, routing horizontally from (1, 0, 0) to (1, 4, 0). It then uses a via to M2 at (2, 4, 0), and continues vertically to (2, 4, 4). It switches back to M1 at (1, 4, 4) using another via.



Test Case 2 (Multiple nets)

- **Input:**

```
6, 6, 4, 10
OBS (1, 1, 5)
net1 (1, 0, 5) (2, 5, 4)
net2 (1, 0, 0) (1, 3, 5)
```

- **Output:**

Net: **net1**

Vias: 3 | Preferred: 6 | Non-pref: 0

Total cost: 18

Path: (1, 0, 5) (2, 0, 5) (2, 0, 4) (1, 0, 4) (1, 1, 4) (1, 2, 4) (1, 3, 4) (1, 4, 4) (1, 5, 4) (2, 5, 4)

Net: **net2**

Vias: 2 | Preferred: 8 | Non-pref: 0

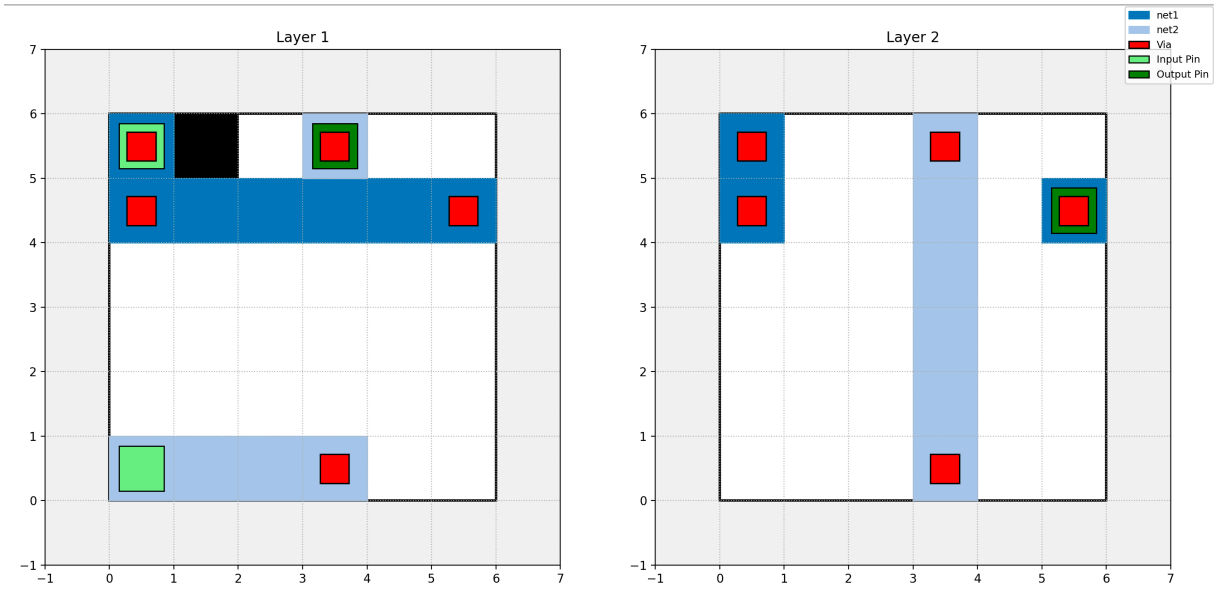
Total cost: 16

Path: (1, 0, 0) (1, 1, 0) (1, 2, 0) (1, 3, 0) (2, 3, 0) (2, 3, 1) (2, 3, 2) (2, 3, 3) (2, 3, 4) (2, 3, 5) (1, 3, 5)

- **Tracing:**
  - **net1**
    - **Path:**

      It starts on M1 at (1, 0, 5), uses a via to M2 at (2, 0, 5), routes vertically to (2, 0, 4), then switches to M1 via a via at (1, 0, 4). It continues horizontally on M1 from (1, 0, 4) to (1, 5, 4), then ends with a via to M2 at (2, 5, 4).
  - **net2**
    - **Path:**

      It starts on M1, routing horizontally from (1, 0, 0) to (1, 3, 0), then uses a via to M2 at (2, 3, 0) and routes vertically to (2, 3, 5), where it switches back to M1 via a via and ends at (1, 3, 5).


Layer 1
Layer 2
net1
net2
Via
Input Pin
Output Pin

Test Case 3 (Multiple nets, Multi-pin)

- **Input**

```
10, 10, 5, 200
OBS (1, 1, 2)
OBS (1, 2, 4)
OBS (1, 3, 6)
OBS (1, 4, 8)
OBS (2, 1, 2)
OBS (2, 2, 4)
OBS (2, 3, 6)
OBS (2, 4, 8)
net1 (1, 0, 0) (1, 1, 1) (1, 2, 2)
net2 (2, 0, 0) (1, 6, 1) (1, 1, 6)
```

- **Output:**

Net: **net1**

Vias: 4 | Preferred: 4 | Non-pref: 0

Total cost: 24

Path: (1, 0, 0) (1, 1, 0) (2, 1, 0) (2, 1, 1) (1, 1, 1) (1, 2, 1) (2, 2, 1) (2, 2, 2) (1, 2, 2)

Net: **net2**

Vias: 7 | Preferred: 21 | Non-pref: 0

Total cost: 56

Path: (2, 0, 0) (2, 0, 1) (2, 0, 2) (2, 0, 3) (1, 0, 3) (1, 1, 3) (1, 2, 3) (1, 3, 3) (1, 4, 3) (1, 5, 3) (1, 6, 3) (2, 6, 3) (2, 6, 2) (2, 6, 1) (1, 6, 1) (1, 5, 1) (1, 4, 1) (1, 3, 1) (2, 3, 1) (2, 3, 2) (2, 3, 3) (2, 3, 4) (2, 3, 5) (1, 3, 5) (1, 2, 5) (1, 1, 5) (2, 1, 5) (2, 1, 6) (1, 1, 6)

- **Tracing:**
  - **net1**
    - **Path 1:** (1, 0, 0) => (1, 1, 1)

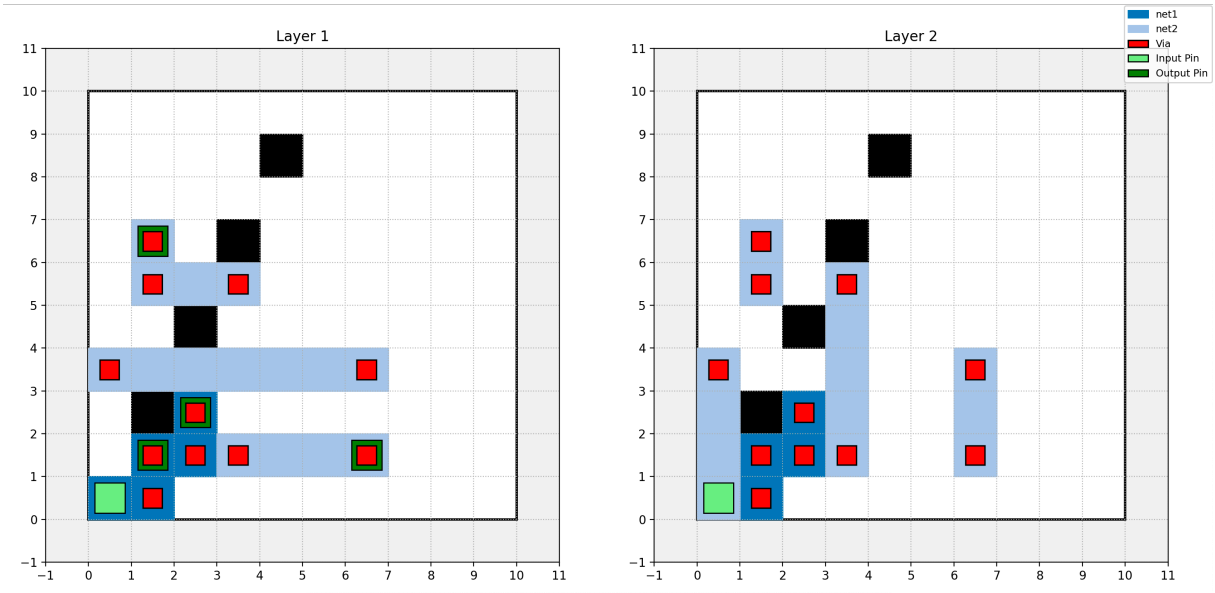
      It starts on M1, routing horizontally from (1, 0, 0) to (1, 1, 0), then uses a via to M2 at (2, 1, 0), moves vertically to (2, 1, 1), and switches back to M1 using a via at (1, 1, 1).
    - **Path 2:** (1, 1, 1) => (1, 2, 2)

      It continues on M1 from (1, 1, 1) to (1, 2, 1) horizontally, then uses a via to M2 at (2, 2, 1), moves vertically to (2, 2, 2), and switches back to M1 via a via at (1, 2, 2).

- **net2**
  - **Path 1:** (2, 0, 0) => (1, 6, 1)

    It starts on M2, routing vertically from (2, 0, 0) to (2, 0, 3), then uses a via to M1 at (1, 0, 3), and continues horizontally on M1 from (1, 0, 3) to (1, 6, 3). It then uses a via to M2 at (2, 6, 3), moves vertically to (2, 6, 1), and switches back to M1 via a via at (1, 6, 1).
  - **Path 2:** (1, 6, 1) => (1, 1, 6)

    It starts on M1 at (1, 6, 1), routes horizontally to (1, 3, 1), then uses a via to M2 at (2, 3, 1), moves vertically to (2, 3, 5), and switches back to M1 via a via at (1, 3, 5). It continues horizontally to (1, 1, 5), then uses a via to M2 at (2, 1, 5), moves vertically to (2, 1, 6), and switches back to M1 at (1, 1, 6).



Test Case 4

- **Input**

```
4, 4, 5, 100
OBS (1, 2, 0)
OBS (1, 2, 1)
OBS (1, 2, 2)
net1 (1, 0, 0) (1, 3, 3)
```

- **Output:**

Net: **net1**

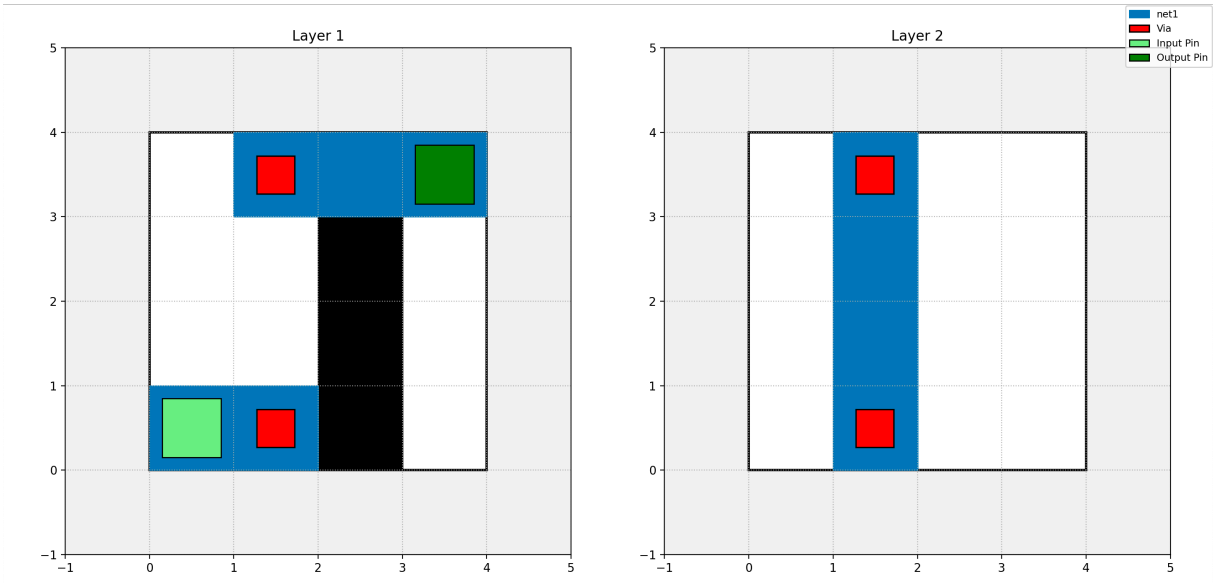
Vias: 2 | Preferred: 6 | Non-pref: 0

Total cost: 16

Path: (1, 0, 0) (1, 1, 0) (2, 1, 0) (2, 1, 1) (2, 1, 2) (2, 1, 3) (1, 1, 3) (1, 2, 3) (1, 3, 3)

- **Tracing:**
  - **net1**
    - **Path:**

      It starts on M1, routing horizontally from (1, 0, 0) to (1, 1, 0), then uses a via to M2 at (2, 1, 0). It continues vertically to (2, 1, 3), then routes horizontally on M1 using a via from (1, 1, 3) to (1, 3, 3).



Test Case 5 (non-pref, required)

- **Input**

```
4, 4, 5, 100
OBS (1, 2, 0)
OBS (1, 2, 1)
OBS (1, 2, 2)
OBS (1, 2, 3)
net1 (1, 0, 0) (1, 3, 3)
```

- **Output:**

Net: **net1**

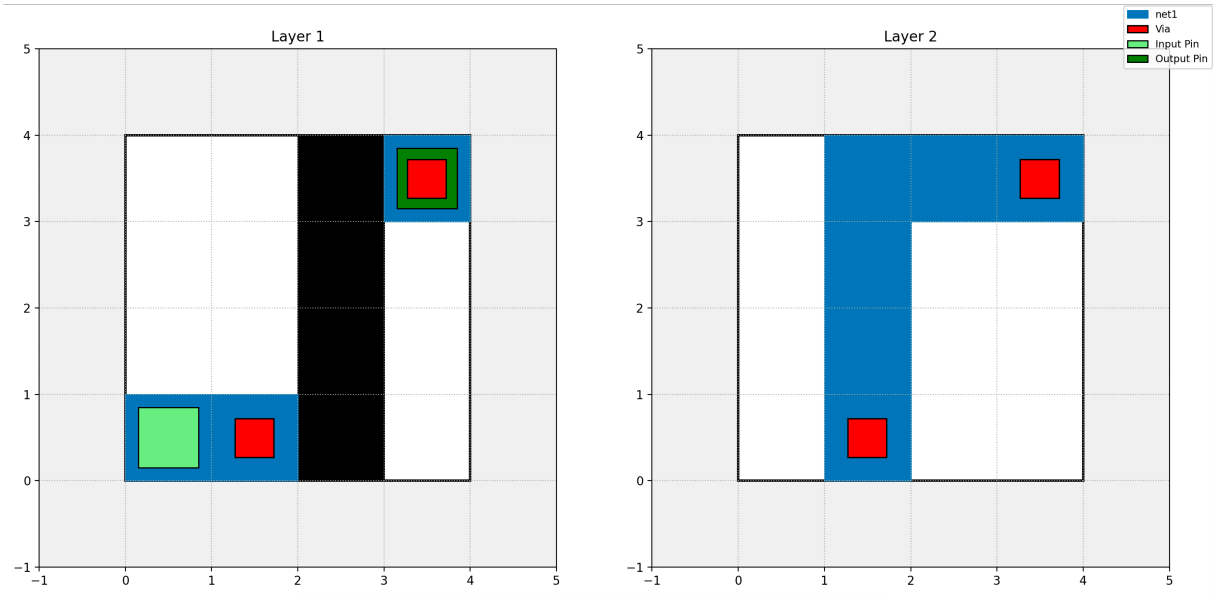
Vias: 2 | Preferred: 4 | Non-pref: 2

Total cost: 214

Path: (1, 0, 0) (1, 1, 0) (2, 1, 0) (2, 1, 1) (2, 1, 2) (2, 1, 3) (2, 2, 3) (2, 3, 3) (1, 3, 3)

- **Tracing:**
  - **net1**
    - **Path:**

      It starts on M1, routing horizontally from (1, 0, 0) to (1, 1, 0), then uses a via to M2 at (2, 1, 0). It continues vertically to (2, 1, 3), then routes horizontally on M2 **(non-preferred)** from (2, 1, 3) to (2, 3, 3). It switches back to M1 using a via at (1, 3, 3).



Test Case 6 (non-pref, not requrired)

- **Input**

```
4, 4, 5, 100
OBS (1, 2, 0)
OBS (1, 2, 1)
OBS (1, 2, 2)
net1 (1, 0, 0) (1, 3, 3)
```

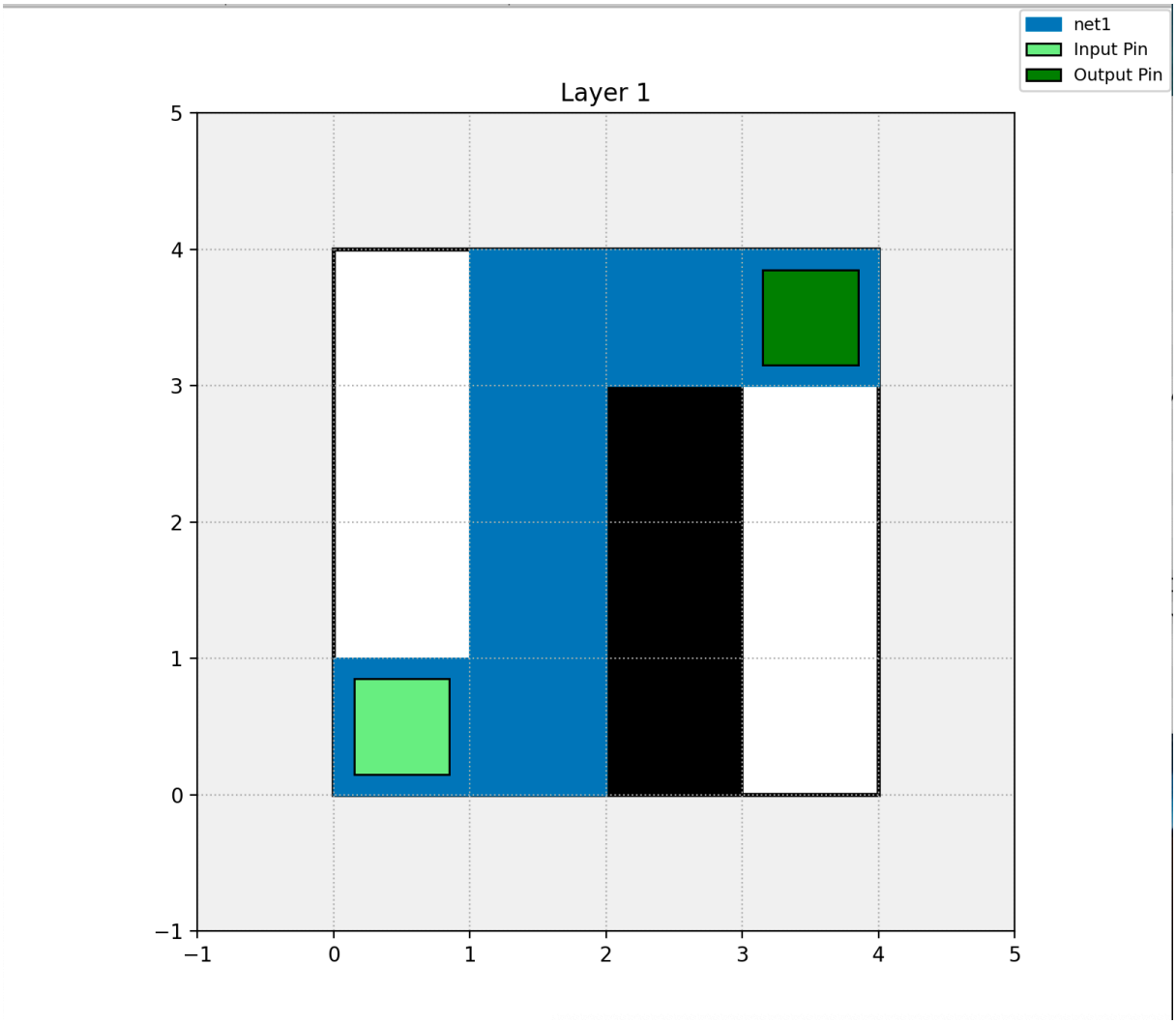
- **Output:**

Net: **net1**

Vias: 0 | Preferred: 3 | Non-pref: 3

Total cost: 18

Path: (1, 0, 0) (1, 1, 0) (1, 1, 1) (1, 1, 2) (1, 1, 3) (1, 2, 3) (1, 3, 3)



Test Case 7 (100x100)

- **Input**

```
100, 100, 5, 50
OBS (1, 10, 10)
OBS (2, 10, 10)
OBS (1, 10, 11)
OBS (2, 10, 11)
OBS (1, 11, 10)
OBS (2, 11, 10)
OBS (1, 11, 11)
OBS (2, 11, 11)
OBS (1, 50, 50)
OBS (2, 50, 50)
OBS (1, 50, 51)
OBS (2, 50, 51)
OBS (1, 51, 50)
OBS (2, 51, 50)
OBS (1, 51, 51)
OBS (2, 51, 51)
OBS (1, 70, 20)
OBS (2, 70, 20)
OBS (1, 70, 21)
OBS (2, 70, 21)
OBS (1, 71, 20)
OBS (2, 71, 20)
OBS (1, 71, 21)
OBS (2, 71, 21)
OBS (1, 80, 80)
OBS (2, 80, 80)
OBS (1, 80, 81)
OBS (2, 80, 81)
OBS (1, 81, 80)
OBS (2, 81, 80)
OBS (1, 81, 81)
OBS (2, 81, 81)
net1 (1, 0, 0) (1, 20, 20) (2, 40, 40)
net2 (1, 55, 55) (2, 60, 60) (2, 75, 75)
net3 (1, 85, 10) (1, 90, 15) (2, 95, 20) (2, 99, 25)
```

- **Output:**

Net: **net1**

Vias: 3 | Preferred: 30 | Non-pref: 0

Total cost: 45

Net: **net2**

Vias: 3 | Preferred: 28 | Non-pref: 0

Total cost: 43

Net: **net3**

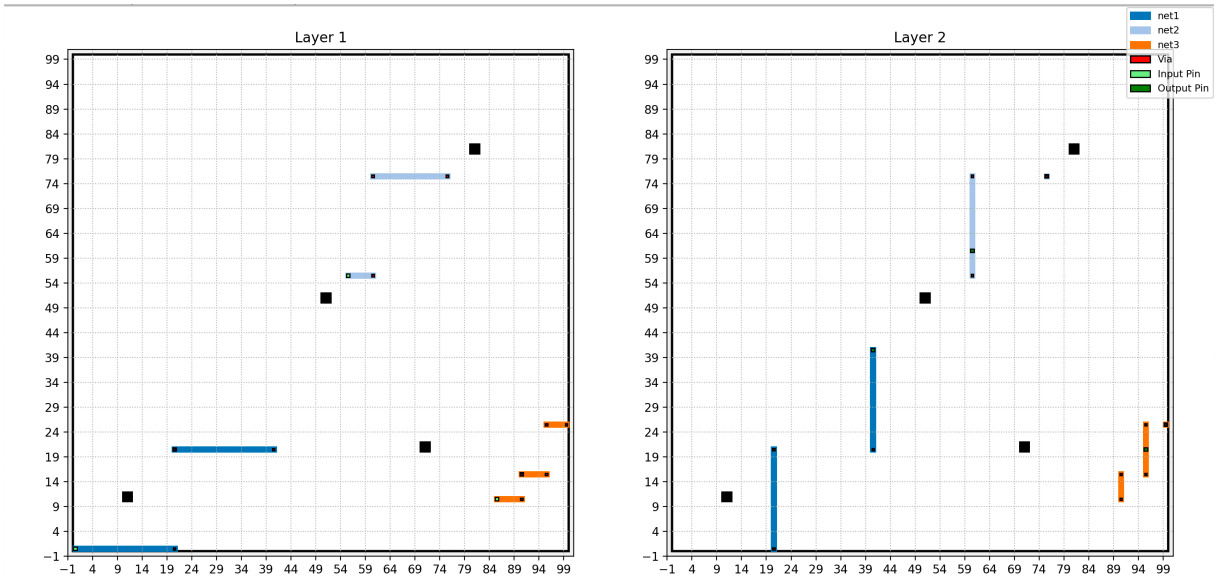
Vias: 2 | Preferred: 25 | Non-pref: 0

Total cost: 35

Net: **net4**

Vias: 3 | Preferred: 20 | Non-pref: 0

Total cost: 35



Test Case 8 (1000x1000)

- **Input**

```
1000, 1000, 5, 9999
OBS (layer, x, y)
net1 (1, 0, 0) (1, 500, 500)
net2 (1, 10, 900) (1, 200, 800)
net3 (2, 400, 100) (2, 600, 300)
net4 (1, 900, 950) (2, 950, 900)
```

Net: **net1**

Vias: 2 | Preferred: 1000 | Non-pref: 0

Total cost: 1010

Net: net2

Vias: 2 | Preferred: 290 | Non-pref: 0

Total cost: 300

Net: net3

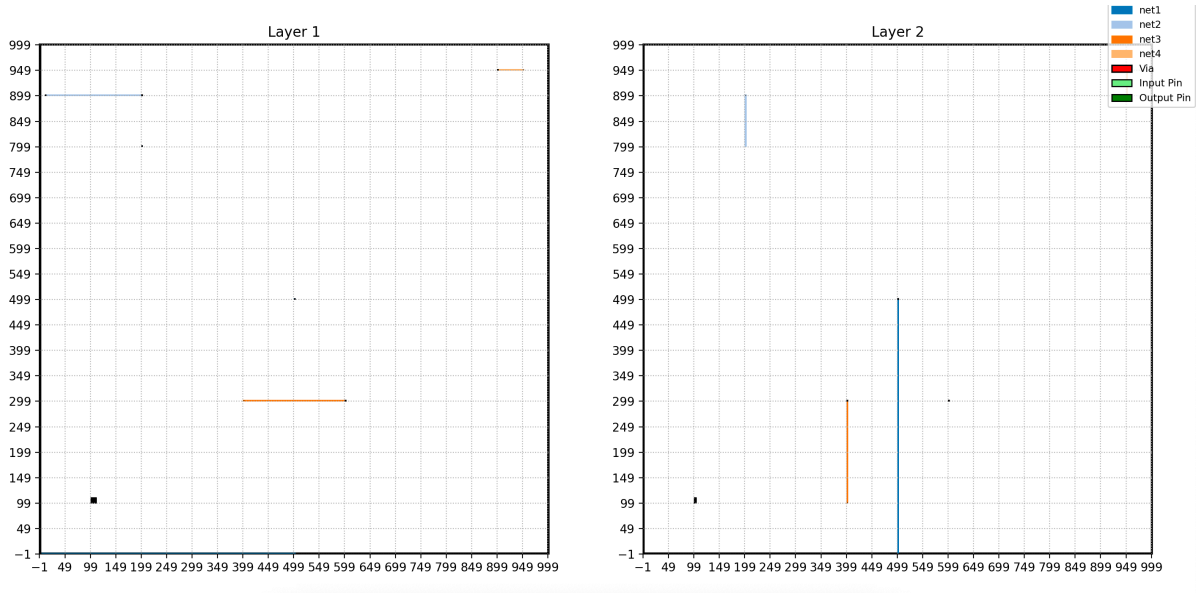
Vias: 2 | Preferred: 400 | Non-pref: 0

Total cost: 410

Net: net4

Vias: 1 | Preferred: 100 | Non-pref: 0

Total cost: 105


Layer 1
Layer 2
net1
net2
net3
net4
Via
Input Pin
Output Pin
999
949
899
849
799
749
699
649
599
549
499
449
399
349
299
249
199
149
99
49
−1
−1 49 99 149 199 249 299 349 399 449 499 549 599 649 699 749 799 849 899 949 999

Test Case 9 (w/o bonus)

- **Input**

```
5, 5, 10, 100
OBS (2, 0, 3)
OBS (2, 1, 3)
OBS (2, 2, 3)
OBS (2, 3, 3)
OBS (2, 4, 3)
net1 (1, 0, 3) (1, 4, 3)
net2 (1, 0, 0) (1, 2, 4)
```

- **Output:**

Net: **net1**

Vias: 0 | Preferred: 4 | Non-pref: 0

Total cost: 4

Path: (1, 0, 3) (1, 1, 3) (1, 2, 3) (1, 3, 3) (1, 4, 3)

Net: **net2**

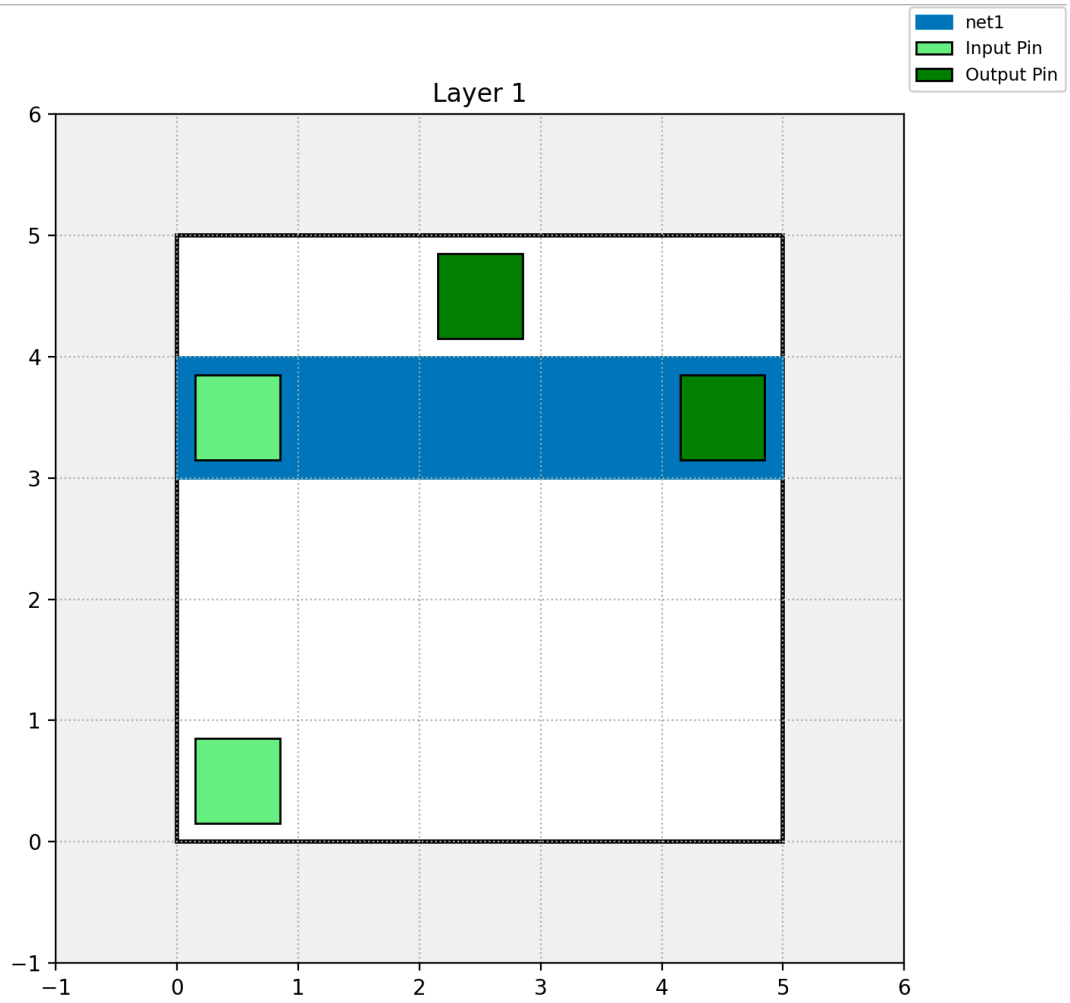
No route found

- **Tracing:**
  - **net1**
    - **Path:**

      It starts on M1 at (1, 0, 3) and routes horizontally to (1, 1, 3), then continues to (1, 2, 3), (1, 3, 3), and finally (1, 4, 3).
  - **net2**
    - **Path:**

      It starts on M1 at (1, 0, 0) and routes horizontally (preferred) to (1, 1, 0) and then to (1, 2, 0). From there, it uses a via to move to M2 at (2, 2, 0). It continues vertically on M2 (preferred) to (2, 2, 1), (2, 2, 2), and (2, 2, 3).

      At this point, the path gets blocked: moving further up on M2 is not possible due to an obstacle at (2, 2, 4), and switching to M1 to go vertically (non-preferred) is also blocked because another route already occupies that space.


net1
Input Pin
Output Pin
Layer 1
6
5
4
3
2
1
0
−1
−1
0
1
2
3
4
5
6

Test Case 9 (with bonus)

- **Input**

```
5, 5, 10, 100
OBS (2, 0, 3)
OBS (2, 1, 3)
OBS (2, 2, 3)
OBS (2, 3, 3)
OBS (2, 4, 3)
net1 (1, 0, 3) (1, 4, 3)
net2 (1, 0, 0) (1, 2, 4)
```

- **Output:**

Net: **net2**

Vias: 2 | Preferred: 4 | Non-pref: 2

Total cost: 224

Path: (1, 0, 0) (1, 1, 0) (1, 2, 0) (2, 2, 0) (2, 2, 1) (2, 2, 2) (1, 2, 2) (1, 2, 3) (1, 2, 4)

Net: **net1**

Vias: 4 | Preferred: 6 | Non-pref: 2

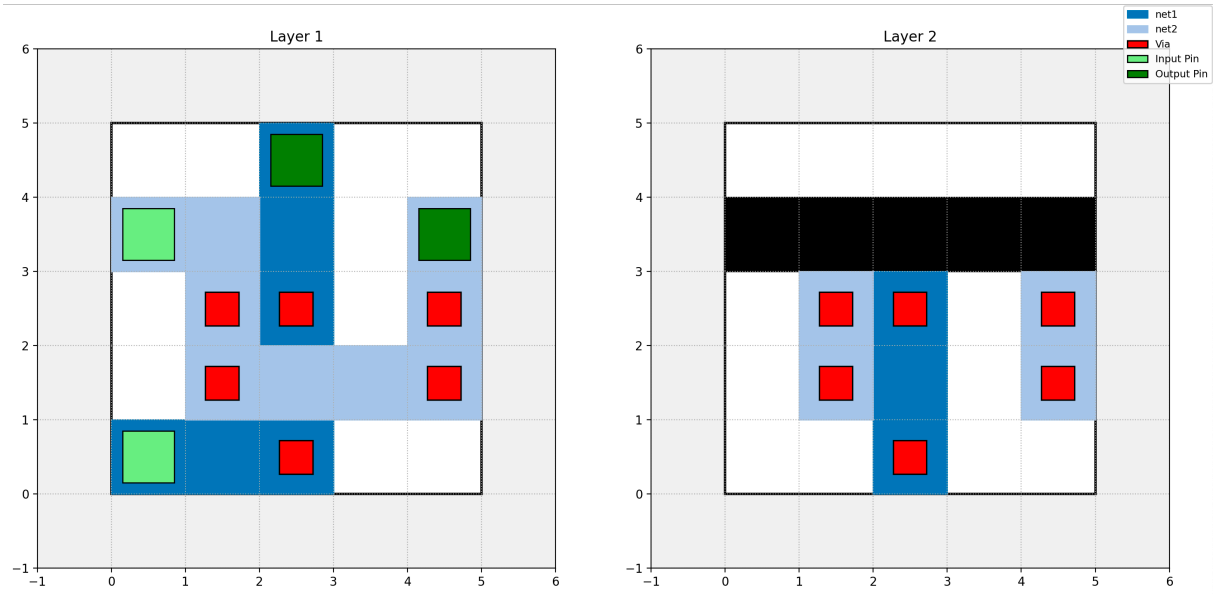
Total cost: 246

Path: (1, 0, 3) (1, 1, 3) (1, 1, 2) (2, 1, 2) (2, 1, 1) (1, 1, 1) (1, 2, 1) (1, 3, 1) (1, 4, 1) (2, 4, 1) (2, 4, 2) (1, 4, 2) (1, 4, 3)

- **Tracing:**
  - **net2**
    - **Path:**

      Net2 starts on M1 at (1, 0, 0), routes horizontally to (1, 2, 0), then vias up to M2 at (2, 2, 0). It continues vertically on M2 to (2, 2, 2), vias back to M1 at (1, 2, 2), and moves vertically (non-preferred) to the destination at (1, 2, 4).
  - **net1**
    - **Path:**

      Net1 starts on M1 at (1, 0, 3), routes horizontally to (1, 1, 3), then vertically downward (non-preferred) to (1, 1, 2). It vias up to M2 at (2, 1, 2), continues vertically to (2, 1, 1) due to have a route on (1, 2, 2), vias down to M1 at (1, 1, 1), moves horizontally to (1, 4, 1), vias up to M2 at (2, 4, 1), goes vertically to (2, 4, 2), vias down to M1 at (1, 4, 2), and finishes vertically at (1, 4, 3).


Layer 1
Layer 2
net1
net2
Via
Input Pin
Output Pin

Test Case 10 (with & w/o bonus)

- **Input**

```
20, 20, 5, 10
OBS (1, 9, 5)
OBS (1, 9, 6)
OBS (1, 9, 7)
OBS (1, 9, 8)
OBS (1, 9, 9)
OBS (1, 9, 10)
OBS (1, 9, 11)
OBS (1, 9, 12)
OBS (2, 9, 5)
OBS (2, 9, 6)
OBS (2, 9, 7)
OBS (2, 9, 8)
OBS (2, 9, 9)
OBS (2, 9, 10)
OBS (2, 9, 11)
OBS (2, 9, 12)
OBS (1, 10, 7)
OBS (1, 10, 8)
OBS (1, 10, 9)
OBS (1, 10, 10)
OBS (1, 10, 11)
OBS (1, 10, 12)
OBS (1, 10, 13)
OBS (2, 10, 7)
OBS (2, 10, 8)
OBS (2, 10, 9)
OBS (2, 10, 10)
OBS (2, 10, 11)
OBS (2, 10, 12)
OBS (2, 10, 13)
OBS (1, 11, 7)
OBS (1, 11, 8)
OBS (1, 11, 9)
OBS (1, 11, 10)
OBS (1, 11, 11)
OBS (1, 11, 12)
OBS (1, 11, 13)
OBS (2, 11, 7)
OBS (2, 11, 8)
OBS (2, 11, 9)
OBS (2, 11, 10)
```

```
OBS (2, 11, 11)
OBS (2, 11, 12)
OBS (2, 11, 13)
OBS (1, 3, 10)
OBS (1, 3, 11)
OBS (1, 3, 12)
OBS (1, 4, 11)
OBS (1, 4, 12)
OBS (2, 3, 10)
OBS (2, 3, 11)
OBS (2, 3, 12)
OBS (2, 4, 11)
OBS (2, 4, 12)
OBS (1, 17, 17)
OBS (1, 17, 18)
OBS (1, 17, 19)
OBS (1, 18, 18)
OBS (1, 18, 19)
OBS (1, 19, 18)
OBS (2, 17, 17)
OBS (2, 17, 18)
OBS (2, 17, 19)
OBS (2, 18, 18)
OBS (2, 18, 19)
OBS (2, 19, 18)
OBS (1, 7, 15)
OBS (2, 7, 15)
OBS (1, 8, 15)
OBS (2, 8, 15)
net1 (1, 0, 0) (1, 8, 8) (2, 12, 14) (1, 14, 16) (2, 19, 19)
net2 (1, 0, 19) (1, 5, 15) (2, 9, 16) (1, 13, 18) (2, 16, 19)
net3 (2, 0, 10) (2, 3, 14) (1, 7, 12) (2, 11, 15) (1, 16, 16)
net4 (1, 1, 5) (1, 5, 9) (2, 8, 12) (1, 13, 13) (2, 18, 17)
net5 (2, 2, 0) (1, 6, 5) (2, 10, 10) (1, 15, 14) (2, 19, 15)
```

Routing order (w/o reordering)	Cost
net1	62
net2	58
net3	85
net4	94
net5	42

Routing order (with reordering)	Cost
net5	33
net1	62
net3	83
net4	81
net2	43

,