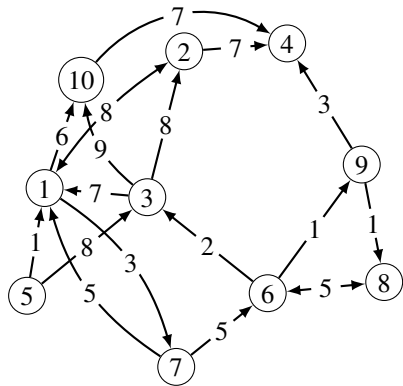


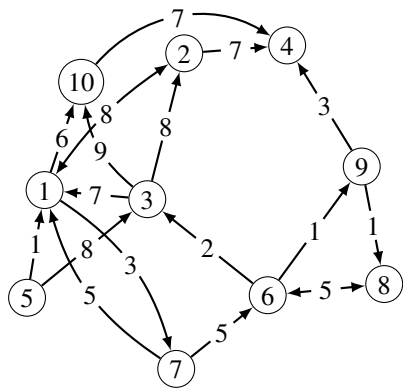
Bitte nicht Drucken!

Dies ist Daumenkino, für die Betrachtung am PC.
Es auszudrucken wäre Papierverschwendung.

Adjazenzmatrix und -liste

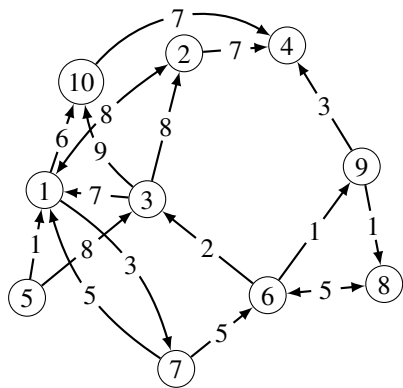


Adjazenzmatrix und -liste



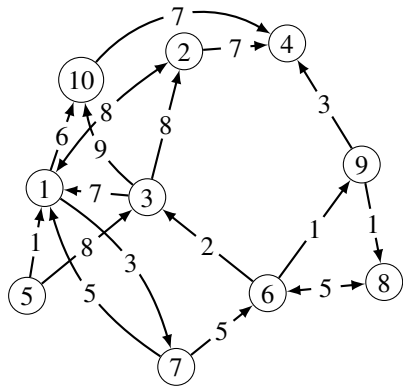
	1	2	3	4	5	6	7	8	9	10
1	-									
2		-								
3			-							
4				-						
5					-					
6						-				
7							-			
8								-		
9									-	
10										-

Adjazenzmatrix und -liste



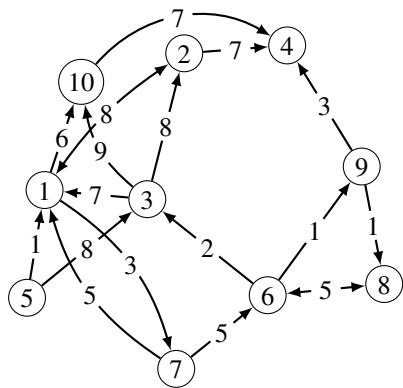
	1	2	3	4	5	6	7	8	9	10
1	—	8	—	—	—	—	3	—	—	6
2	8	—	—	7	—	—	—	—	—	—
3	7	8	—	—	—	—	—	—	—	9
4	—	—	—	—	—	—	—	—	—	—
5	1	—	8	—	—	—	—	—	—	—
6	—	—	2	—	—	—	—	5	1	—
7	5	—	—	—	—	5	—	—	—	—
8	—	—	—	—	—	5	—	—	—	—
9	—	—	—	3	—	—	—	1	—	—
10	—	—	—	7	—	—	—	—	—	—

Adjazenzmatrix und -liste



	Adjazenzliste
1	
2	
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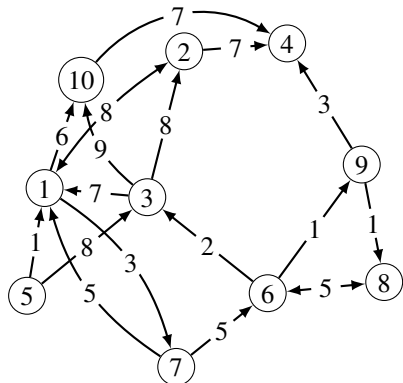
Adjazenzmatrix und -liste



	Adjazenzliste
1	2 (8), 7 (3), 10 (6)
2	1 (8), 4 (7)
3	1 (7), 2 (8), 10 (9)
4	
5	1 (1), 3 (8)
6	3 (2), 8 (5), 9 (1)
7	1 (5), 6 (5)
8	6 (5)
9	4 (3), 8 (1)
10	4 (7)

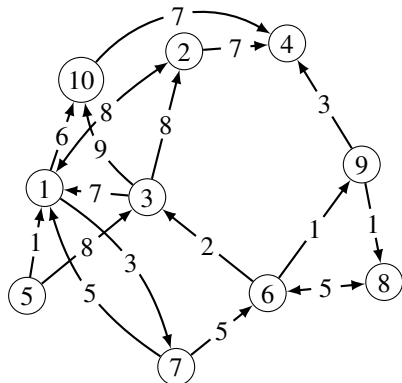
Tiefensuche

2



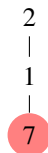
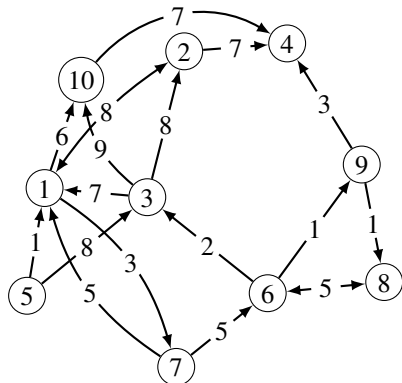
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Tiefensuche



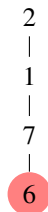
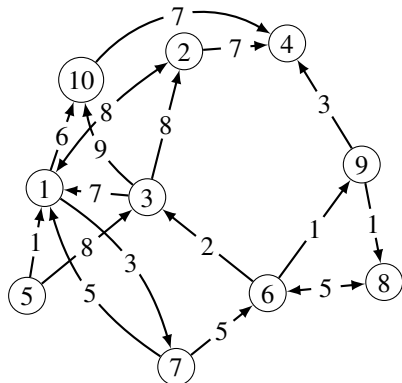
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Tiefensuche



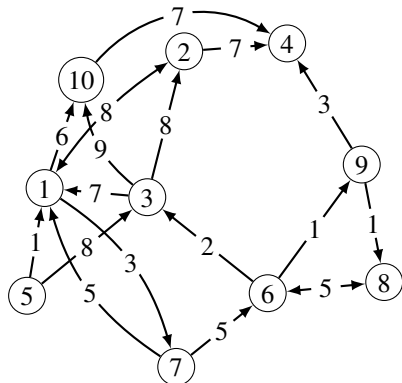
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Tiefensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

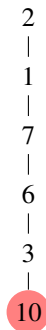
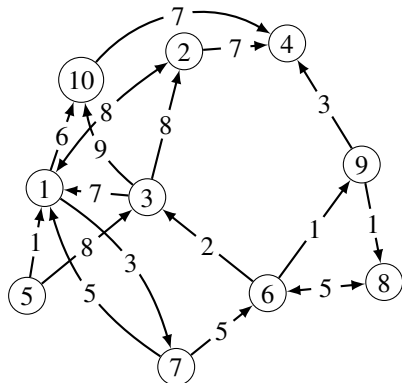
Tiefensuche



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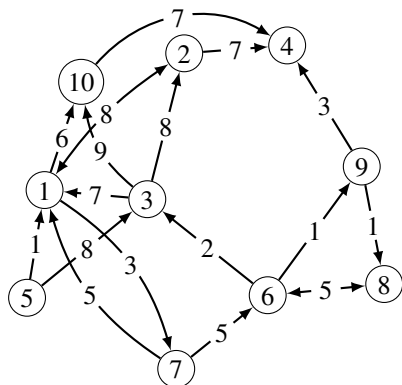
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Tiefensuche

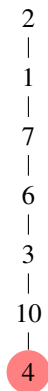


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

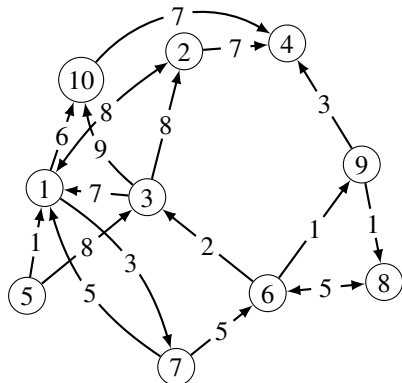
Tiefensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



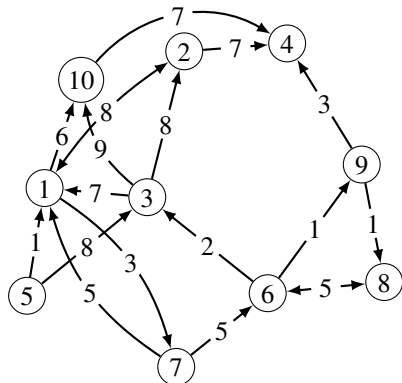
Tiefensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

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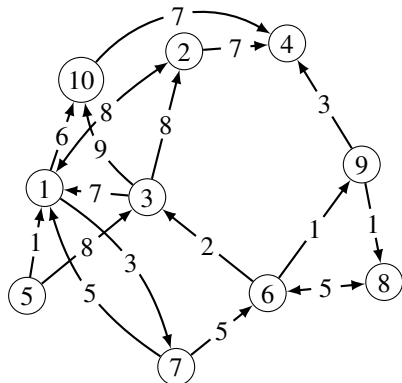
Tiefensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

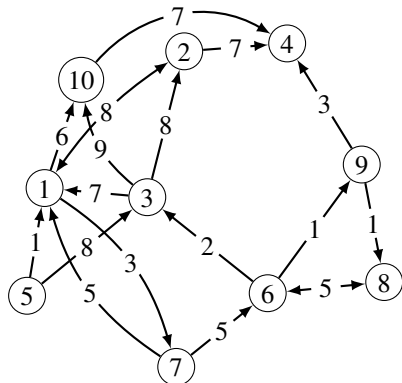
2
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4

Tiefensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

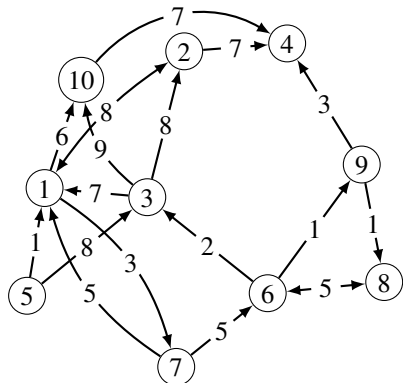
Tiefensuche



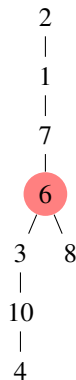
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2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



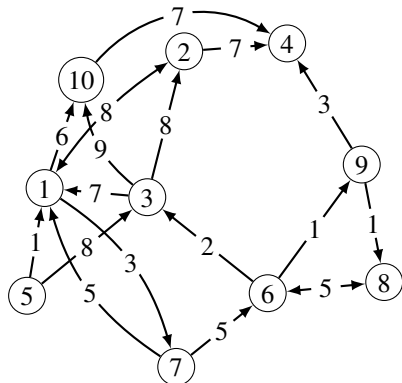
Tiefensuche



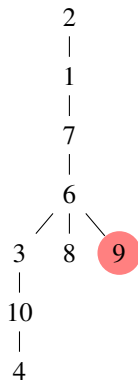
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2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



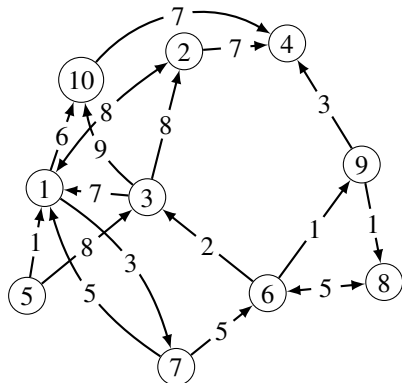
Tiefensuche



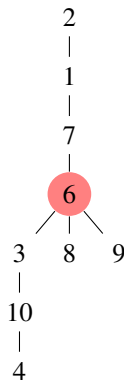
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2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



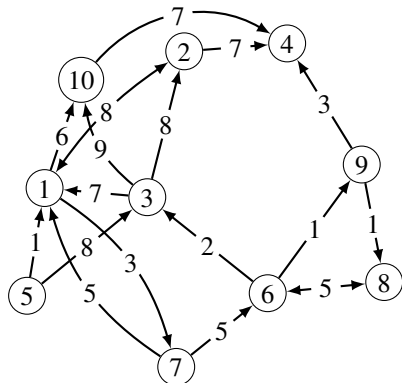
Tiefensuche



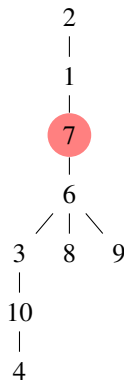
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



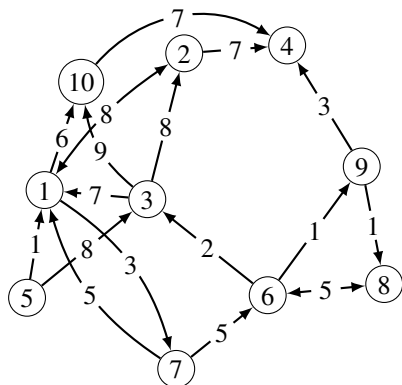
Tiefensuche



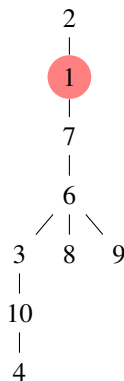
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2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



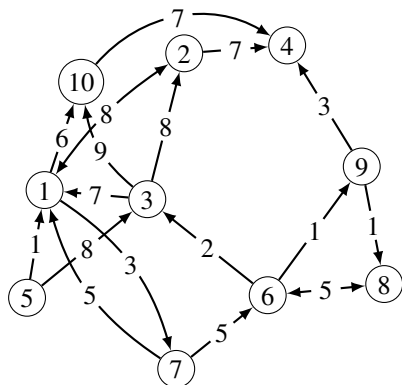
Tiefensuche



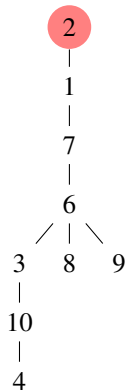
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2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



Tiefensuche

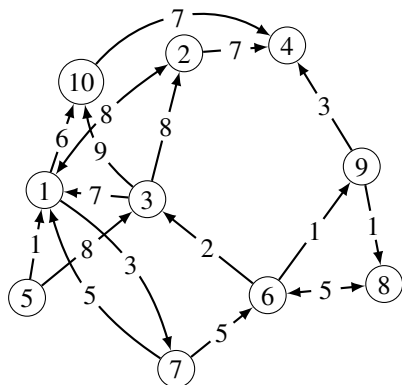


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
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4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)



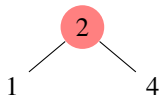
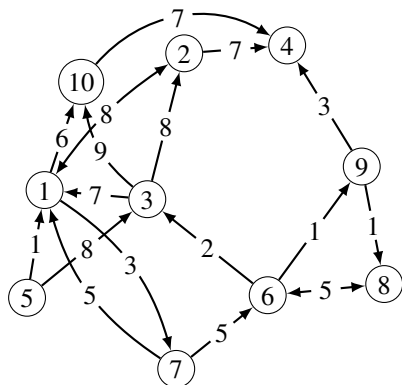
Breitensuche

2



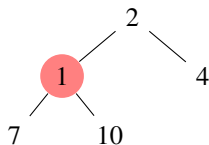
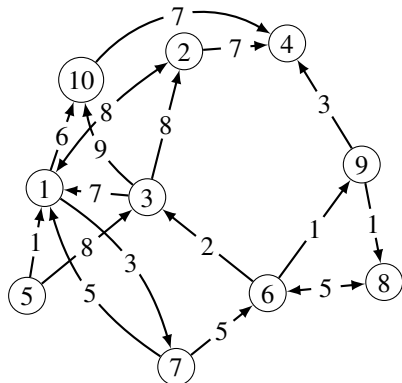
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



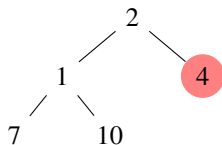
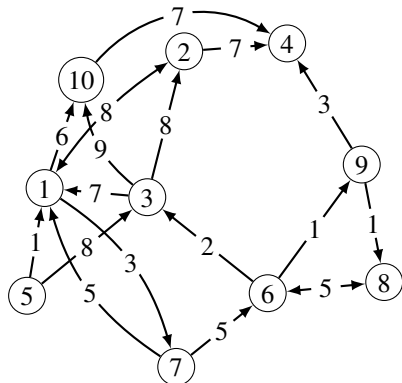
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



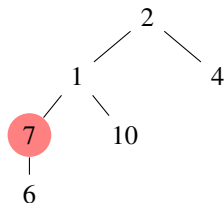
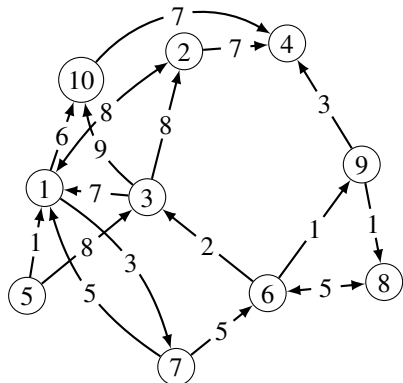
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



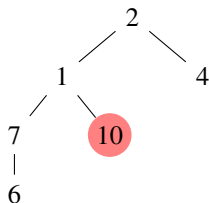
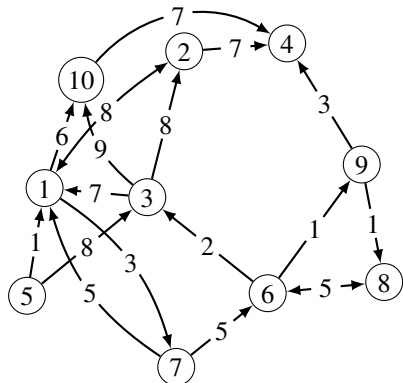
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



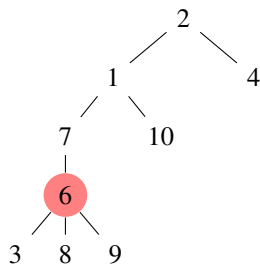
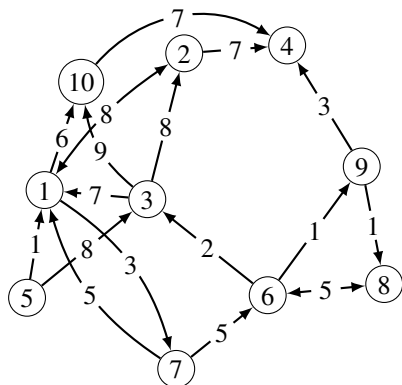
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



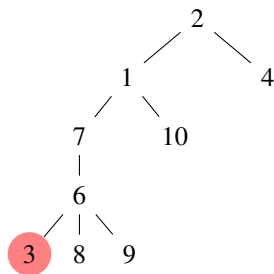
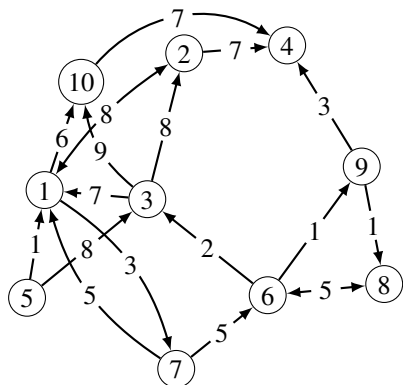
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
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Breitensuche



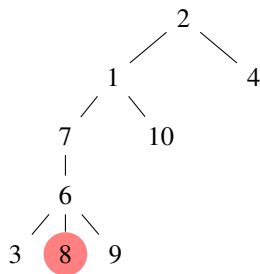
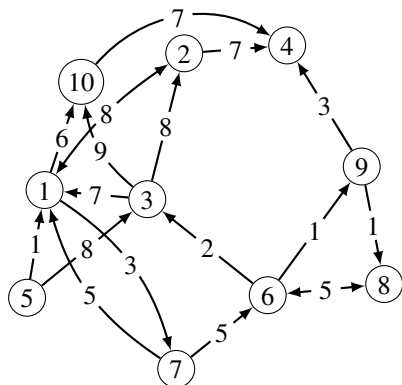
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



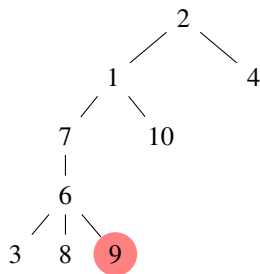
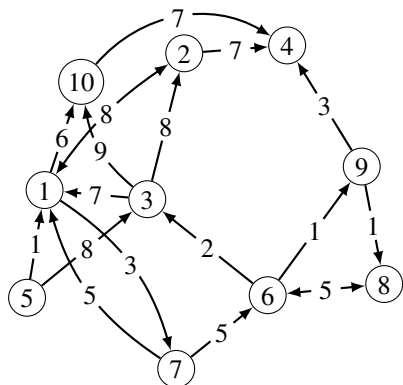
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Breitensuche



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	—	Nach
2	8 (-)	0	—	7 (-)	—	—	—	—	—	—
3	7 (-)	8 (-)	0	—	—	—	—	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	—	8 (-)	—	0	—	—	—	—	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	—	—
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	Von	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	—	Nach
2	8 (-)	0	—	7 (-)	—	—	—	—	—	—
3	7 (-)	8 (-)	0	—	—	—	—	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	—	8 (-)	—	0	—	—	—	—	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	—	—
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	Von	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	↑	Nach
2	8 (-)	0	—	7 (-)	—	—	—	—	↑	—
3	7 (-)	8 (-)	0	—	—	—	—	—	↑	9 (-)
4	—	—	—	0	—	—	—	—	↑	—
5	1 (-)	—	8 (-)	—	0	—	—	—	↑	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	?	—
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	Von	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	↑	Nach
2	8 (-)	0	—	7 (-)	—	—	—	—	↑	—
3	7 (-)	8 (-)	0	—	—	—	—	—	↑	9 (-)
4	—	—	—	0	—	—	—	—	↑	—
5	1 (-)	—	8 (-)	—	0	—	—	—	↑	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	—	—
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	Von	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	↑	Nach
2	8 (-)	0	—	7 (-)	—	—	—	—	—	—
3	7 (-)	8 (-)	0	—	—	—	—	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	—	8 (-)	—	0	—	—	—	—	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	—	—
8	—	—	—	—	—	5 (-)	—	0	6 (6)	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	Von	—	—	7 (-)	—	—	Von 8 nach 9 über 6			

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Neue Kanten einfügen: Zeile $\rightarrow i \rightarrow$ Spalte, falls besser.

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	—	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	—	—	—	—
3	7 (-)	8 (-)	0	—	—	—	—	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	—	8 (-)	—	0	—	—	—	—	—
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	—	—	—	—	5 (-)	0	—	—	—
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	-	-	-	-	3 (-)	-	-	6 (-)
2	8 (-)	0	-	7 (-)	-	-	11 (1)	-	-	14 (1)
3	7 (-)	8 (-)	0	-	-	-	10 (1)	-	-	9 (-)
4	-	-	-	0	-	-	-	-	-	-
5	1 (-)	9 (1)	8 (-)	-	0	-	4 (1)	-	-	7 (1)
6	-	-	2 (-)	-	-	0	-	5 (-)	1 (-)	-
7	5 (-)	13 (1)	-	-	-	5 (-)	0	-	-	11 (1)
8	-	-	-	-	-	5 (-)	-	0	-	-
9	-	-	-	3 (-)	-	-	-	1 (-)	0	-
10	-	-	-	7 (-)	-	-	-	-	-	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Pfade über Knoten 1, bspw. $7 \rightarrow 1 \rightarrow 2$, Länge $5 + 8 = 13$ (1)

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	-	-	-	-	3 (-)	-	-	6 (-)
2	8 (-)	0	-	7 (-)	-	-	11 (1)	-	-	14 (1)
3	7 (-)	8 (-)	0	-	-	-	10 (1)	-	-	9 (-)
4	-	-	-	0	-	-	-	-	-	-
5	1 (-)	9 (1)	8 (-)	-	0	-	4 (1)	-	-	7 (1)
6	-	-	2 (-)	-	-	0	-	5 (-)	1 (-)	-
7	5 (-)	13 (1)	-	-	-	5 (-)	0	-	-	11 (1)
8	-	-	-	-	-	5 (-)	-	0	-	-
9	-	-	-	3 (-)	-	-	-	1 (-)	0	-
10	-	-	-	7 (-)	-	-	-	-	-	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	—	—	2 (-)	—	—	0	—	5 (-)	1 (-)	—
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	—	20 (2)	—	5 (-)	0	—	—	11 (1)
8	—	—	—	—	—	5 (-)	—	0	—	—
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	—	15 (2)	—	—	3 (-)	—	—	6 (-)
2	8 (-)	0	—	7 (-)	—	—	11 (1)	—	—	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	—	10 (1)	—	—	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	—	4 (1)	—	—	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	15 (2)	—	8 (7)	3 (-)	13 (7)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	21 (7)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	20 (7)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	9 (7)	4 (1)	14 (7)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	15 (2)	—	8 (7)	3 (-)	13 (7)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	21 (7)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	20 (7)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	9 (7)	4 (1)	14 (7)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	—	—	—	3 (-)	—	—	—	1 (-)	0	—
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	15 (2)	—	8 (7)	3 (-)	13 (7)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	21 (7)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	20 (7)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	9 (7)	4 (1)	14 (7)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	15 (2)	—	8 (7)	3 (-)	13 (7)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	21 (7)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	20 (7)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	16 (2)	0	9 (7)	4 (1)	14 (7)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	17 (3)	—	0	12 (3)	5 (-)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	20 (2)	—	5 (-)	0	10 (6)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	22 (6)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Achtung: Verbesserungen möglich!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

... und manchmal ändert sich nichts.

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	Knoten 5 ist nicht erreichbar					—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	1 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Knoten 4 ist eine Sackgasse

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	12 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Knoten 10 führt nur in die Sackgasse 4

In jeder Zelle ein Paar: Distanz (Wegpunkt)

Der Wegpunkt muss *nicht* der nächste Schritt sein!

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	–	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	–	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	–	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	Zusammenhängender (stark verbundener) Subgraph. –									
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	–	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	–	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	–	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	–	6 (8)	18 (8)	1 (-)	0	17 (8)
10	–	–	–	7 (-)	–	–	–	–	–	0

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

5 \rightsquigarrow 4

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

5 \rightsquigarrow 9 \rightsquigarrow 4

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

5 \rightsquigarrow 7 \rightsquigarrow 9 \rightsquigarrow 4

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

5 \rightsquigarrow 1 \rightsquigarrow 7 \rightsquigarrow 9 \rightsquigarrow 4

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

$$5 \rightarrow_1 1 \rightsquigarrow 7 \rightsquigarrow 9 \rightsquigarrow 4$$

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

$$5 \rightarrow_1 1 \rightarrow_3 7 \rightsquigarrow 9 \rightsquigarrow 4$$

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

$$5 \rightarrow_1 1 \rightarrow_3 7 \rightsquigarrow 6 \rightsquigarrow 9 \rightsquigarrow 4$$

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightsquigarrow 9 \rightsquigarrow 4$$

Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightarrow_1 9 \rightsquigarrow 4$$

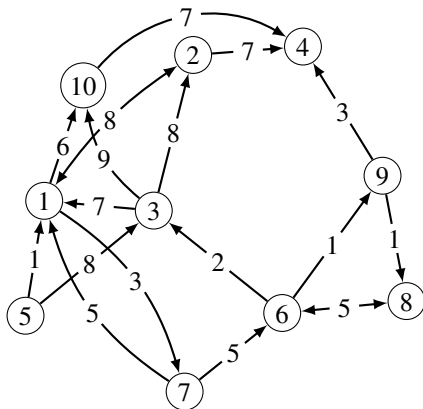
Floyd: All-Pairs Shortest Path

	1	2	3	4	5	6	7	8	9	10
1	0	8 (-)	10 (7)	12 (9)	—	8 (7)	3 (-)	10 (9)	9 (7)	6 (-)
2	8 (-)	0	18 (7)	7 (-)	—	16 (7)	11 (1)	18 (9)	17 (7)	14 (1)
3	7 (-)	8 (-)	0	15 (2)	—	15 (7)	10 (1)	17 (9)	16 (7)	9 (-)
4	—	—	—	0	—	—	—	—	—	—
5	1 (-)	9 (1)	8 (-)	13 (9)	0	9 (7)	4 (1)	11 (9)	10 (7)	7 (1)
6	9 (3)	10 (3)	2 (-)	4 (9)	—	0	12 (3)	2 (9)	1 (-)	11 (3)
7	5 (-)	13 (1)	7 (6)	9 (9)	—	5 (-)	0	7 (9)	6 (6)	11 (1)
8	14 (6)	15 (6)	7 (6)	9 (9)	—	5 (-)	17 (6)	0	6 (6)	16 (6)
9	15 (8)	16 (8)	8 (8)	3 (-)	—	6 (8)	18 (8)	1 (-)	0	17 (8)
10	—	—	—	7 (-)	—	—	—	—	—	0

Beispiel: Weg von 5 nach 4.

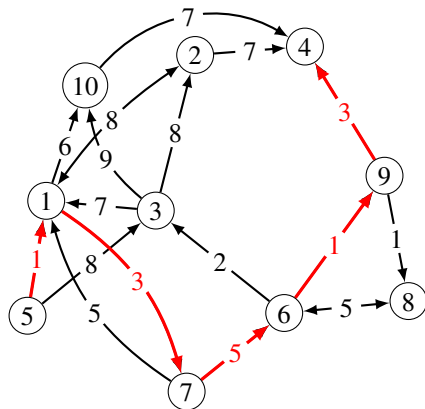
$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightarrow_1 9 \rightarrow_3 4 = 13$$

Floyd: All-Pairs Shortest Path



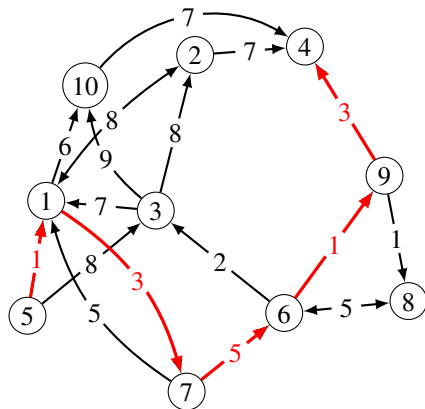
$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightarrow_1 9 \rightarrow_3 4 = 13$$

Floyd: All-Pairs Shortest Path



$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightarrow_1 9 \rightarrow_3 4 = 13$$

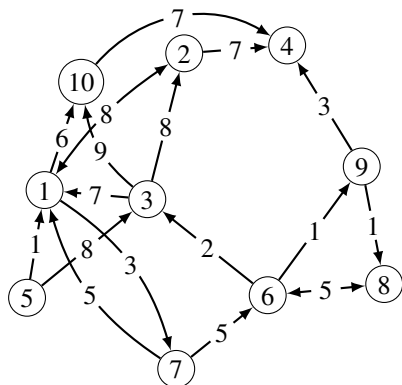
Floyd: All-Pairs Shortest Path



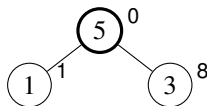
$$5 \rightarrow_1 1 \rightarrow_3 7 \rightarrow_5 6 \rightarrow_1 9 \rightarrow_3 4 = 13$$

Siehe auch: Dijkstra, beginnend bei 5 ...

Dijkstra: Single-Source Shortest Path



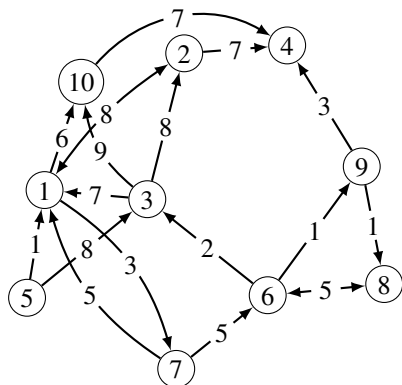
Besuch von 5 (0):



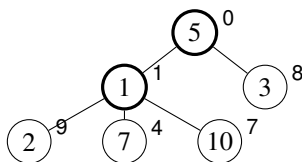
1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra ist eine *Prioritätssuche*.

Dijkstra: Single-Source Shortest Path

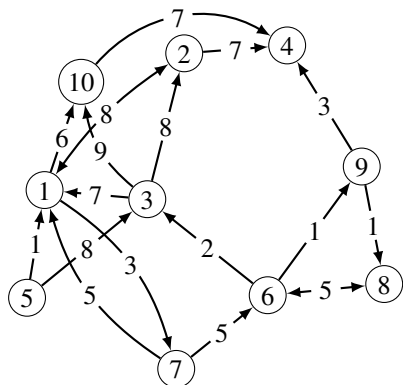


Besuch von 1 (1):

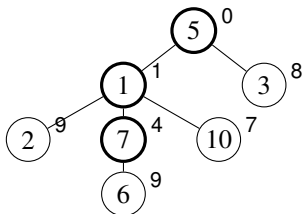


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

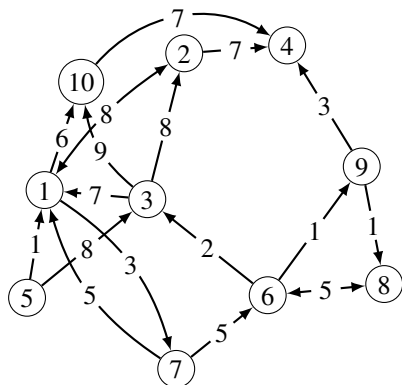


Besuch von 7 (4):

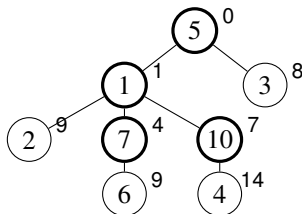


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

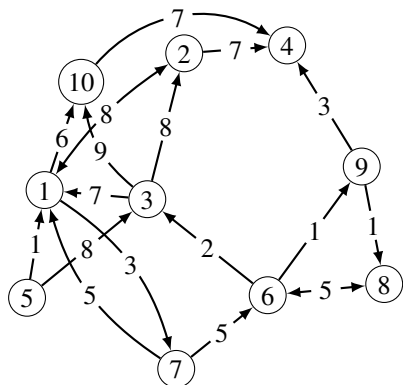


Besuch von 10 (7):

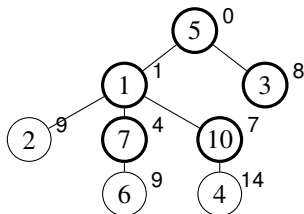


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

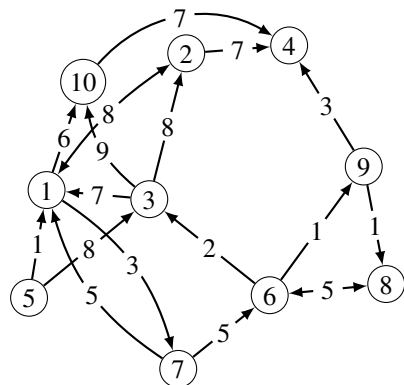


Besuch von 3 (8):

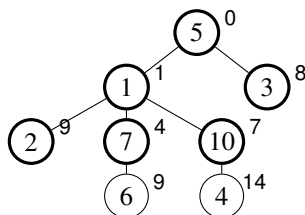


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

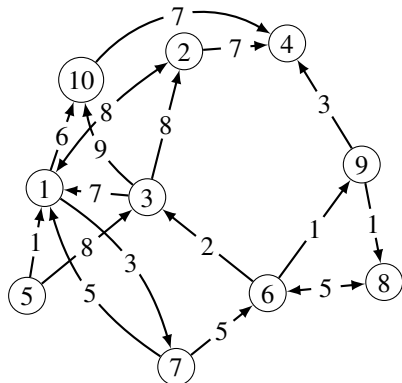


Besuch von 2 (9):

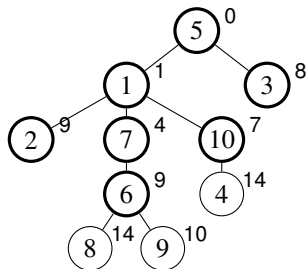


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

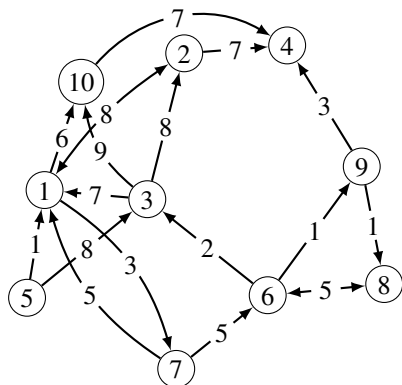


Besuch von 6 (9):

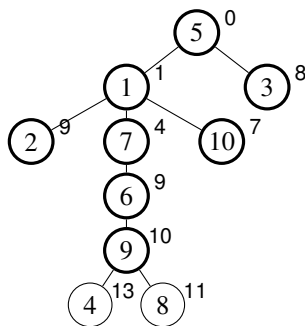


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

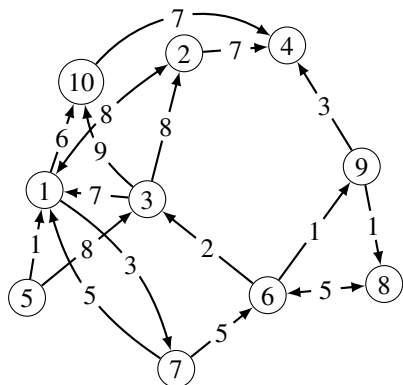


Besuch von 9 (10):

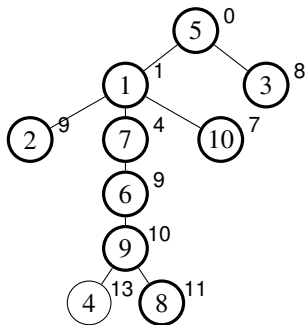


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path

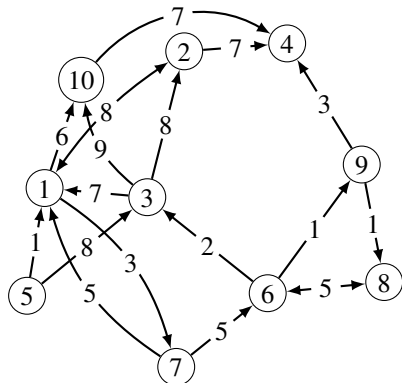


Besuch von 8 (11):

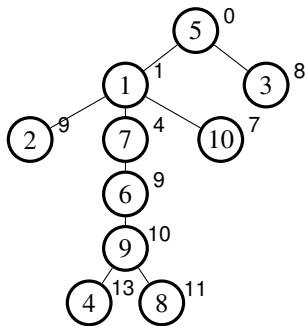


1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Dijkstra: Single-Source Shortest Path



Besuch von 4 (13): Ende



1	2 (8), 7 (3), 10 (6)	6	3 (2), 8 (5), 9 (1)
2	1 (8), 4 (7)	7	1 (5), 6 (5)
3	1 (7), 2 (8), 10 (9)	8	6 (5)
4		9	4 (3), 8 (1)
5	1 (1), 3 (8)	10	4 (7)

Graphalgorithmen – Anwendungsgebiete

Graphalgorithmen tauchen überall auf!

- ▶ Routenplaner: kürzeste/schnellste (Straßen, MVV, ...)
- ▶ Computerspiele: Wegplanung (Gefahren, Hindernisse, ...)
- ▶ Planung von Netzwerken (Transport, Internet, Funk, ...)
- ▶ Empfehlung von Produkten, Freunden, Webseiten, ...
- ▶ Suche von Lösungen in anderen Problemen
(z.B. Computeralgebrasysteme, Automatic Reasoning)

Beliebter Ansatz um ein neues Problem zu lösen:

1. Als Graph formulieren (z.B. Baum aller möglichen Lösungsansätze)
2. Einen Graphalgorithmus wie Dijkstra verwenden um bspw. die einfachste (kürzeste) Lösung zu finden.