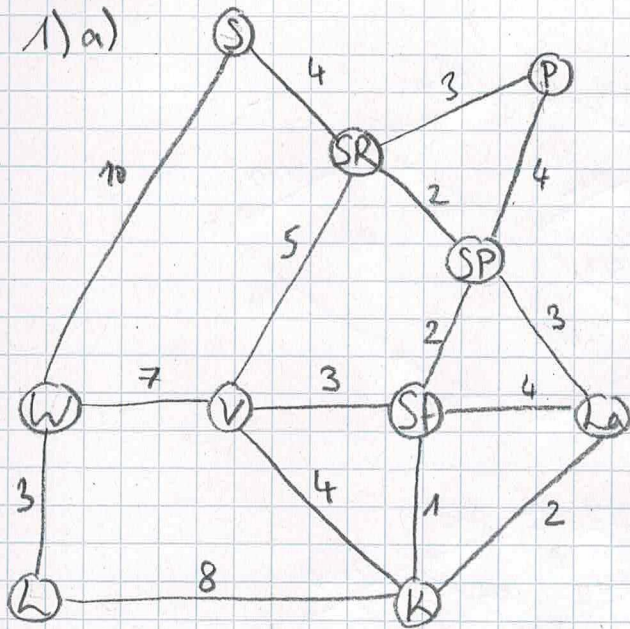# Der Algorithmus von Dijkstra

Algorithm DIJKSTRA(G, w, v_0)

```
 1: INIT($G, v_0$)
 2: $S := \emptyset$
 3: $Q := V$
 4: while $Q \neq \emptyset$ do
 5:     $u :=$ EXTRACT-MIN($Q$)
 6:     $S := S \cup \{u\}$
 7:     for  $v \in \mathrm{Adj}[u]$ do
 8:         RELAX($u, v, w$)
 9:     end for
10: end while
```
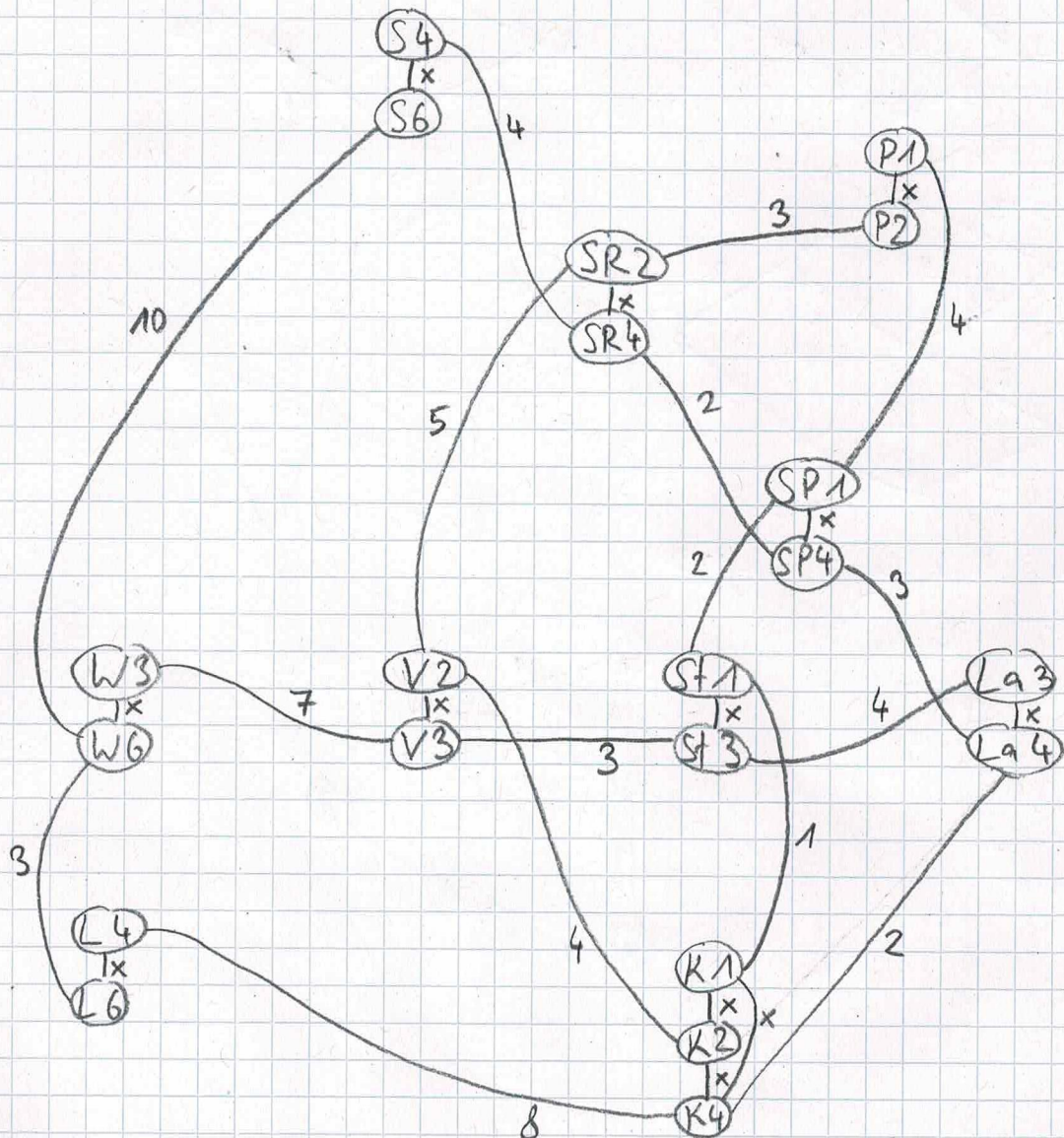
DGA Ü7

1) a)

	d			π	
K	0			NIL	
L	∞	8		NIL	K
V	∞	4		NIL	K
St	∞	1		NIL	K
La	∞	2		NIL	K
W	∞	11		NIL	V
SR	∞	5		NIL	SP
SP	∞	3		NIL	St
P	∞	7		NIL	SP
S	∞	9		NIL	SR

⇒ K, St, SP, SR, S ist der kürzeste Weg und dauert 9 Minuten

b)

DGA Ü7

2) a)

```
Algorithm (G, w, v₀) {
    for v ∈ V {
        d(v) = 0;   π(v) = NIL;
    }
    d(v₀) = 1;
    Q = V;
    while Q ≠ Ø {
        u = EXTRACT-MAX(Q);
        for v ∈ Adj[u] {
            if d(v) < d(u)·w(u,v) {
                d(v) = d(u)·w(u,v);   π(v) = u;
            }
        }
    }
}
```
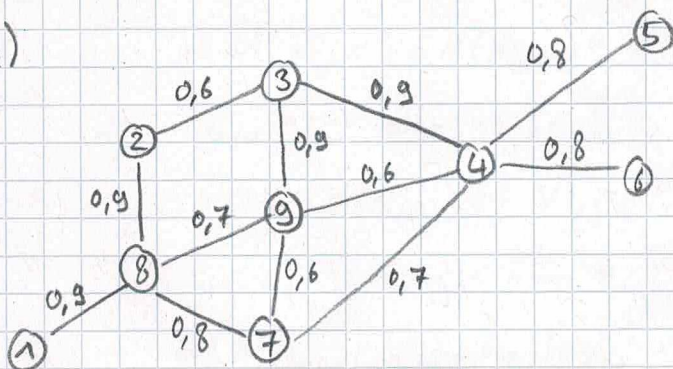
b)

	d	π
1	1	NIL
2	~~0~~ 0,81	~~NIL~~ 8
3	~~0~~ ~~0,486~~ 0,567	~~NIL~~ ~~2~~ 9
4	~~0~~ ~~0,504~~ 0,5103	~~NIL~~ ~~7~~ 3
5	~~0~~ 0,40824	~~NIL~~ 4
6	~~0~~ 0,40824	~~NIL~~ 4
7	~~0~~ 0,72	~~NIL~~ 8
8	~~0~~ 0,9	~~NIL~~ 1
9	~~0~~ 0,63	~~NIL~~ 8

⇒ [1, 8, 9, 3, 4, 5] ist der zuverlässigste Weg mit 40,824 %

Algorithm BF(G, w, v_0)

```
 1: INIT(G, v₀)
 2: for i = 1 to |V| − 1 do
 3:     for (u, v) ∈ E do
 4:         RELAX(u, v, w)
 5:     end for
 6: end for
 7: for (u, v) ∈ E do
 8:     if d(v) > d(u) + w(u, v) then
 9:         return FALSE    % Zyklen mit negativen Gewicht!
10:     end if
11: end for
12: return TRUE
```

3) NEW_BF (G, w, v_0) {

INIT (G, v_0);

for $j = 1, ..., |E|$ {

for $i = 1, ..., |V|-1$ {

for $(u,v) \in E$ {

RELAX (u, v, w);

}
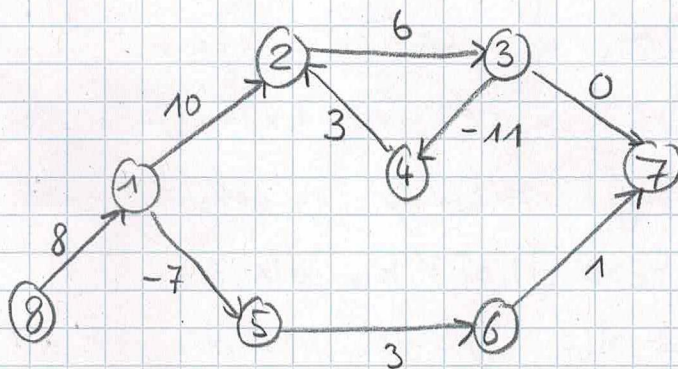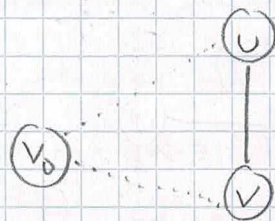
}

for $(u,v) \in \bar{E}$ {

if $d(v) > d(u) + w(u,v)$ {

$d(v) = -\infty$;

}

}

}

}

U

V

v_0

6

10   2 ————————— 3   0

3   -11   7

1   4

8

-7   5   6   1

3

	1	2	3	4	5	6	7	8
minimale Entfernung	0	$-\infty$	$-\infty$	$-\infty$	-7	-4	$-\infty$	$+\infty$

Algorithm FLOYD-WARSHALL(W)

```
 1: for i = 1 to n do
 2:     for j = 1 to n do
 3:         d_{i,j} := w_{i,j}
 4:     end for
 5: end for
 6: for i = 1 to n do
 7:     for j = 1 to n do
 8:         for k = 1 to n do
 9:             d_{j,k} := min(d_{j,k}, d_{j,i} + d_{i,k})
10:         end for
11:         if d_{j,j} < 0 then
12:             STOP     % Zyklen mit negativen Gewicht!
13:         end if
14:     end for
15: end for
16: return (d_{i,j})_{1≤i,j≤n}
```

DGA Ü7

4)

	a	b	c	d	e	f	g
a	0	~~6~~5	1	3	~~∞~~~~9~~8	~~∞~~~~7~~~~8~~4	~~∞~~~~11~~10
b	~~6~~5	0	~~6~~5	~~∞~~~~9~~2	3	1	~~9~~7
c	1	~~6~~5	0	~~9~~4	~~∞~~~~9~~8	4	~~9~~10
d	3	~~∞~~~~9~~2	~~9~~4	0	~~∞~~~~12~~5	1	~~8~~7
e	~~∞~~~~9~~8	3	~~∞~~~~9~~8	~~∞~~~~12~~5	0	~~5~~4	2
f	~~∞~~~~7~~~~8~~4	1	4	1	~~5~~4	0	~~7~~6
g	~~∞~~~~11~~10	~~∞~~~~7~~5	~~∞~~~~12~~~~11~~10	~~8~~7	2	~~7~~6	0