

# Selection sort

7 2 5 9 6 2 1 4 9

1 2 5 9 6 2 7 4 9

2 5 9 6 2 7 4 9

2 9 6 5 7 4 9

4 6 5 7 9 9

5 6 7 9 9

6 7 9 9



1 2 2 4 5 6 7 9 9

## Insertion sort

[7] 2 5 9 6 2 1 4 9

[7 2]

[2 7 5]

[2 5 7 9]

[2 5 7 9 6]

[2 5 6 7 9 2]

[2 2 5 6 7 9 1]

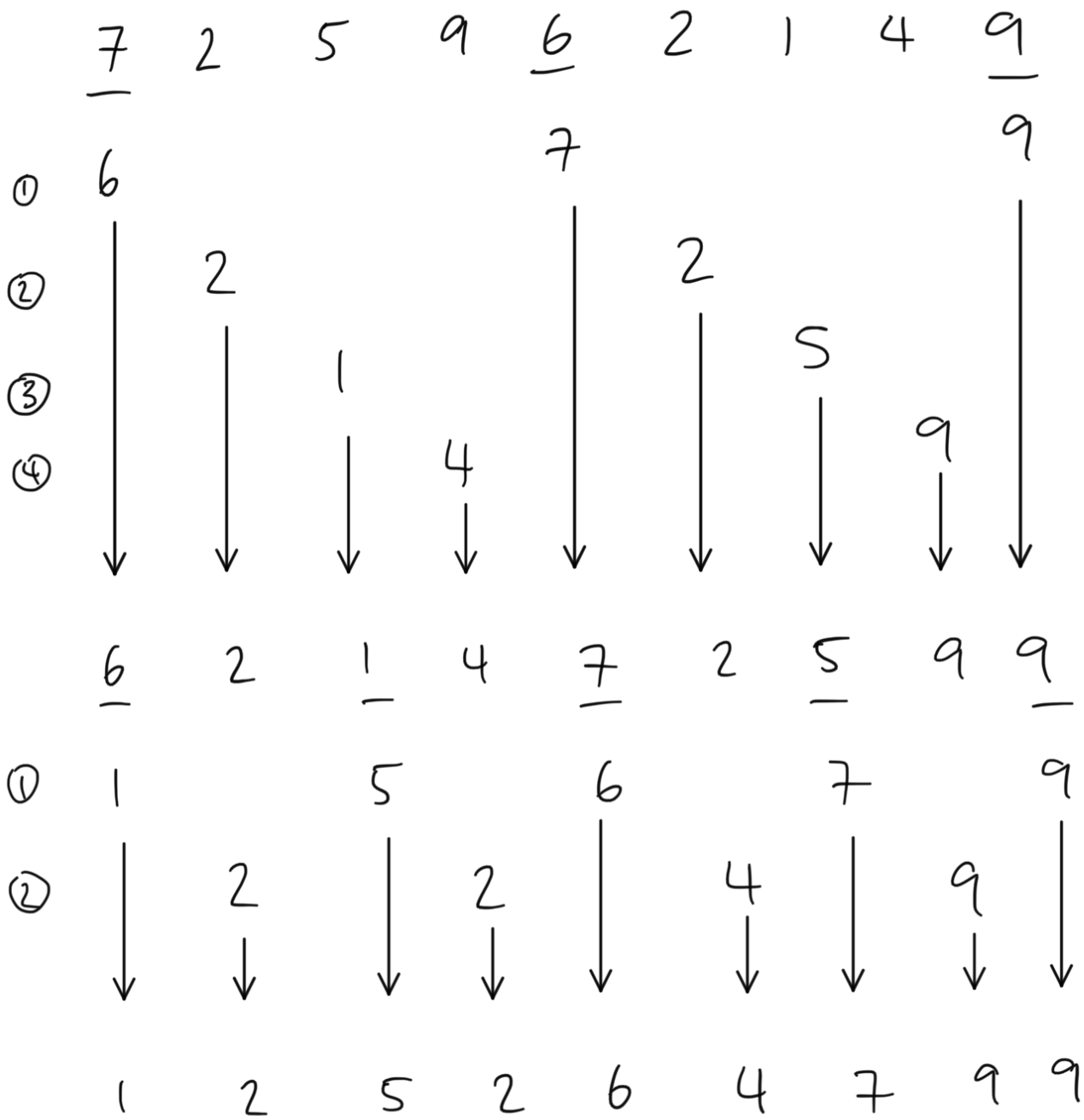
[1 2 2 5 6 7 9 4]

[1 2 2 4 5 6 7 9 9]

# Shell sort

$$\text{length} = 9$$

$$\text{mid} = 9 // 2 = 4$$



do insertion

1      2      5      2      6      4      7      9      9

[1]

[1 2]

[1 2 5]

[1 2 5 2]

[1 2 2 5 6]

[1 2 2 5 6 4]

[1 2 2 4 5 6 7]

[1 2 2 4 5 6 7 9]

[1 2 2 4 5 6 7 9 9]

# Bubble sort

7 2 5 9 6 2 1 4 9

2 7 5

5 7 9

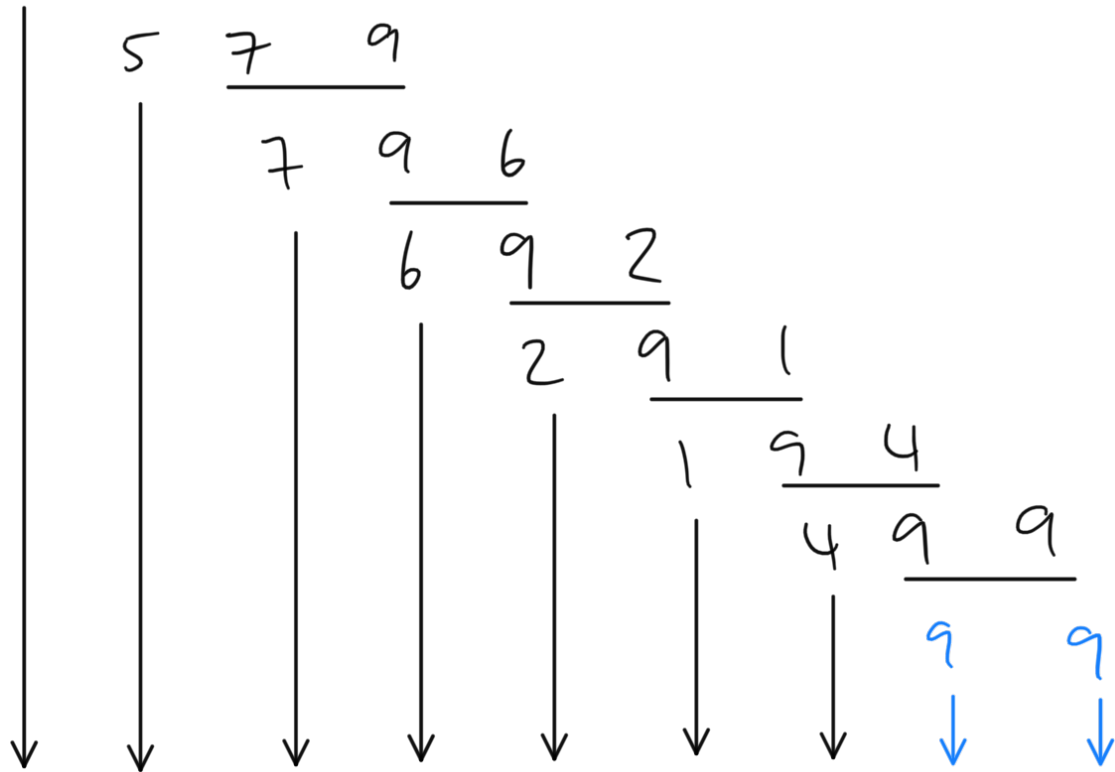
7 9 6

6 9 2

2 9 1

1 9 4

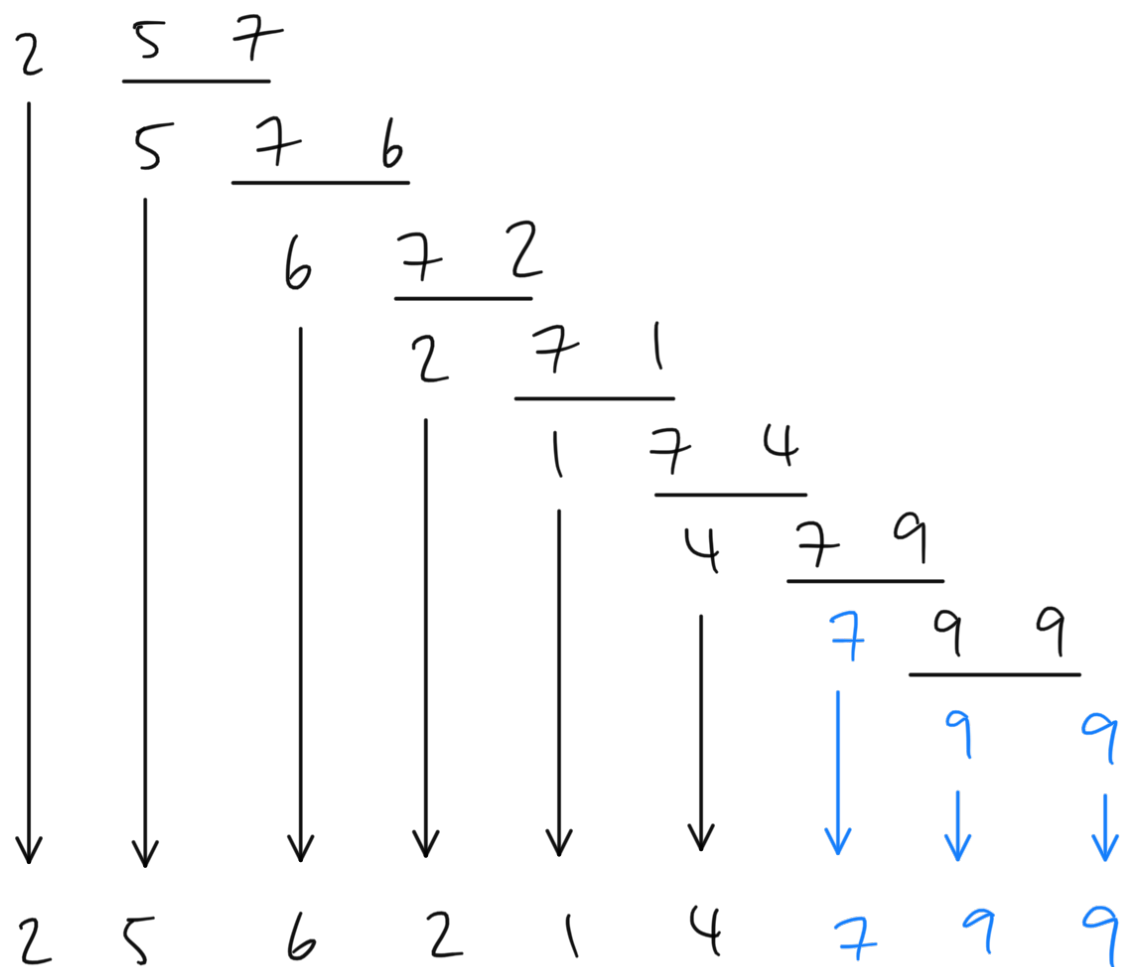
4 9 9



2 5 7 6 2 1 4 9 9

first pass completed

2 5 7 6 2 1 4 9 9



Second pass completed

2 5 6 2 1 4 7 9 9

2 5 6

↓  
5 6 2

2 6 1

↓  
1 6 4

↓  
4 6 7

↓  
6 7 9

↓  
7 9 9

↓  
9 9

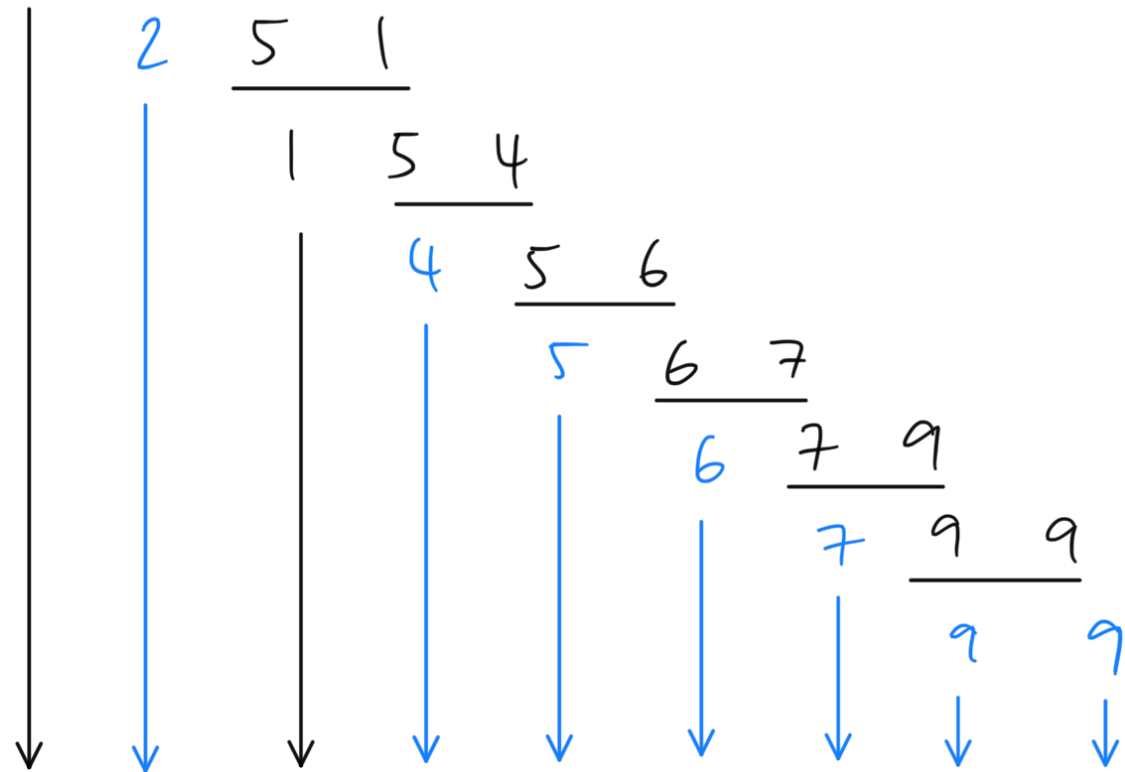
↓  
9 9

2 5 2 1 4 6 7 9 9

third pass completed

2   5   2   1   4   6   7   9   9

2   5   2



2   2   1   4   5   6   7   9   9

fourth pass completed



2   2   1   4   5   6   7   9   9

2   2   1

↓  
1   2   4

2   4   5

↓  
4   5   6

↓  
5   6   7

↓  
6   7   9

↓  
7   9   9

↓  
9   9

↓  
2   1   2   4   5   6   7   9   9

fifth pass completed

2 1 2 4 5 6 7 9 9

1 2 2

2 2 4

2 4 5

4 5 6

5 6 7

6 7 9

7 9 9

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 2 2 4 5 6 7 9 9

Sixth pass completed, all sorted

# Merge sort

7 2 5 9 6 2 1 4 9

7 2 5 9

6 2 1 4 9

7 2 5 9

6 2 1 4 9

7 2 5 9

6 2 1 4 9

7 2 5 9

6 2 1 4 9

7 2 5 9

6 2

1 4 9

7 2 5 9

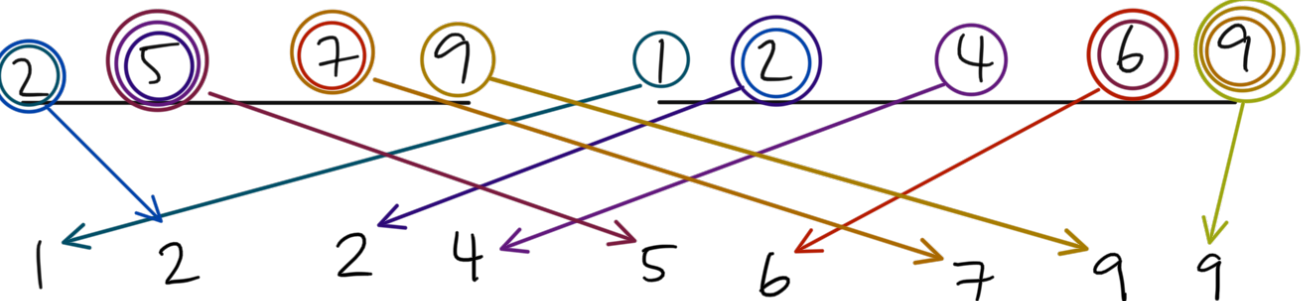
6 2

1 4 9

2 7 5 9

2 6

1 4 9



# Quick sort

legend

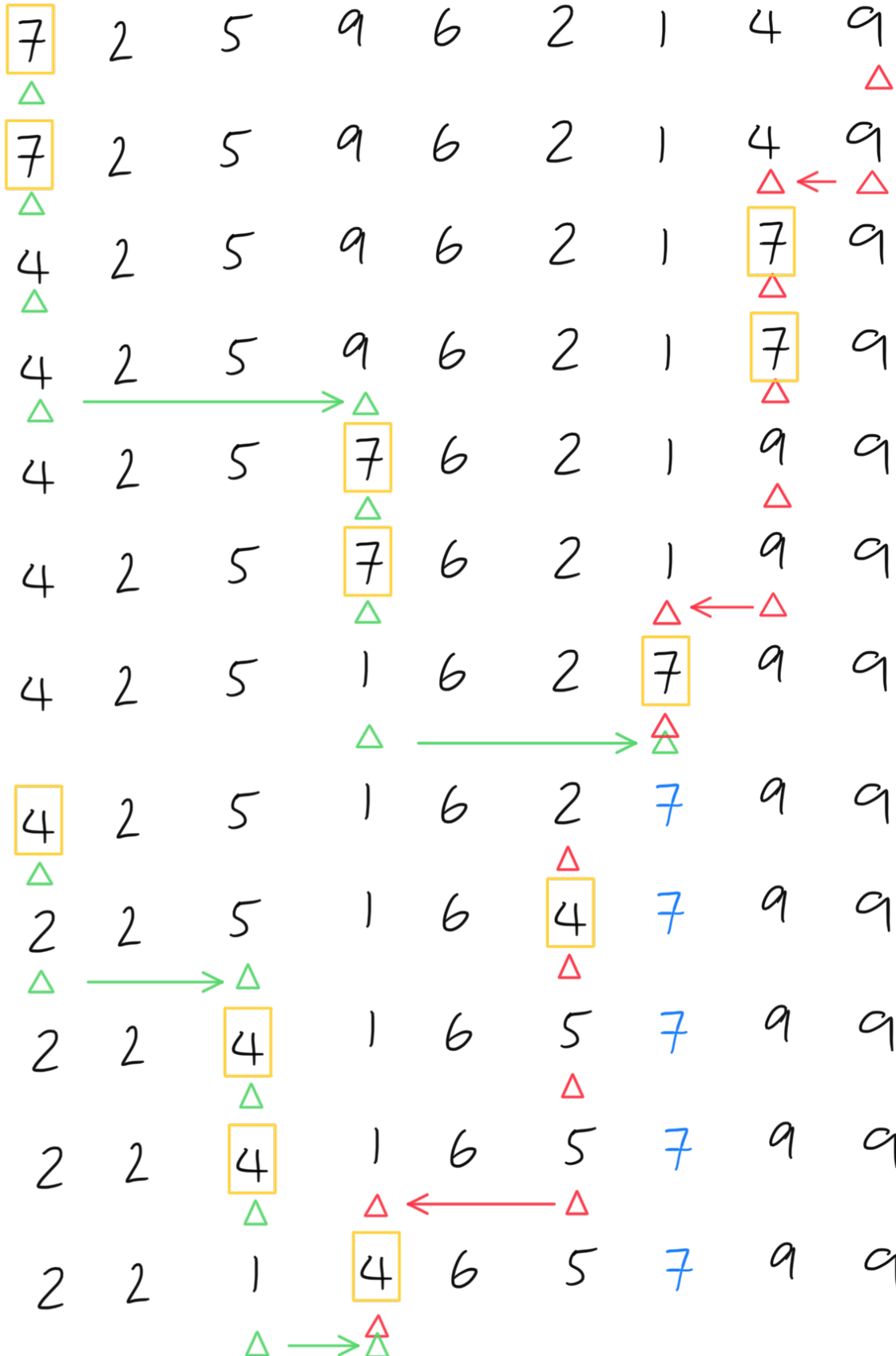
□ pivot

△ left cursor

△ right cursor

n sorted

→ cursor movement



<span style="border: 1px solid orange; padding: 2px;">2</span>	2	1	4	6	5	7	9	9
<span style="color: green;">△</span>		<span style="color: red;">△</span>						
1	2	<span style="border: 1px solid orange; padding: 2px;">2</span>	4	6	5	7	9	9
<span style="color: green;">△</span>		<span style="color: red;">△</span>						
1	2	<span style="border: 1px solid orange; padding: 2px;">2</span>	4	6	5	7	9	9
<span style="color: green;">△</span>	<span style="color: green;">→</span>	<span style="color: red;">△</span>						
<span style="border: 1px solid orange; padding: 2px;">1</span>	2	2	4	6	5	7	9	9
<span style="color: green;">△</span>	<span style="color: red;">△</span>							
<span style="border: 1px solid orange; padding: 2px;">1</span>	2	2	4	6	5	7	9	9
<span style="color: green;">△</span>	<span style="color: red;">△</span>	<span style="color: red;">←</span>						
1	<span style="border: 1px solid orange; padding: 2px;">2</span>	2	4	6	5	7	9	9
	<span style="color: green;">△</span>							
1	2	2	4	<span style="border: 1px solid orange; padding: 2px;">6</span>	5	7	9	9
				<span style="color: green;">△</span>	<span style="color: red;">△</span>			
1	2	2	4	5	<span style="border: 1px solid orange; padding: 2px;">6</span>	7	9	9
				<span style="color: green;">△</span>	<span style="color: red;">△</span>			
1	2	2	4	5	<span style="border: 1px solid orange; padding: 2px;">6</span>	7	9	9
				<span style="color: green;">△</span>	<span style="color: red;">△</span>			
1	2	2	4	<span style="border: 1px solid orange; padding: 2px;">5</span>	6	7	9	9
				<span style="color: green;">△</span>	<span style="color: red;">△</span>			
1	2	2	4	5	6	7	<span style="border: 1px solid orange; padding: 2px;">9</span>	9
							<span style="color: red;">△</span>	<span style="color: green;">△</span>
1	2	2	4	5	6	7	<span style="border: 1px solid orange; padding: 2px;">9</span>	9
							<span style="color: red;">△</span>	<span style="color: green;">△</span>
1	2	2	4	5	6	7	9	<span style="border: 1px solid orange; padding: 2px;">9</span>
							<span style="color: green;">←</span>	<span style="color: red;">△</span>
1	2	2	4	5	6	7	9	9
								<span style="color: green;">△</span>

