



Figure 1: network topology

## 1 HW3

1. Assign a letter to each node as shown in Fig. 1. Define the following notation:

- $d(v)$ : cost of the least-cost path from the source node to destination  $v$  as of this iteration of the algorithm.
- $d_x(y)$  current minimum cost from node  $x$  to node  $y$ .
- $c(x, y)$  cost from  $x$  to directly attached neighbor  $y$ .
- $p(v)$ : previous node (neighbor of  $v$ ) along the current least-cost path from the source to  $v$ .
- $N$ : all the nodes.
- $N'$ : subset of nodes;  $v$  is in  $N'$  if the least-cost path from the source to  $v$  is definitively known.

**Link-State (Dijkstra algorithm):**

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N' = {A}
for all nodes v
  if v is a neighbor of A then
    d(v) = c(A, v)
  else

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    d(v) = ∞
loop
    find w not in N' such that d(w) is a minimum
    add w to N'
    update d(V) for each neighbor v of w and not in N':
        d(v) = min(d(v), d(w) + c(w, v))
until N' = N

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Table 1 shows all the rounds using Dijkstra algorithm to find the shortest paths. In the table,  $N'$  is a set contains the nodes whose shortest path costs are already known. Each row in the table is a round that computes the shortest path cost from the source node (A) to a picked node. For cells in the columns titled with nodes letters, '-' means we already know the least cost to the node. Value (X, y) means current path cost from source node A to the node (denoted by the column title) is y, and the previous node is X. For example, in the first row of column F, "A,  $\infty$ " means current path cost to node F is infinite (unknown), and in the third row of column C, "D, 6" means current path cost to node C is 6 and the previous node is node D.

Table 1: Find shortest path using Dijkstra algorithm.

Picked node	$N'$	A	B	C	D	E	F
A	{A}	-	A, 3	A, 7	A, $\infty$	A, $\infty$	A, $\infty$
B	{A, B}		-	A, 7	B, 4	B, 8	B, 11
D	{A, B, D}			D, 6	-	B, 8	B, 11
C	{A, B, C, D}			-		B, 8	B, 11
E	{A, B, C, D, E}					-	B, 11
F	{A, B, C, D, E, F}						-

According to the table, we can get the shortest path from A to all other nodes:

- From A to B: A->B, cost = 3.
- From A to C: A->B->D->C, cost = 6.
- From A to D: A->B->D, cost = 4.
- From A to E: A->B->E, cost = 8.
- From A to F: A->B->F, cost = 11.