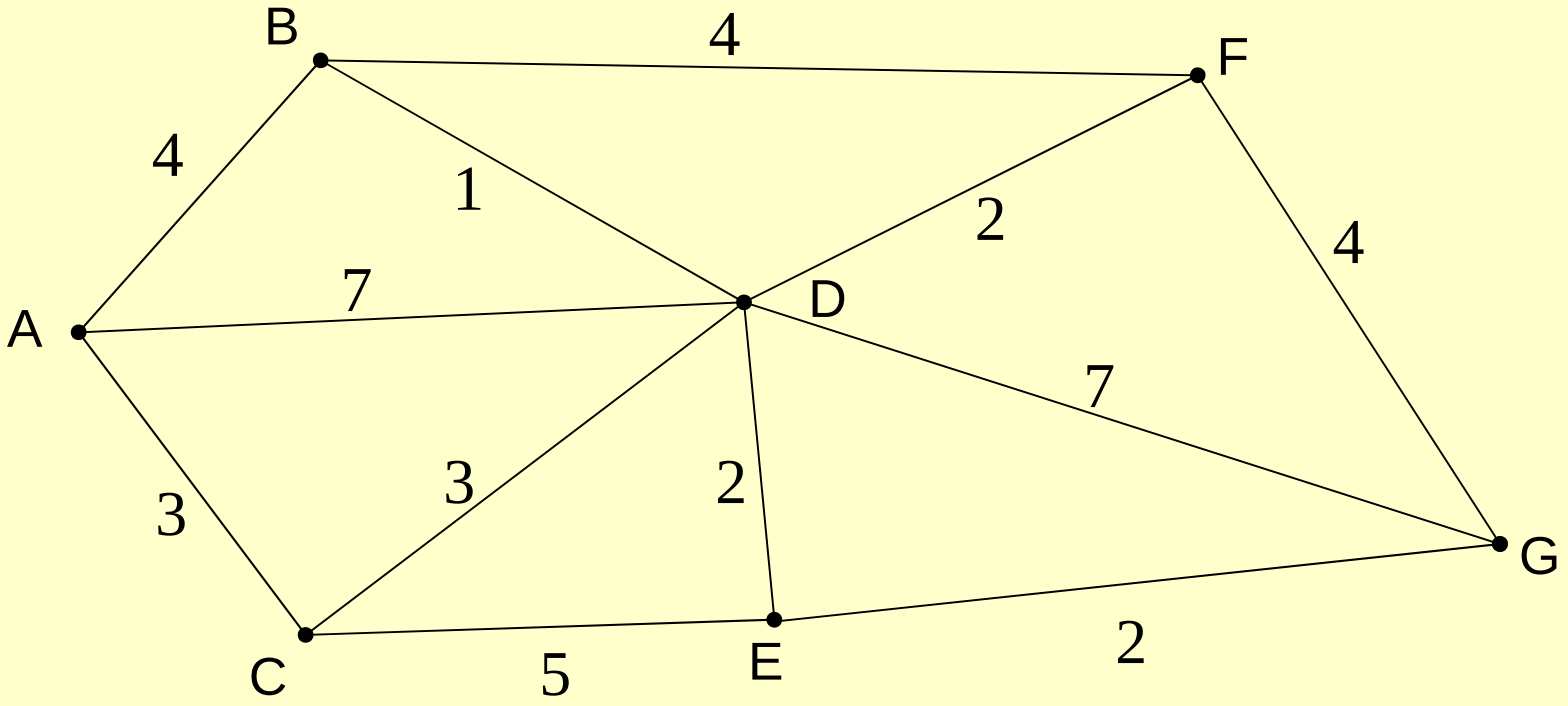
Shortest Path

Dijkstra's Algorithm

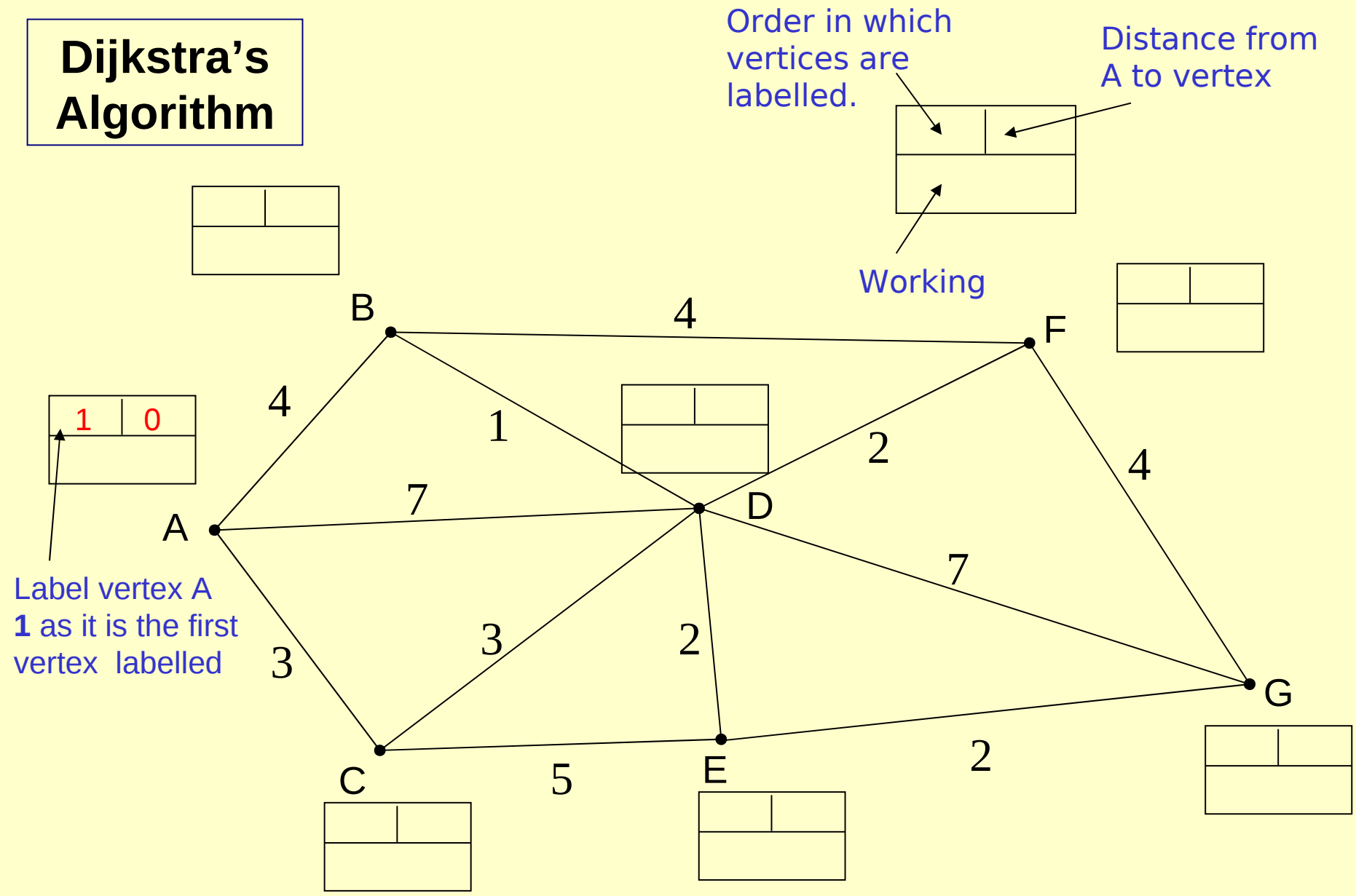
finds the shortest path from the start vertex to every other vertex in the network. We will find the shortest path from A to G



Dijkstra's Algorithm

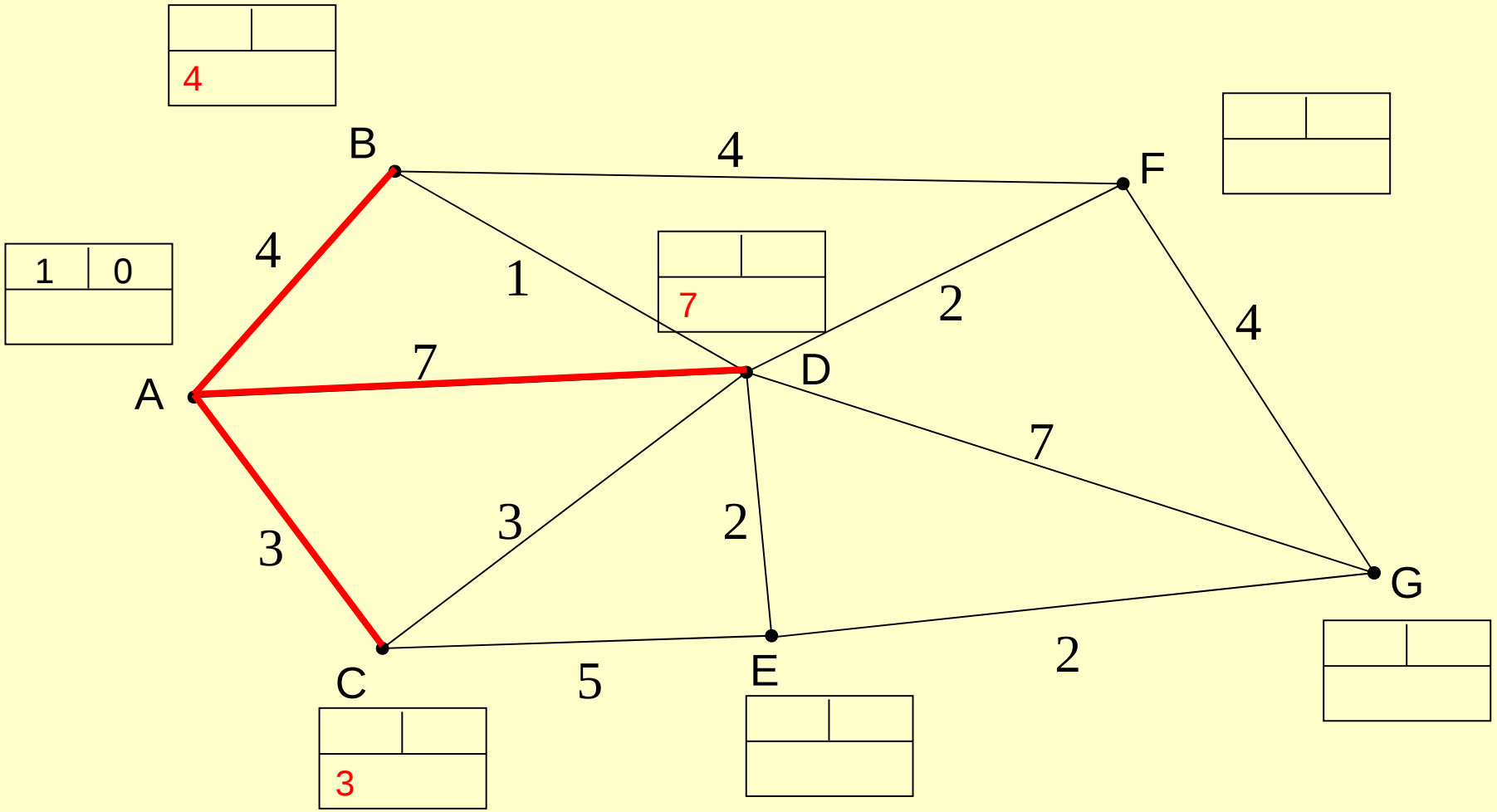
1. Label the start vertex with permanent label 0 and order label 1
2. Assign temporary labels to all the vertices that can be reached directly from the start
3. Select the vertex with the smallest temporary label and make its label permanent. Add the correct order label.
4. Put temporary labels on each vertex that can be reached directly from the vertex you have just made permanent. The temporary label must be equal to the sum of the permanent label and the direct distance from it. If there is an existing temporary label at a vertex, it should be replaced only if the new sum is smaller.
5. Select the vertex with the smallest temporary label and make its label permanent. Add the correct order label.
6. Repeat until the finishing vertex has a permanent label.
7. To find the shortest paths(s), trace back from the end vertex to the start vertex. Write the route forwards and state the length.

Dijkstra's Algorithm

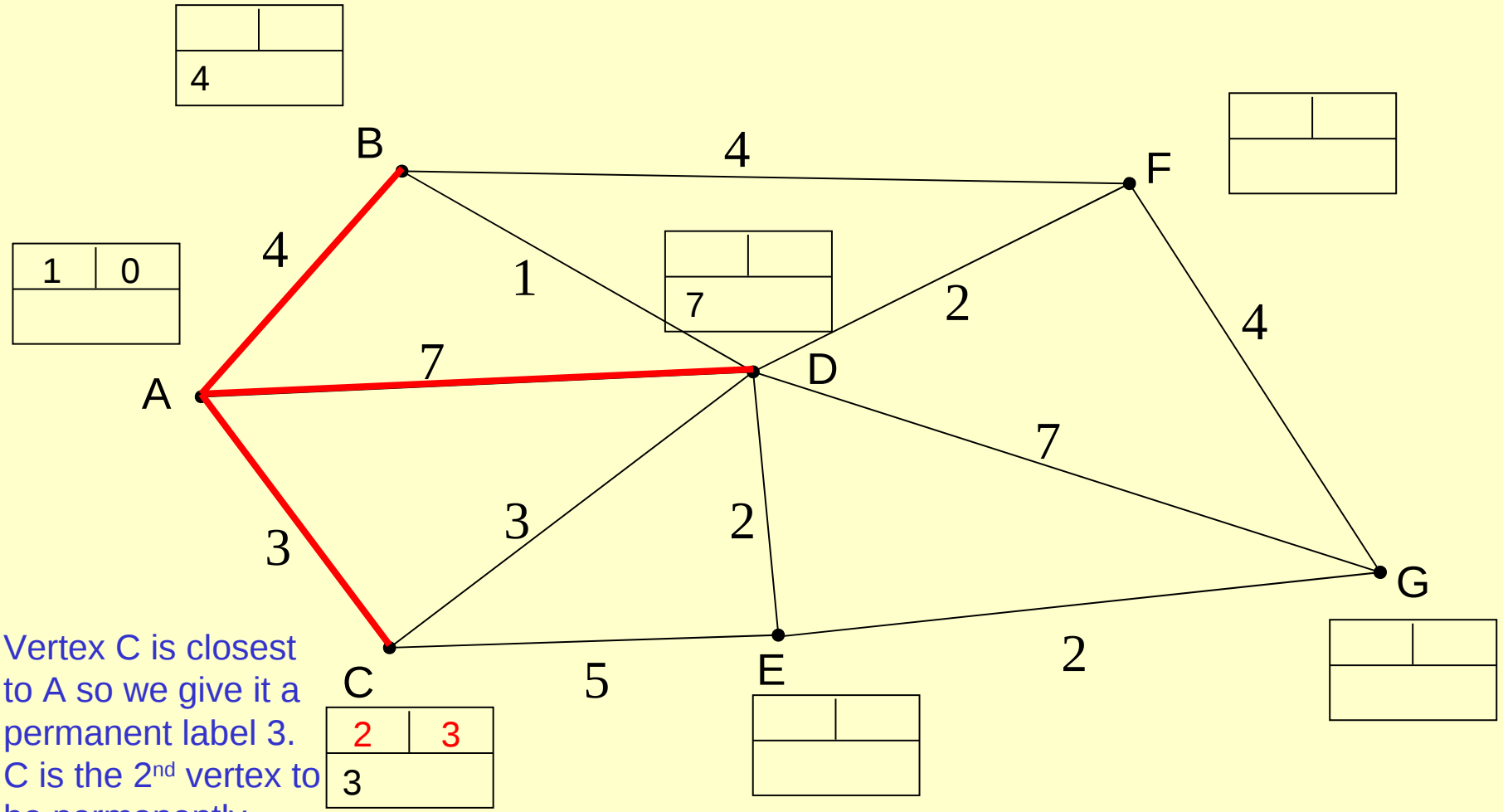


Dijkstra's Algorithm

We update each vertex adjacent to A with a 'working value' for its distance from A.



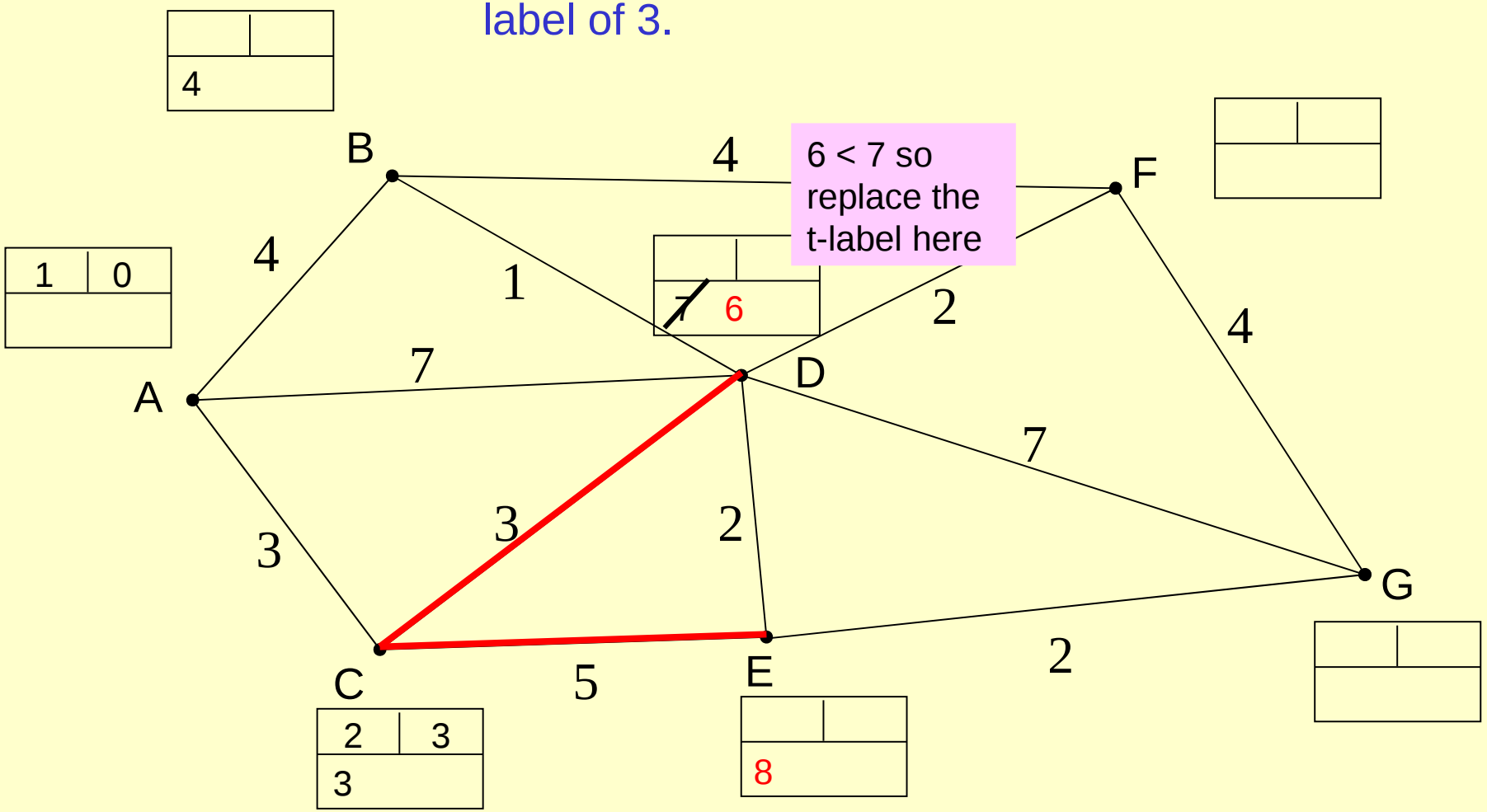
Dijkstra's Algorithm



Vertex C is closest to A so we give it a permanent label 3. C is the 2nd vertex to be permanently labelled.

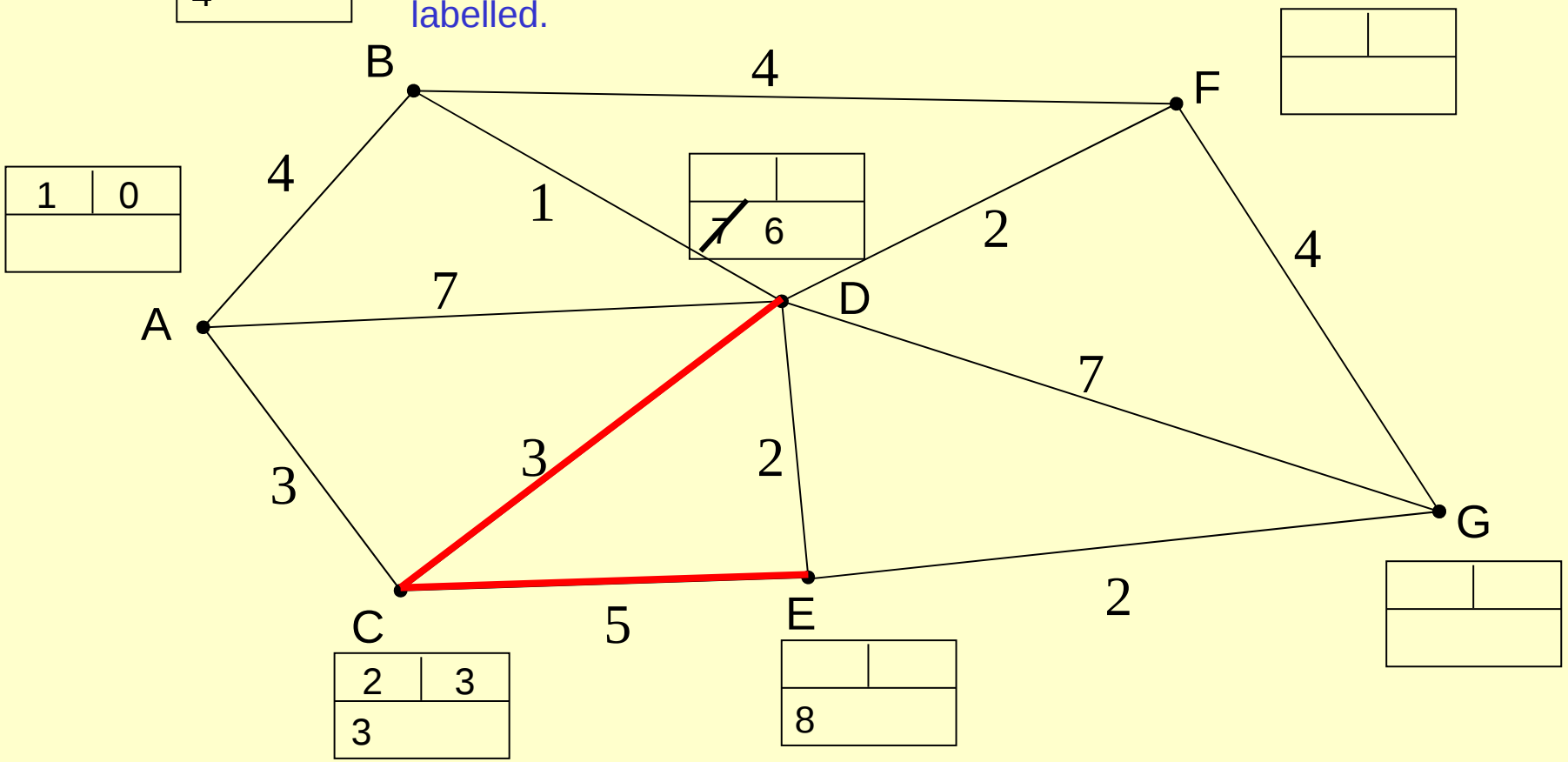
Dijkstra's Algorithm

We update each vertex adjacent to C with a 'working value' for its total distance from A, by adding its distance from C to C's permanent label of 3.



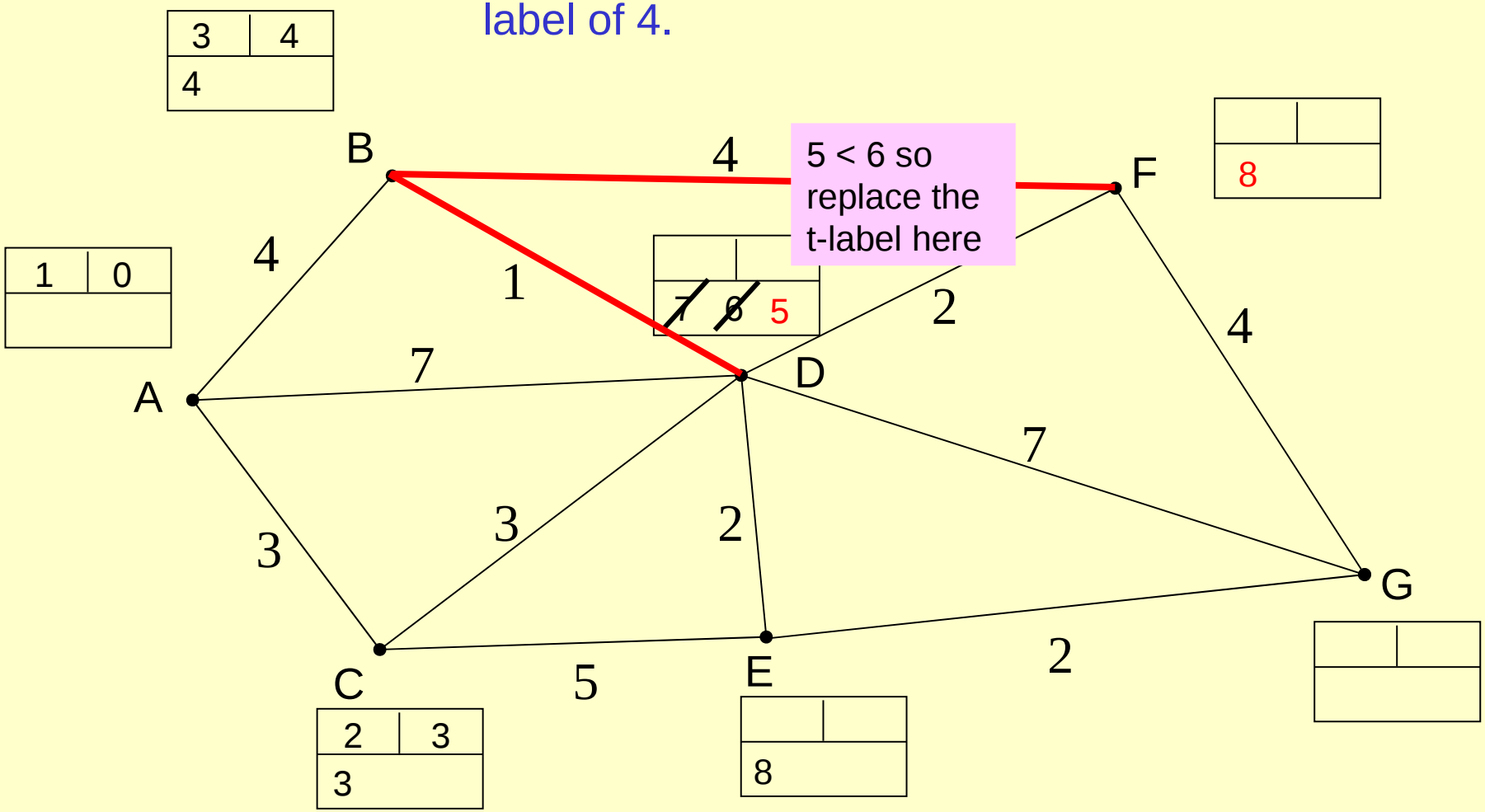
Dijkstra's Algorithm

The vertex with the smallest temporary label is B, so make this label permanent. B is the 3rd vertex to be permanently labelled.



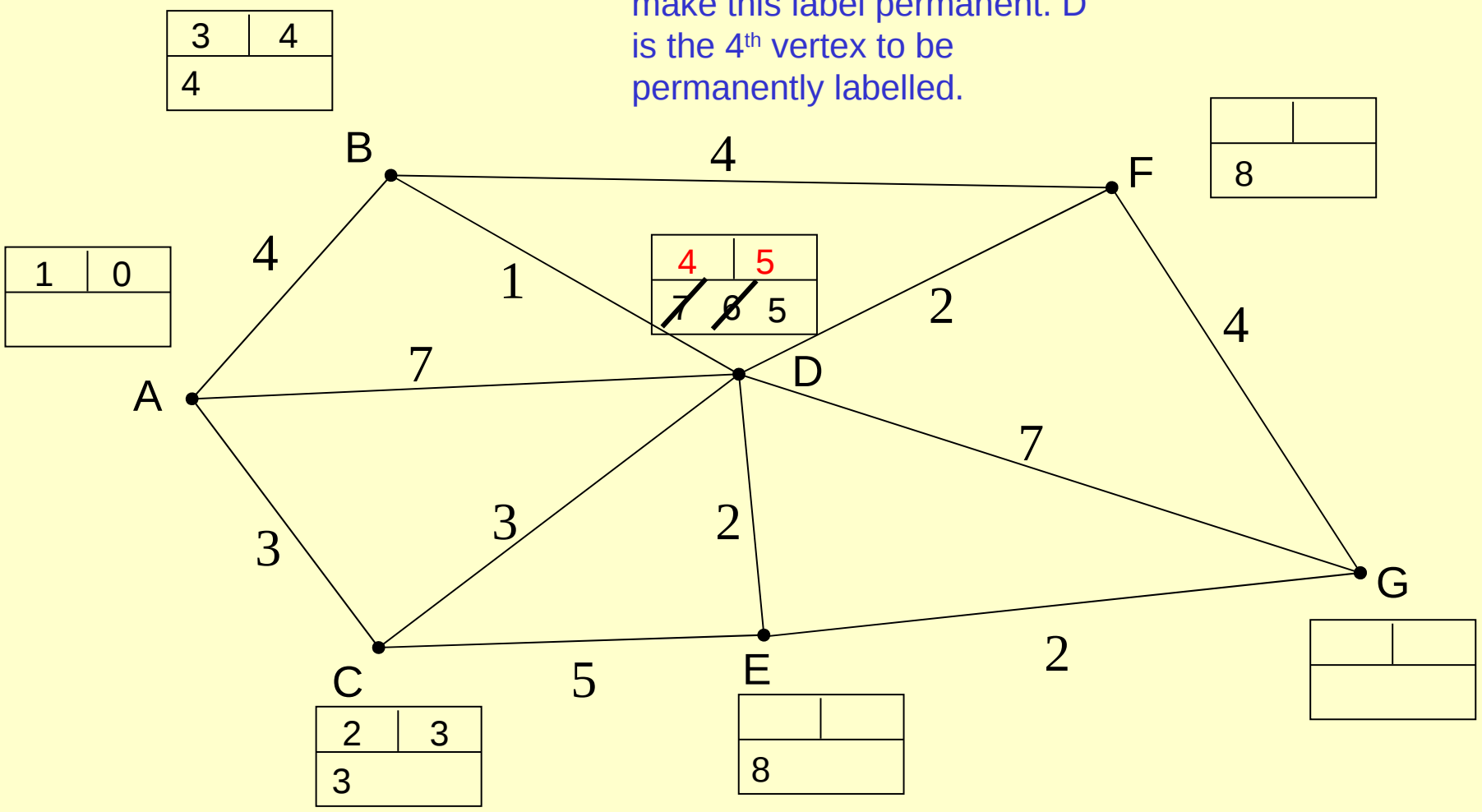
Dijkstra's Algorithm

We update each vertex adjacent to B with a 'working value' for its total distance from A, by adding its distance from B to B's permanent label of 4.



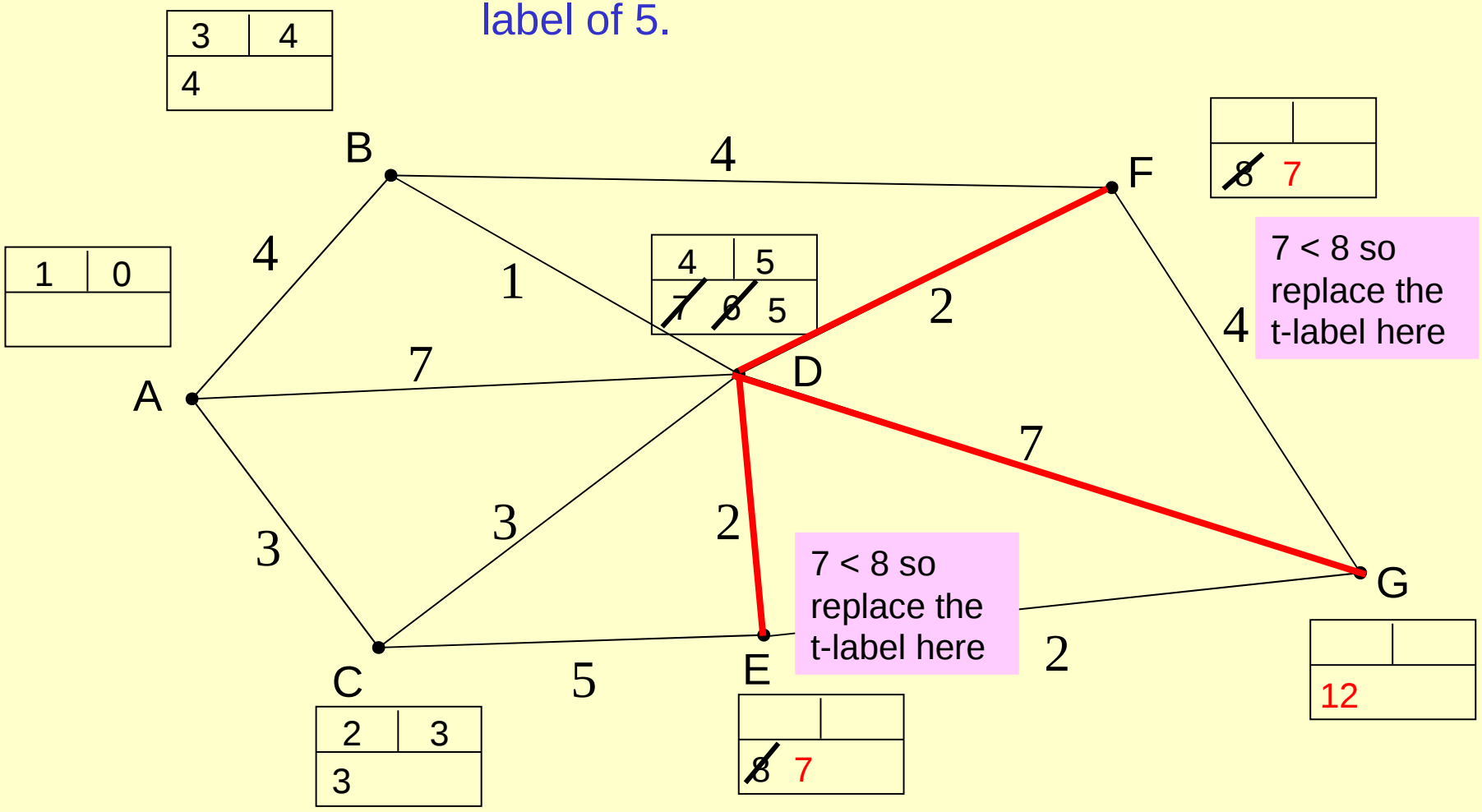
Dijkstra's Algorithm

The vertex with the smallest temporary label is D, so make this label permanent. D is the 4th vertex to be permanently labelled.

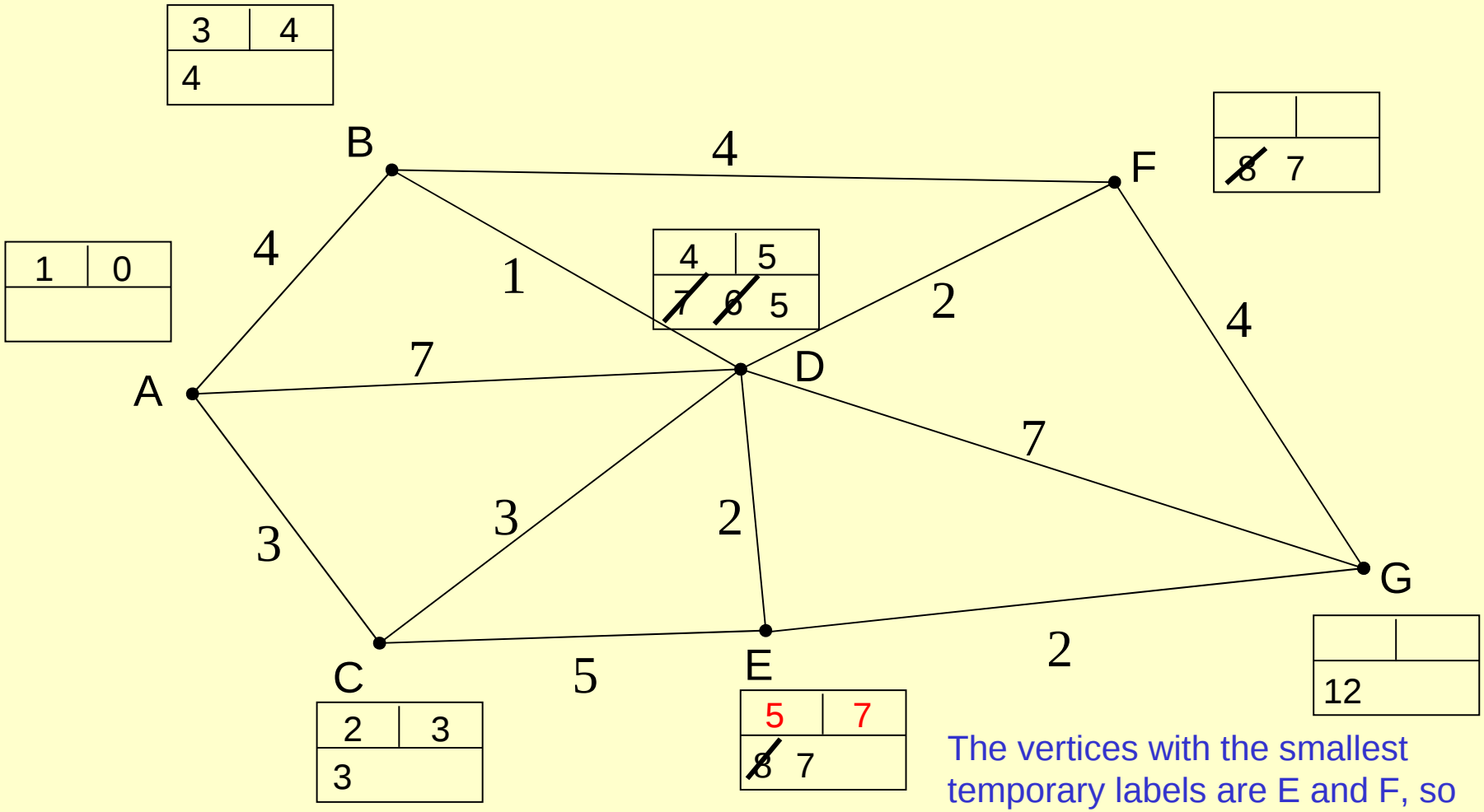


Dijkstra's Algorithm

We update each vertex adjacent to D with a 'working value' for its total distance from A, by adding its distance from D to D's permanent label of 5.



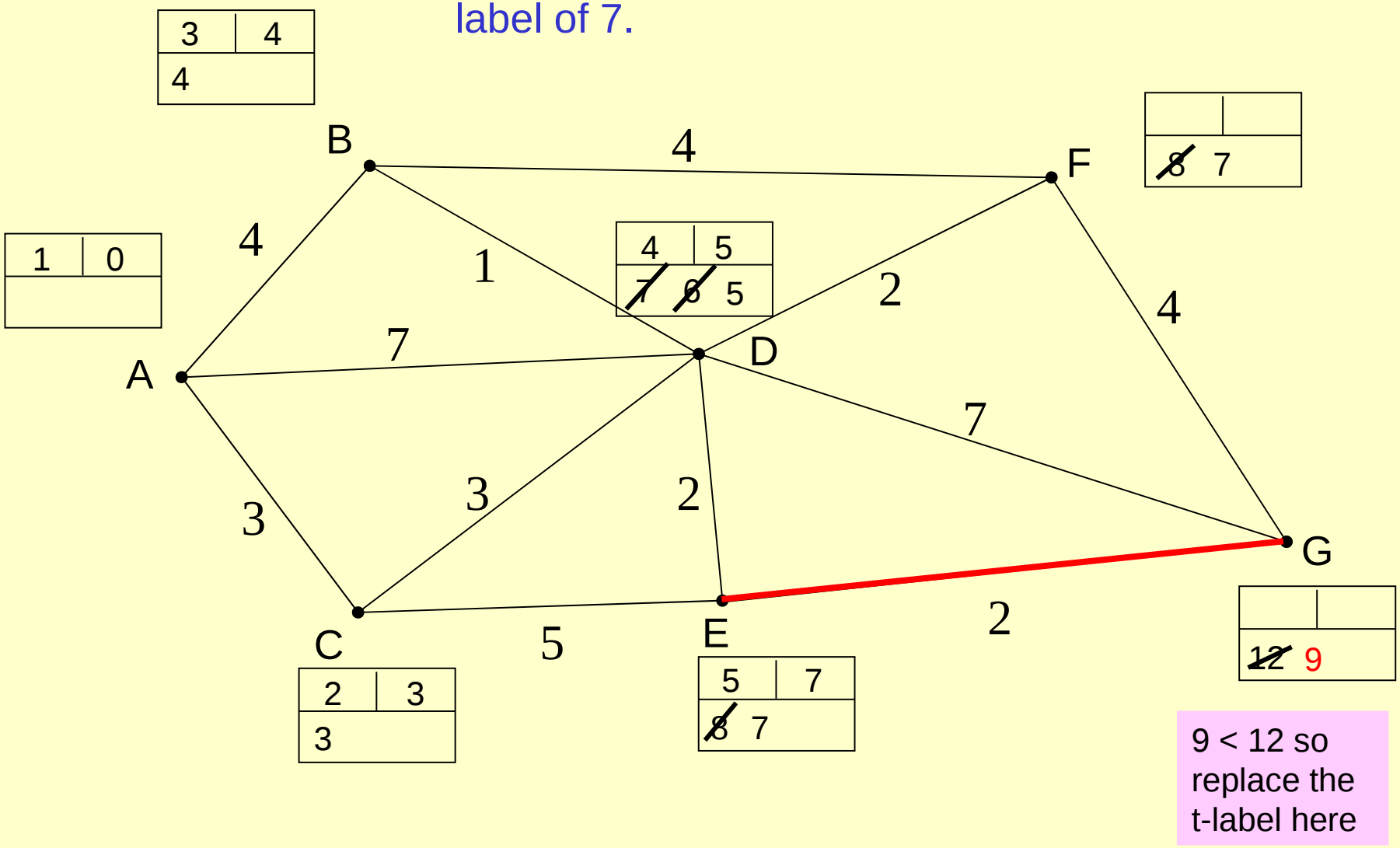
Dijkstra's Algorithm



The vertices with the smallest temporary labels are E and F, so choose one and make the label permanent. E is chosen - the 5th vertex to be permanently labelled.

Dijkstra's Algorithm

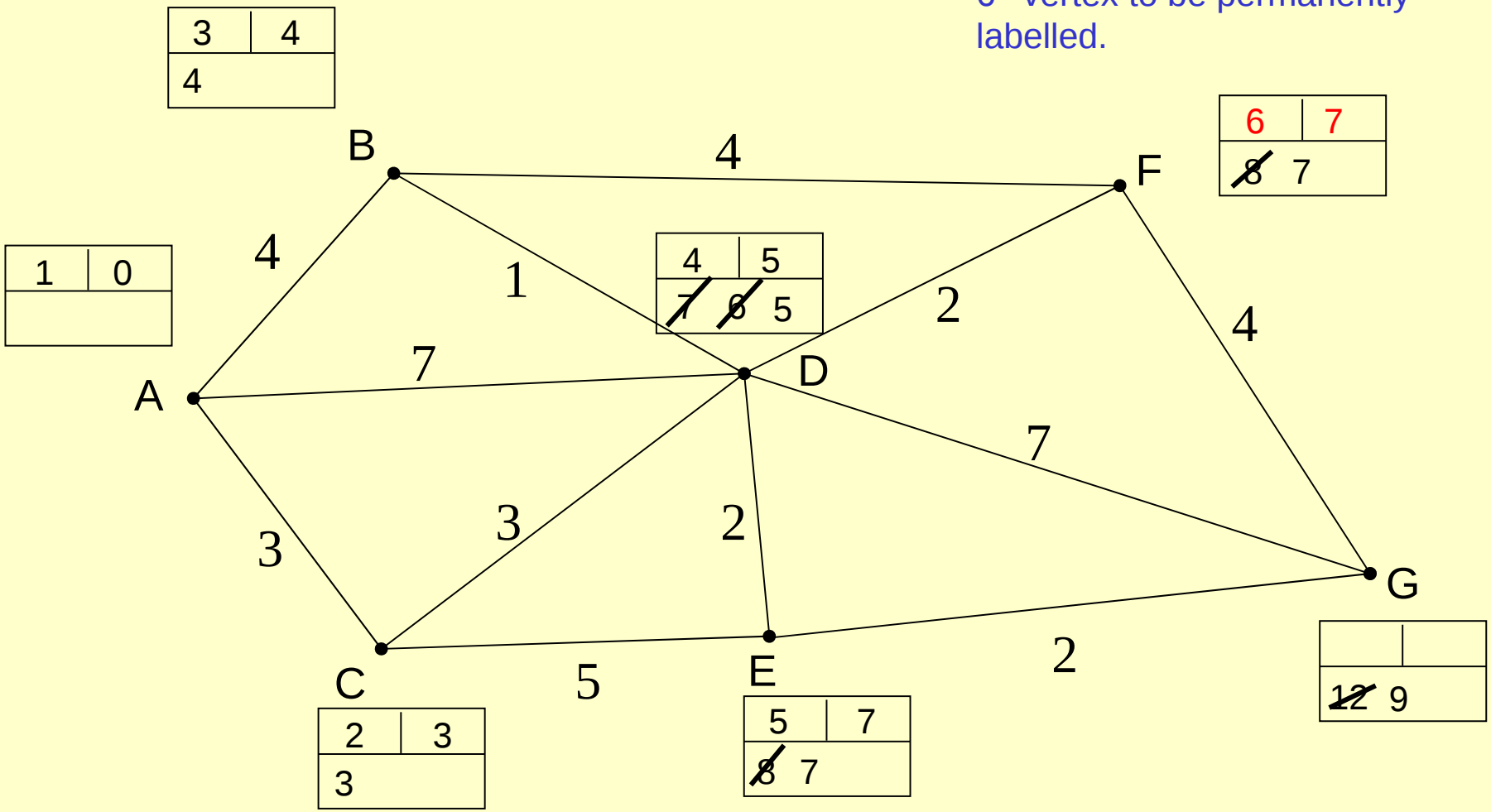
We update each vertex adjacent to E with a 'working value' for its total distance from A, by adding its distance from E to E's permanent label of 7.



9 < 12 so replace the t-label here

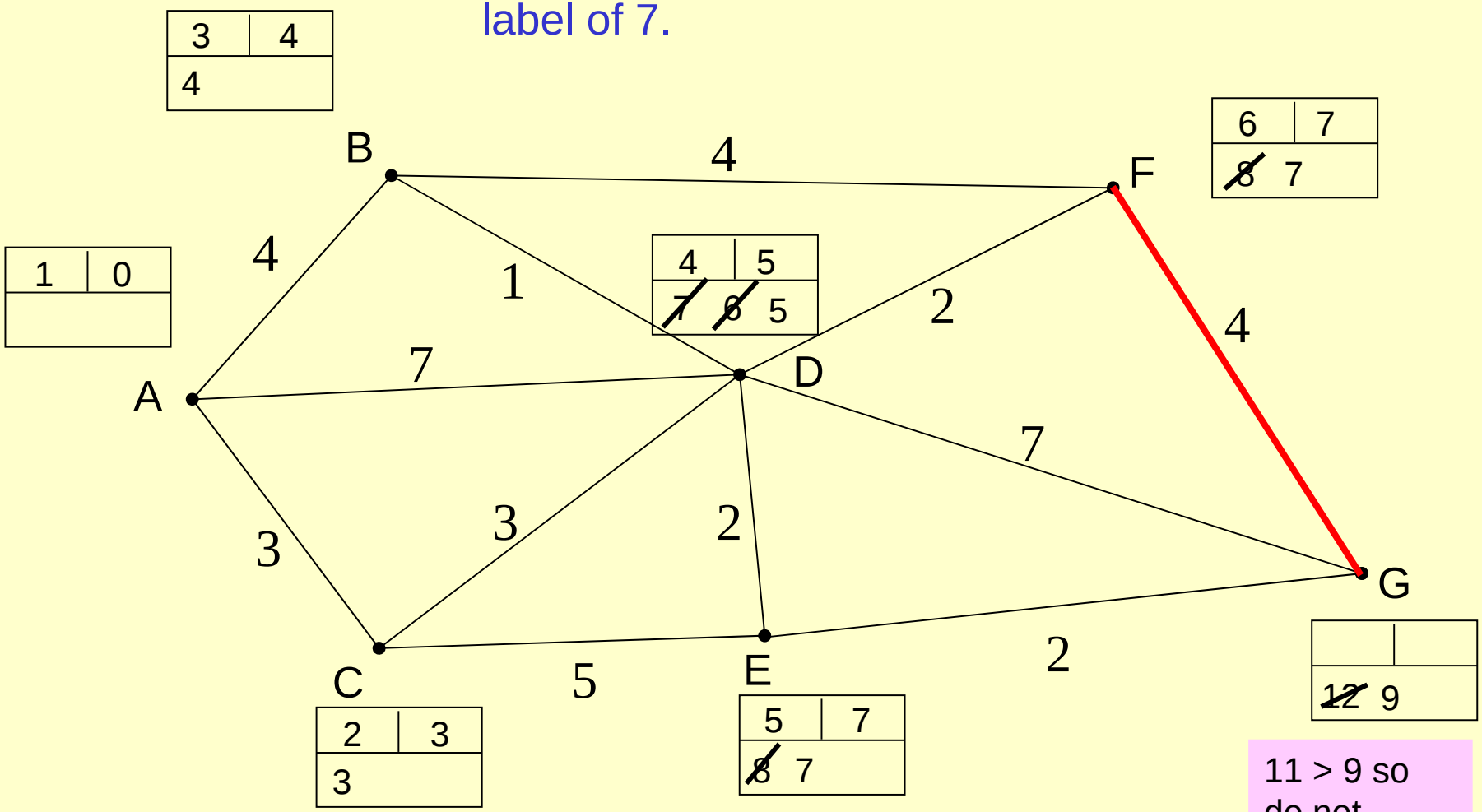
Dijkstra's Algorithm

The vertex with the smallest temporary label is F, so make this label permanent.F is the 6th vertex to be permanently labelled.

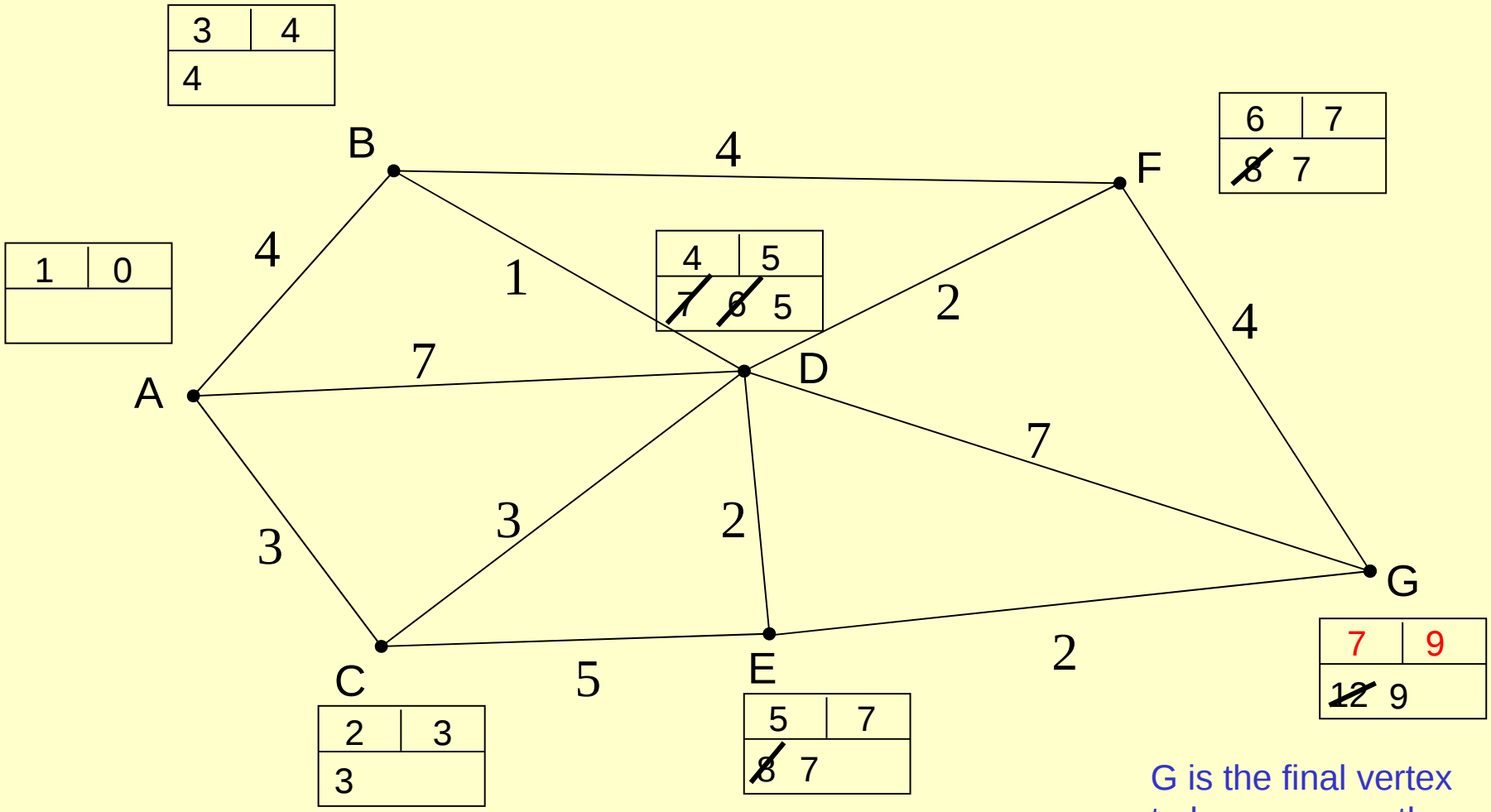


Dijkstra's Algorithm

We update each vertex adjacent to F with a 'working value' for its total distance from A, by adding its distance from F to F's permanent label of 7.

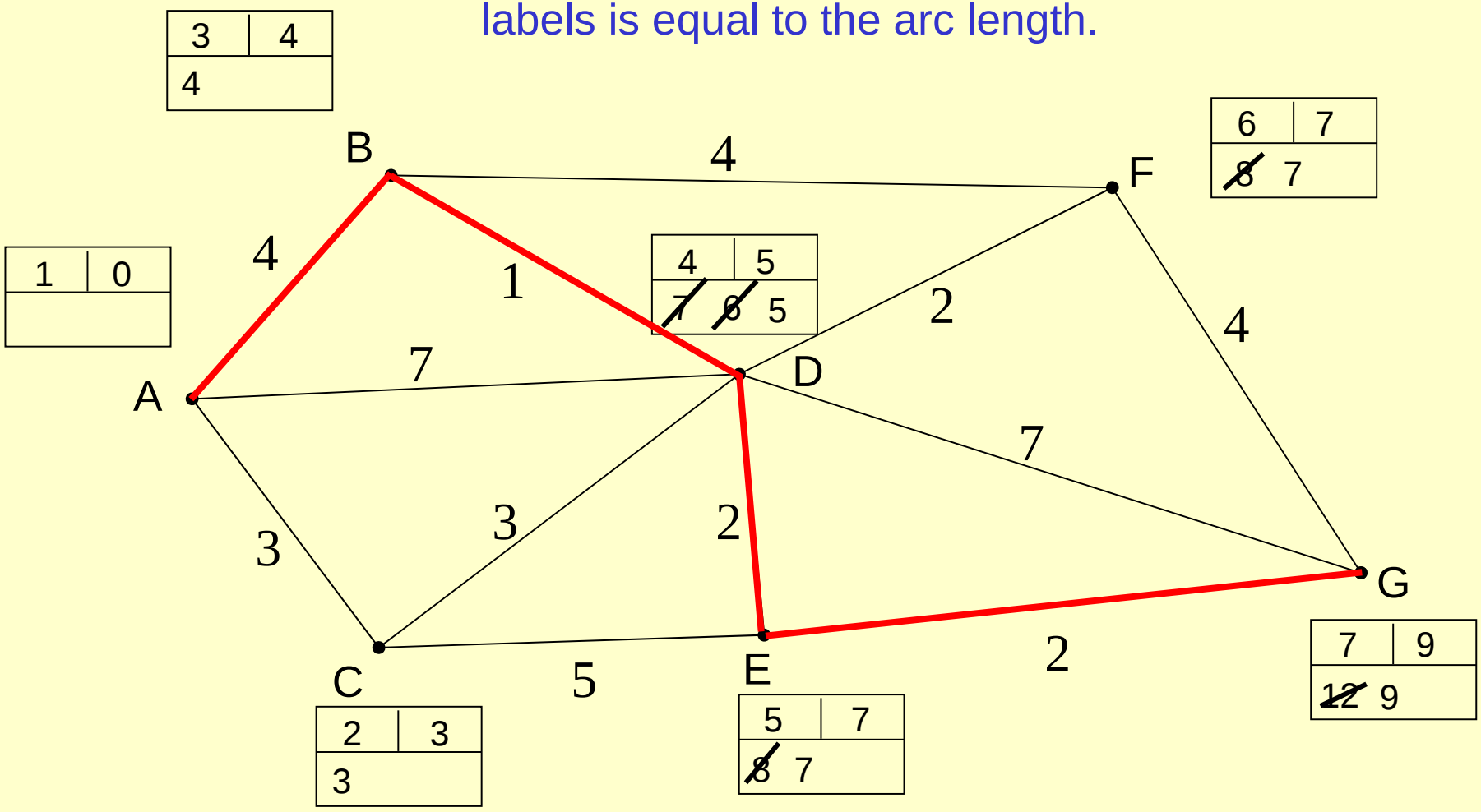


Dijkstra's Algorithm



Dijkstra's Algorithm

To find the shortest path from A to G, start from G and work backwards, choosing arcs for which the difference between the permanent labels is equal to the arc length.



The shortest path is ABDEG, with length 9.