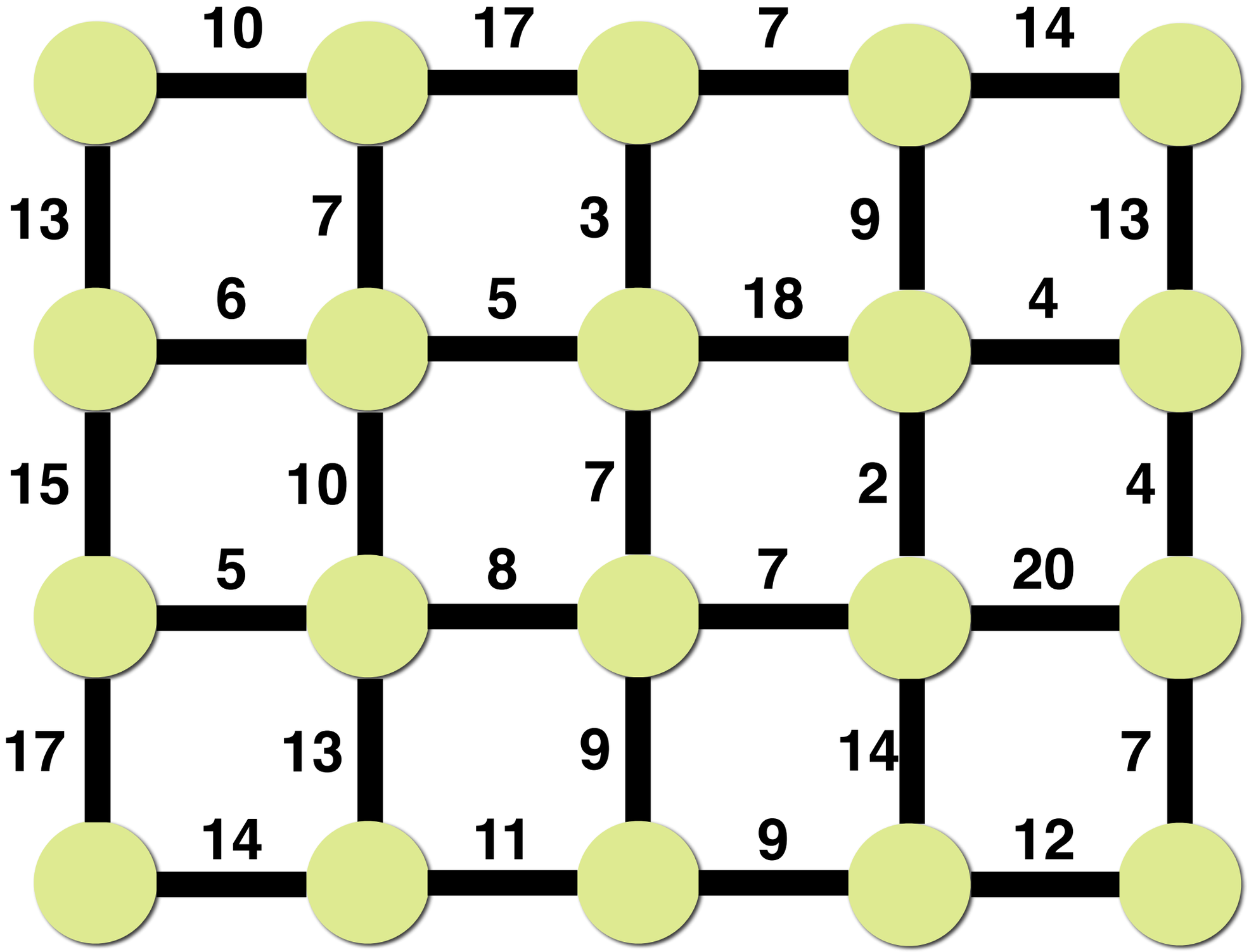
Single-Source Shortest Path problem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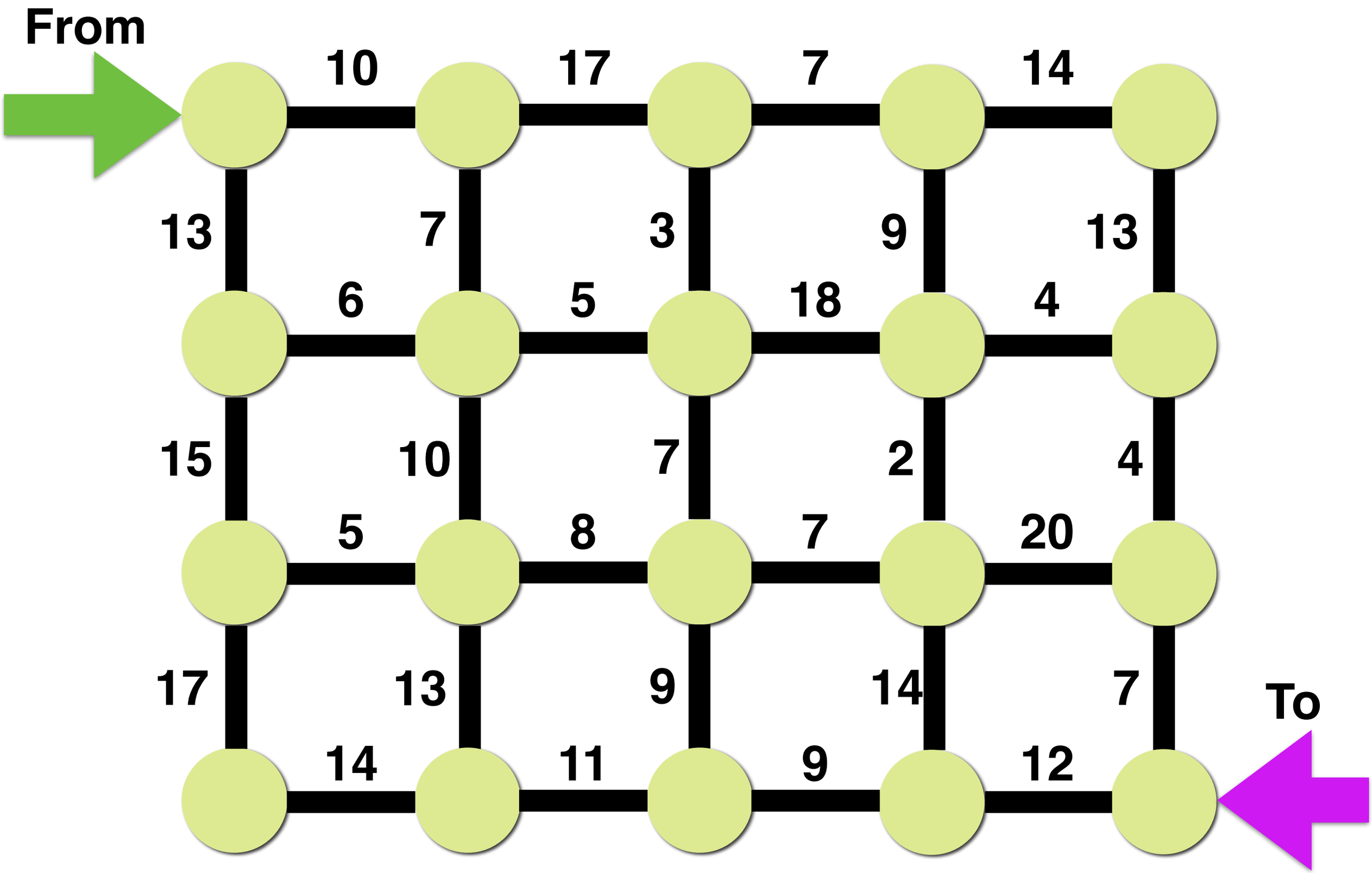
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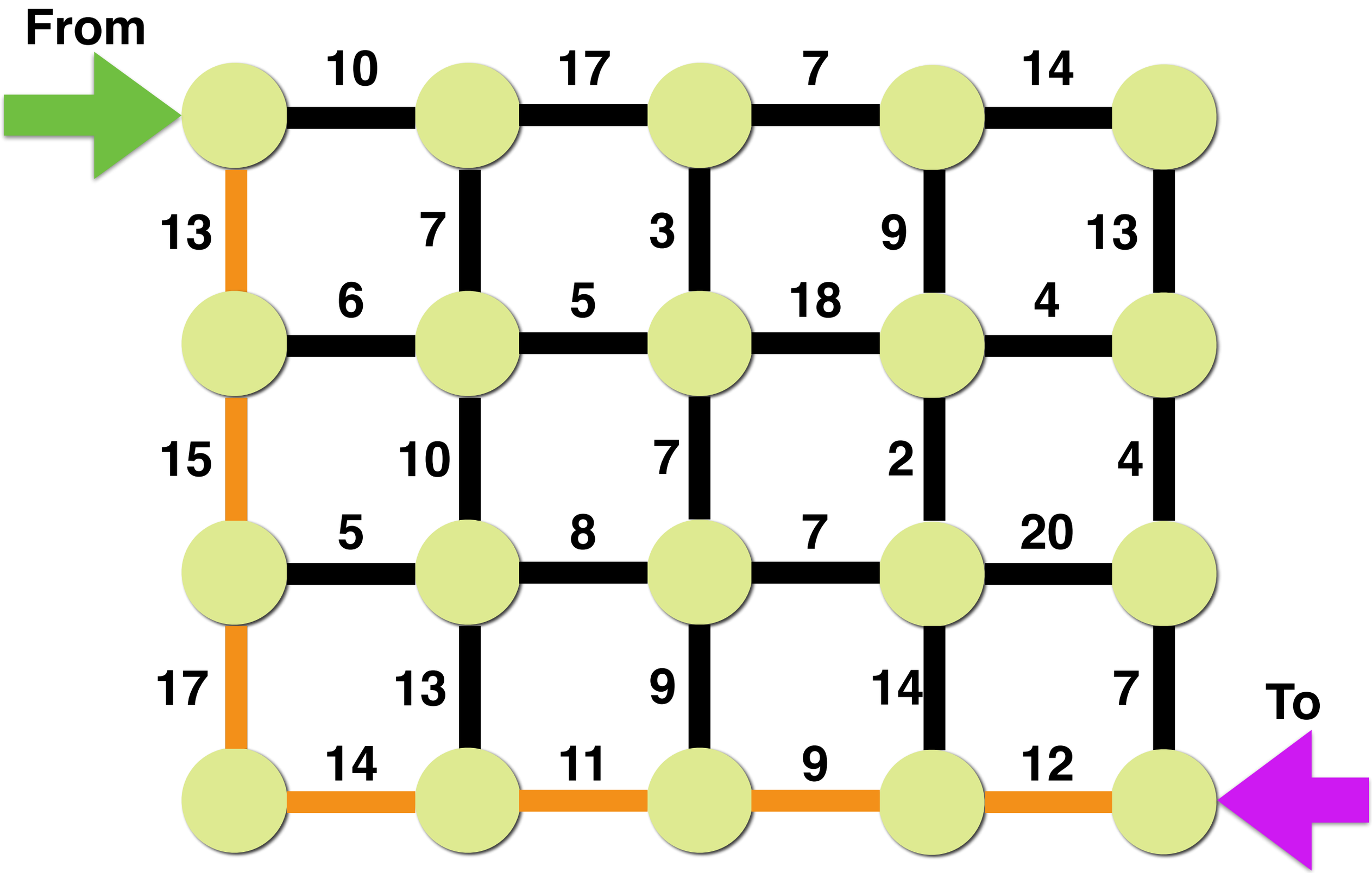
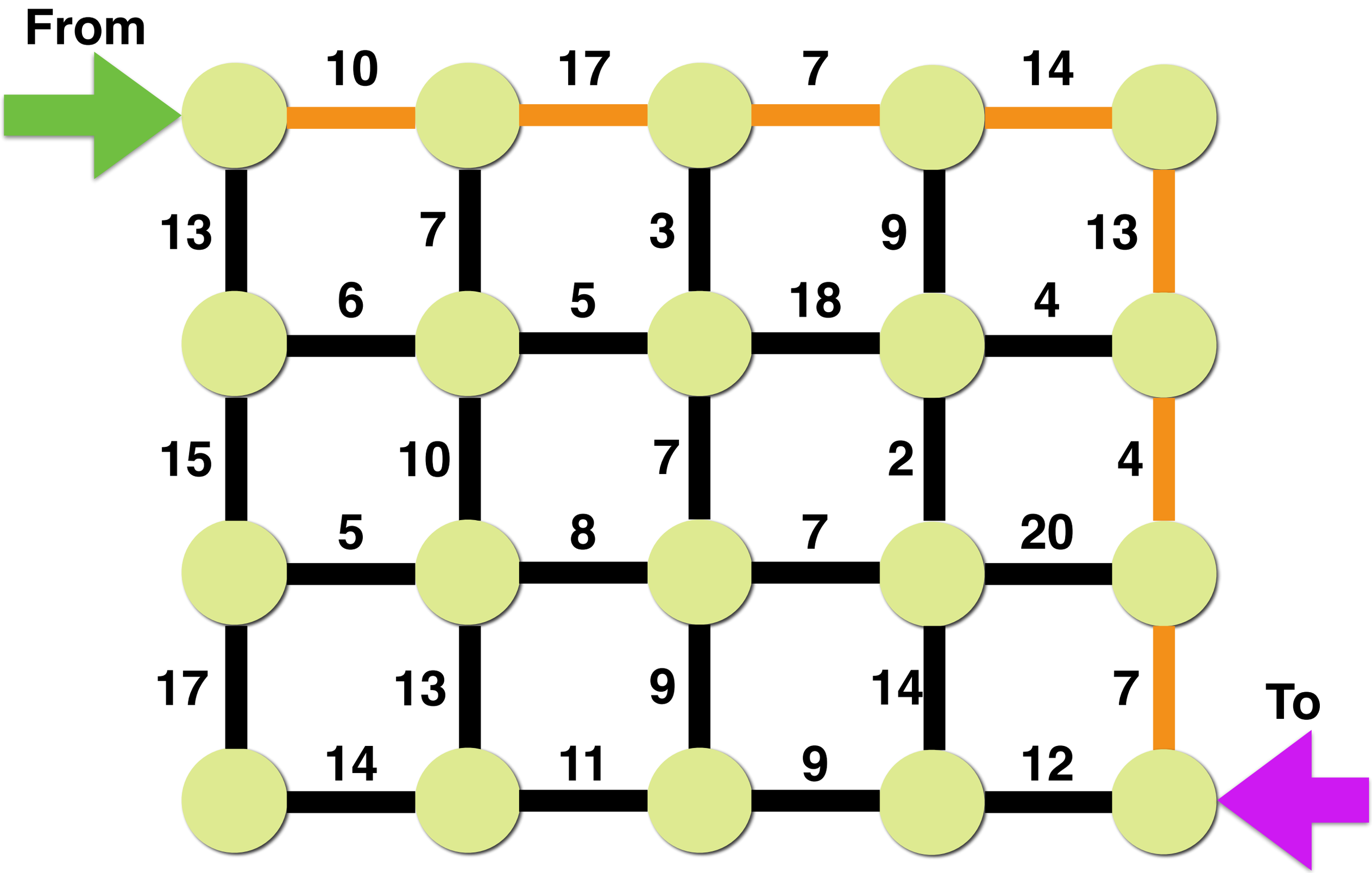
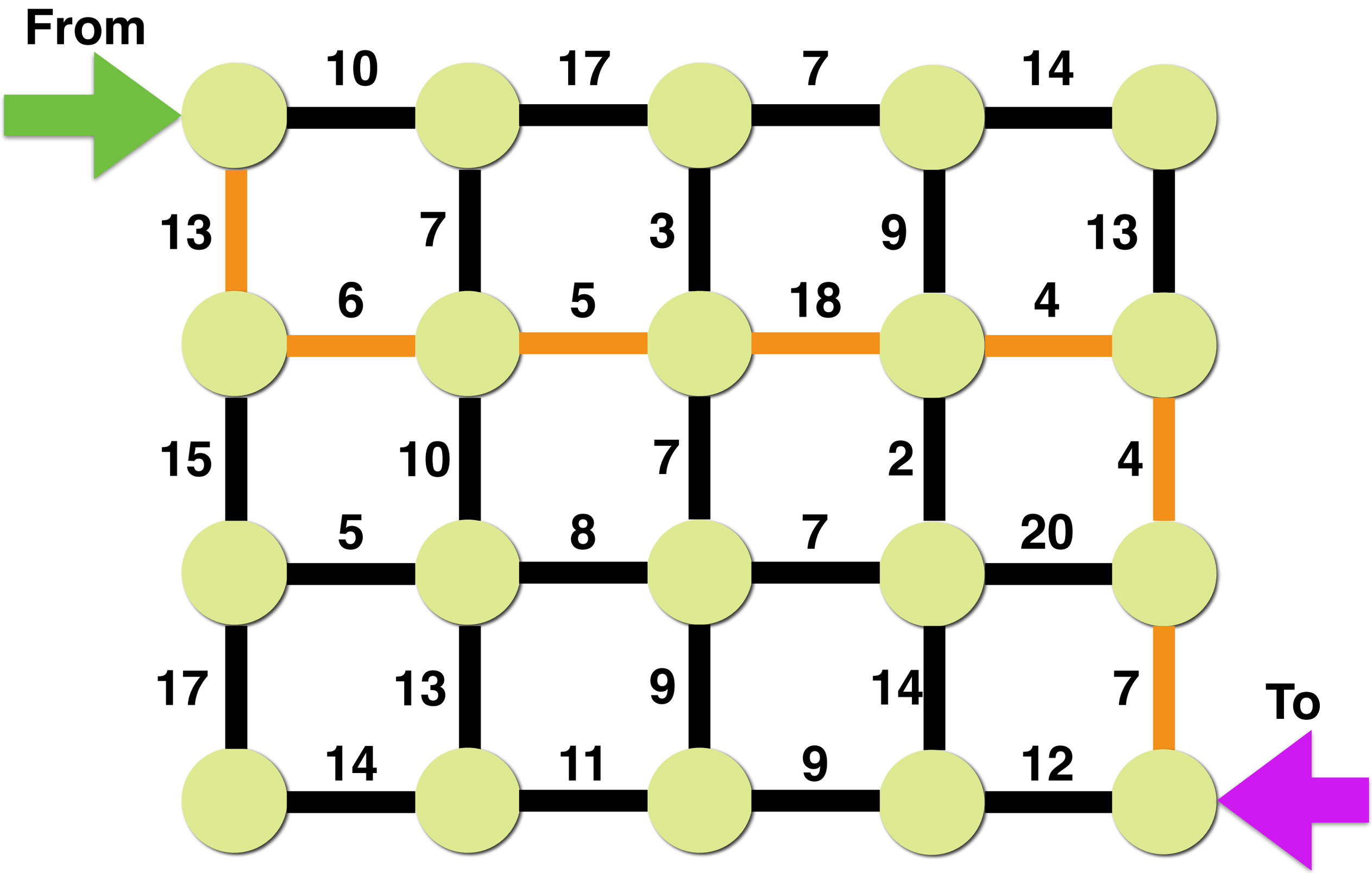


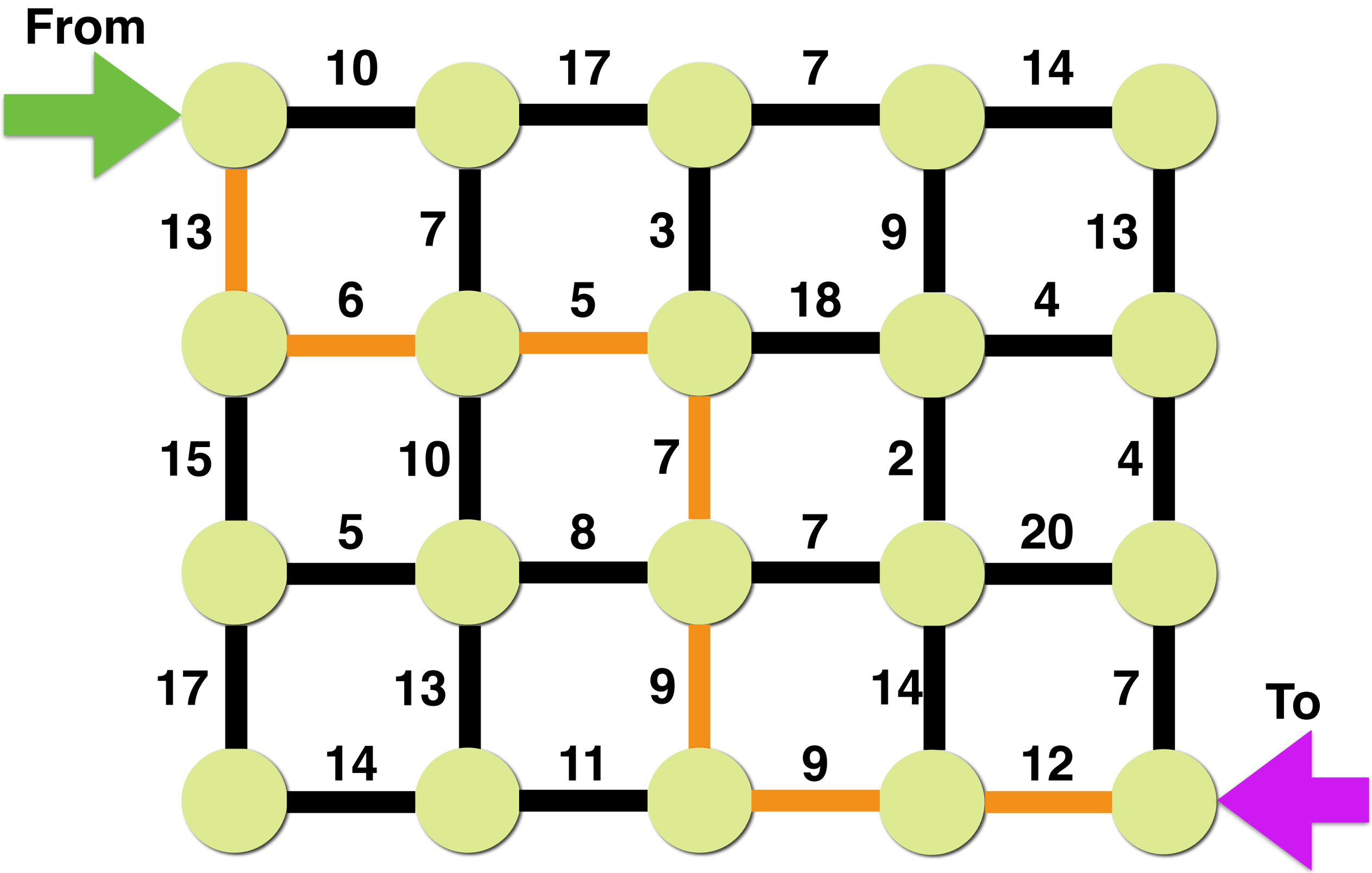
Travel Time: 13 + 15 + 17 + 14 + 11 + 9 + 12 = 91



Travel Time: 10 + 17 + 7 + 14 + 13 + 4 + 7 = 72



Travel Time: 13 + 6 + 5 + 18 + 2 + 20 + 7 = 71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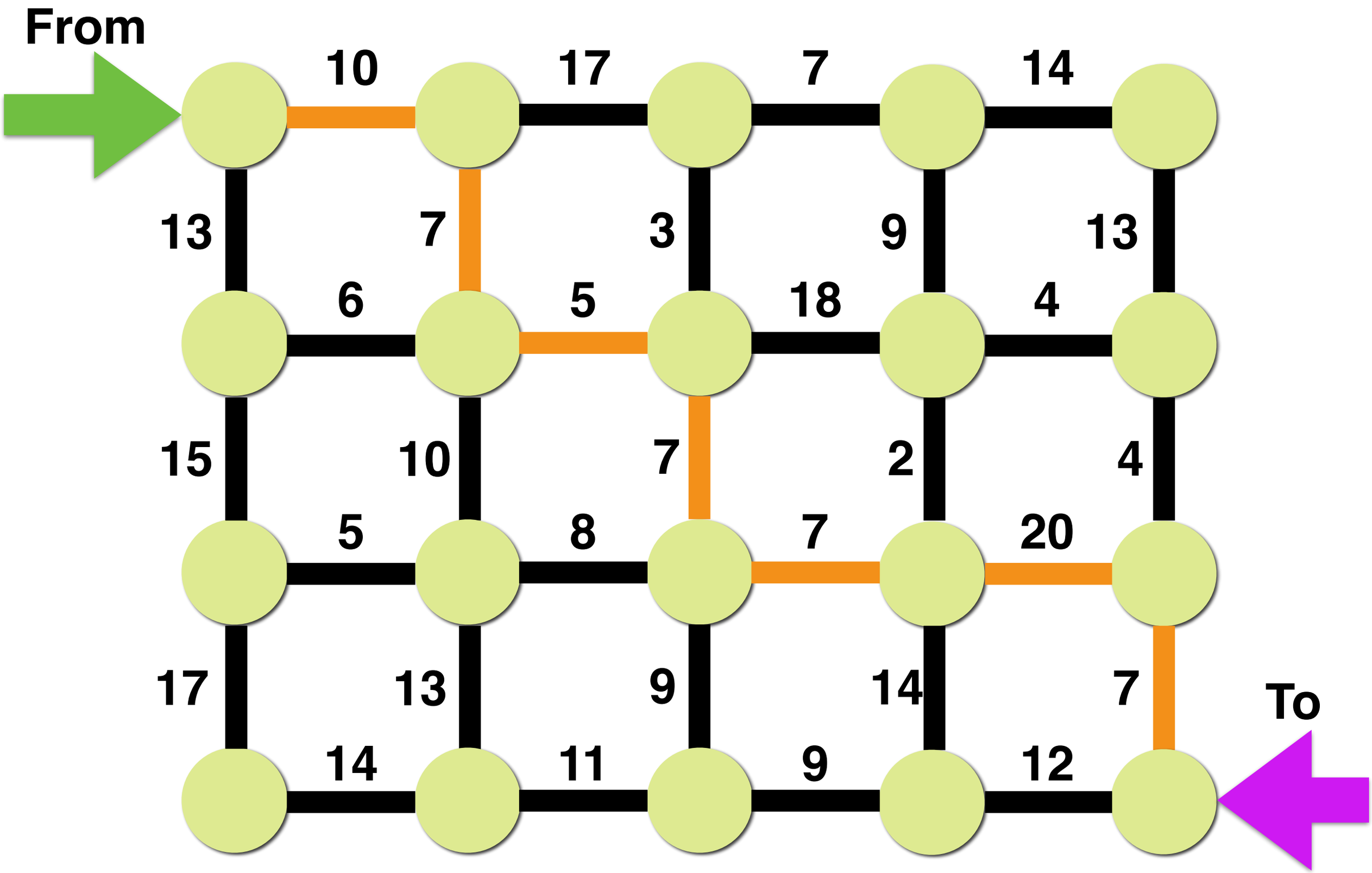
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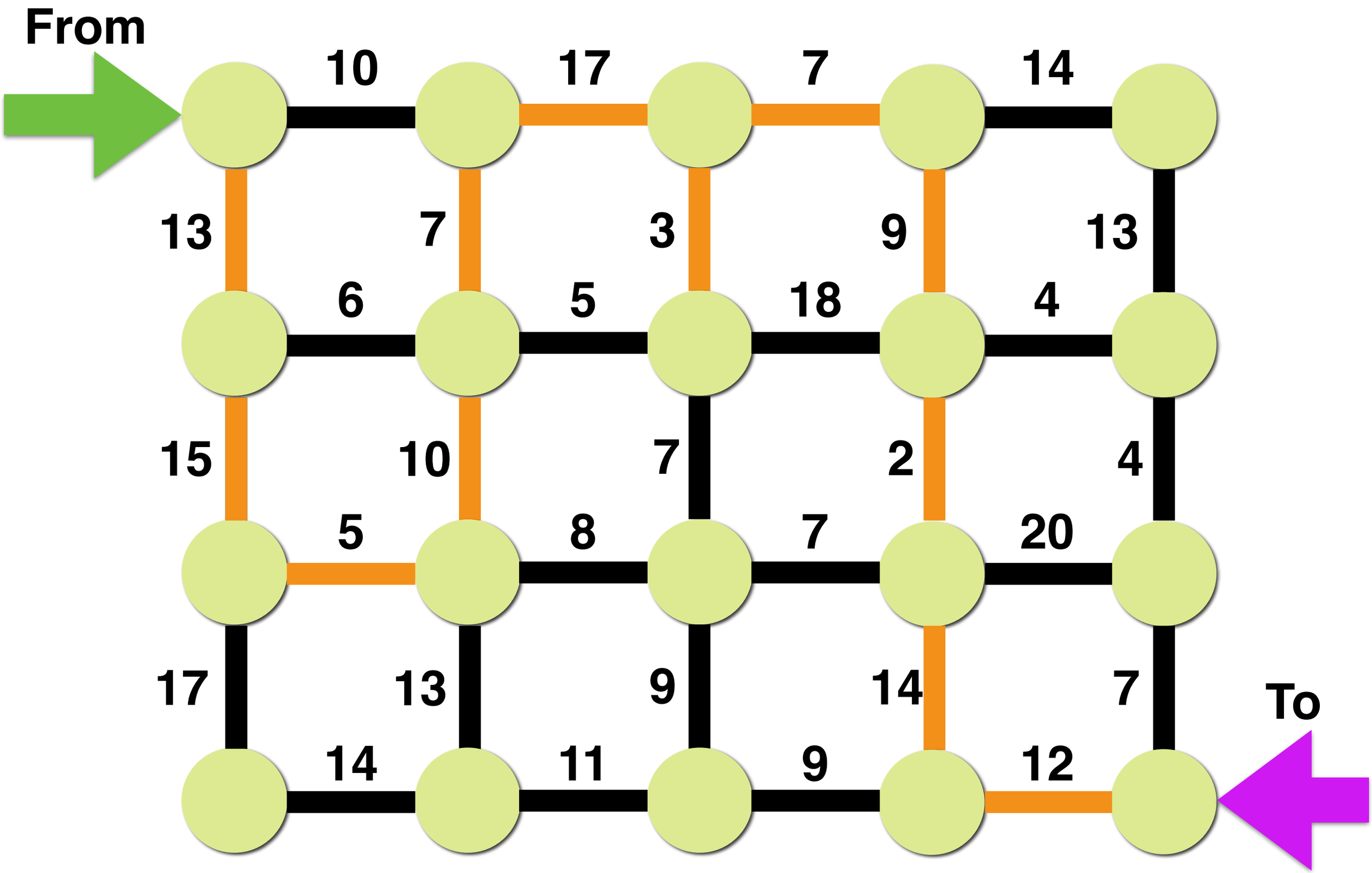
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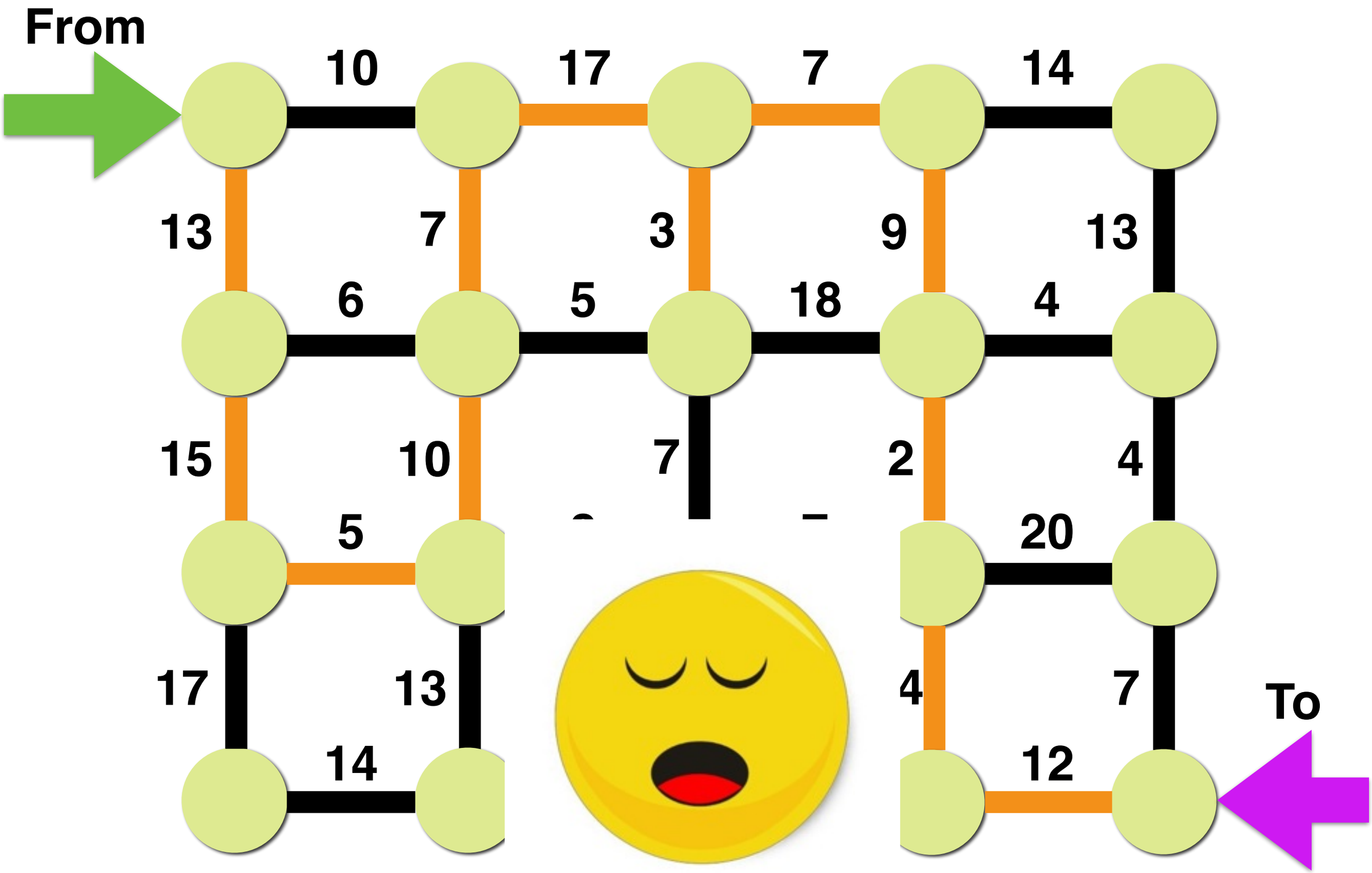
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Dijkstar's Algorithm

- It was designed by computer scientist **Edsger W. Dijkstra** in 1956. (May 11, 1930 – August 6, 2002)

- Received the 1972 **A. M. Turing Award**, widely considered the most prestigious award in computer science

Dijkstar's algorithm

Step1: Assign to every node a tentative distance

set zero for the **initial node**

set infinity for **all other nodes**

Step2: Mark all nodes **unvisited**.

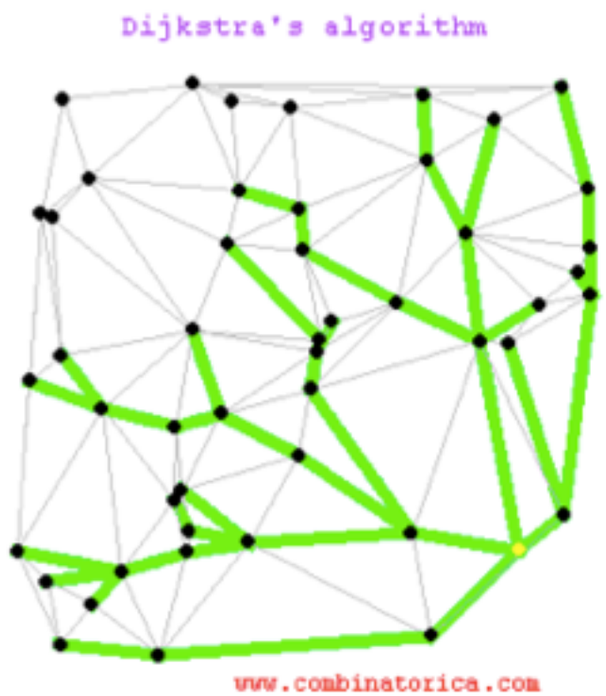
Set the initial node as **current**

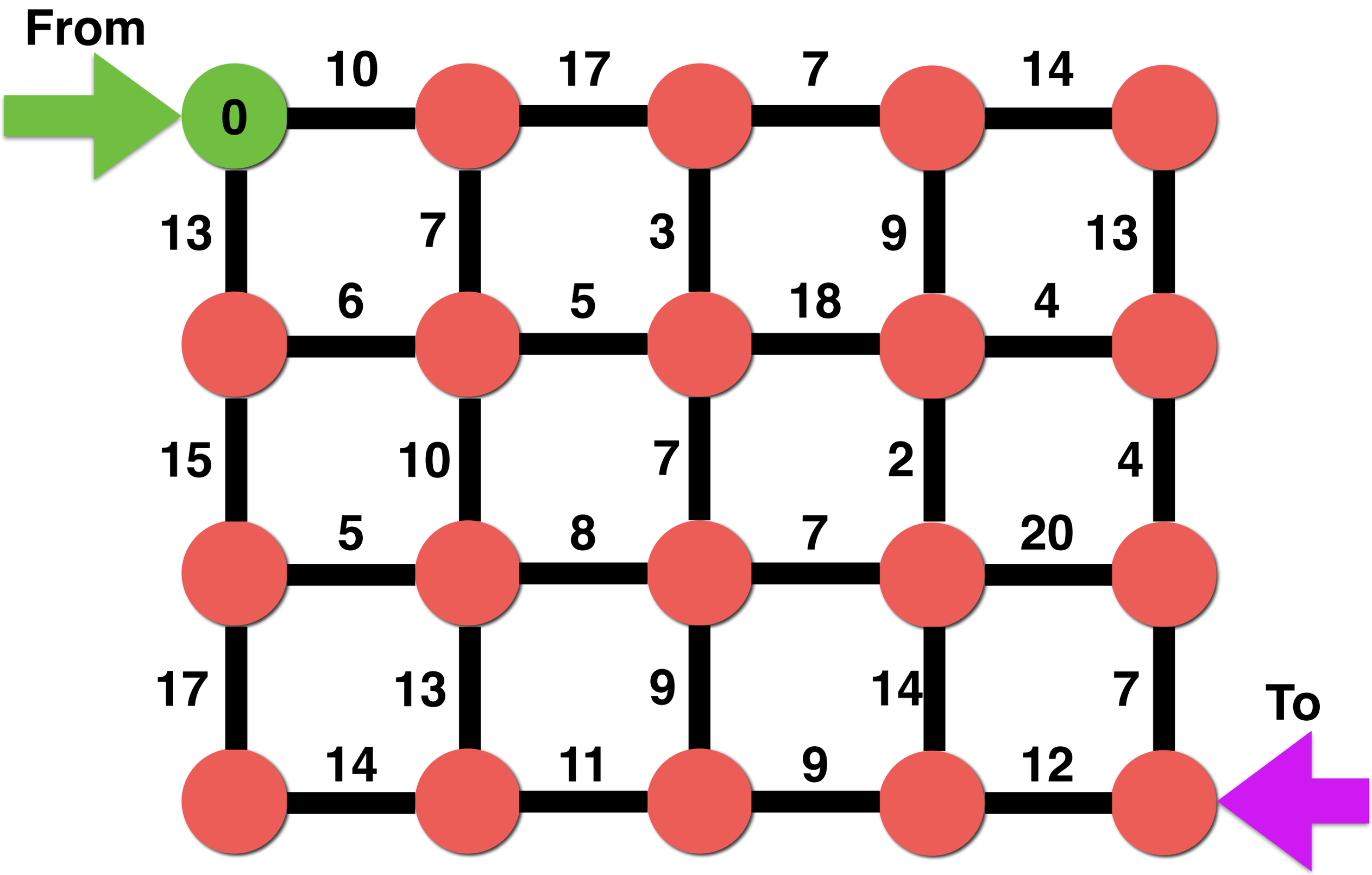
single-source shortest path algorithm

The problem of finding shortest paths from a source vertex v to all other vertices in the graph.

Weighted graph G = (E,V)

Source vertex s ∈ V to all vertices v ∈ V

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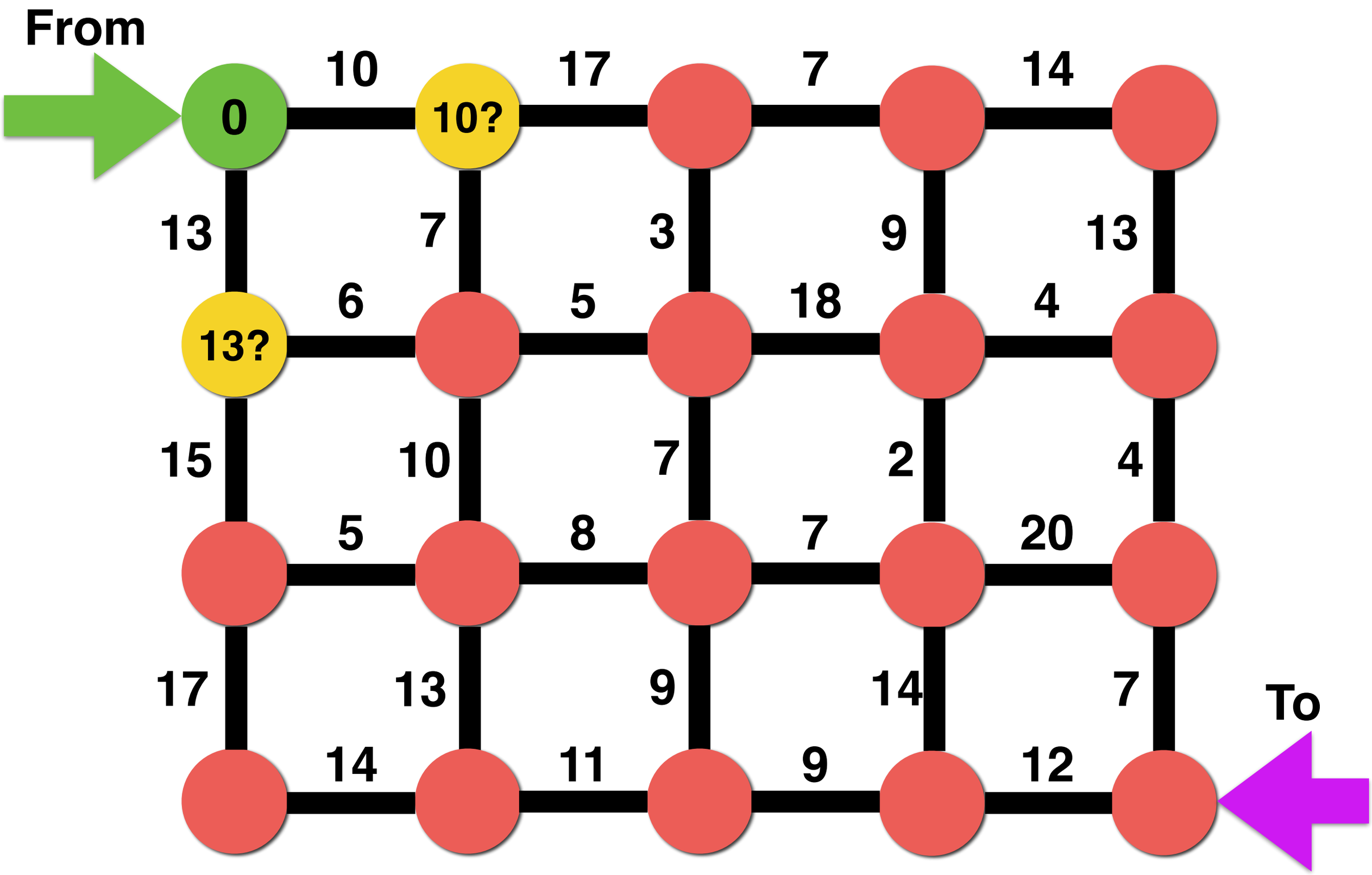
To

Dijkstar's algorithm

Step3: For the current node, **consider all of its unvisited neighbors** and calculate their tentative distances. Compare the newly calculated *tentative* distance to the current assigned value and assign the smaller one.

Step4: When we are done considering all of the neighbors of the current node, **mark the current node as visited and remove it from the unvisited set**. A visited node will never be checked again.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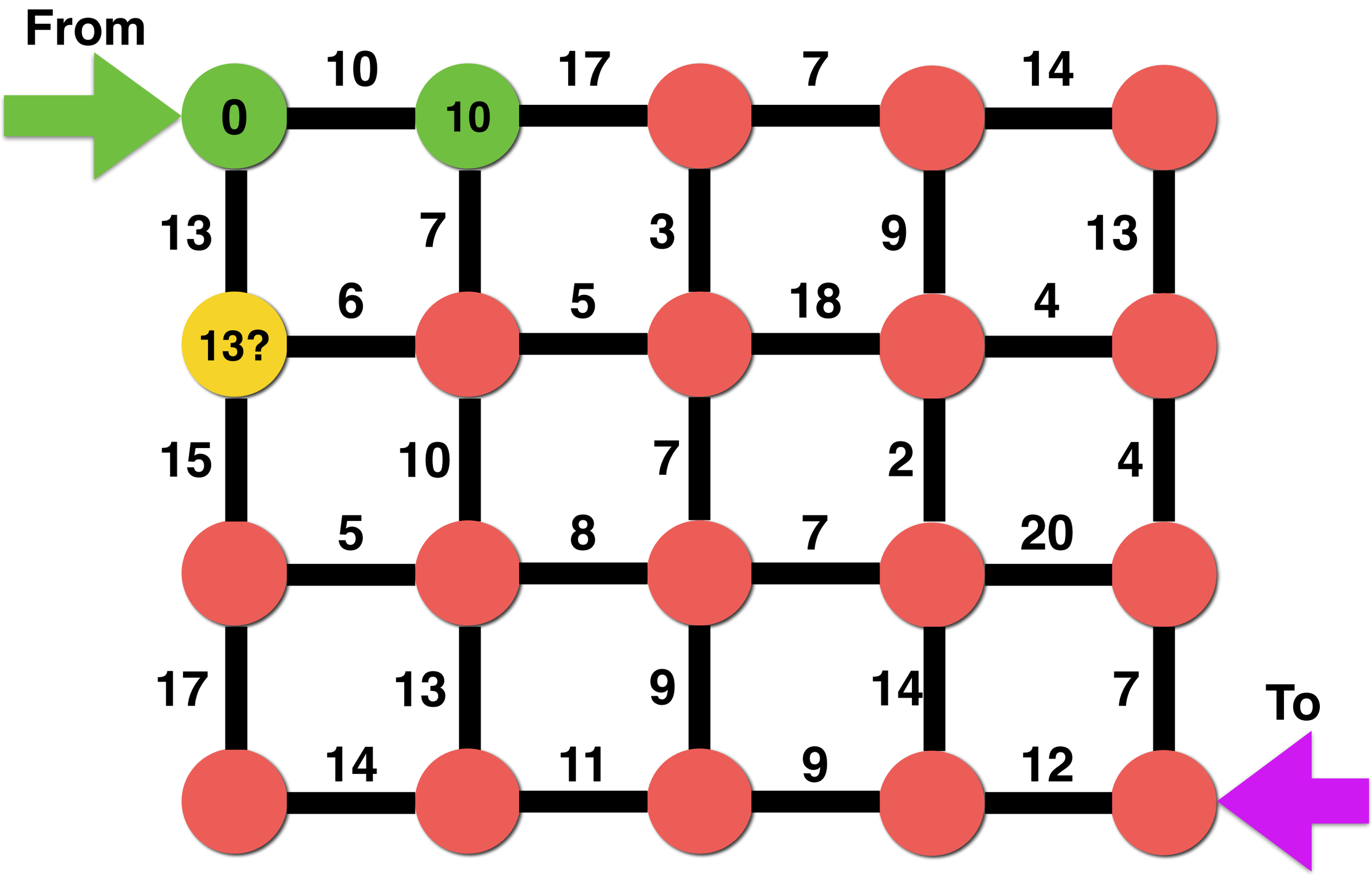
Dijkstar’s algorithm

Step5: If the destination node has been marked visited the algorithm has finished.

Step6: Select the unvisited node that is marked with the **smallest tentative distance**, and set it as the new “current node”, then go back to step3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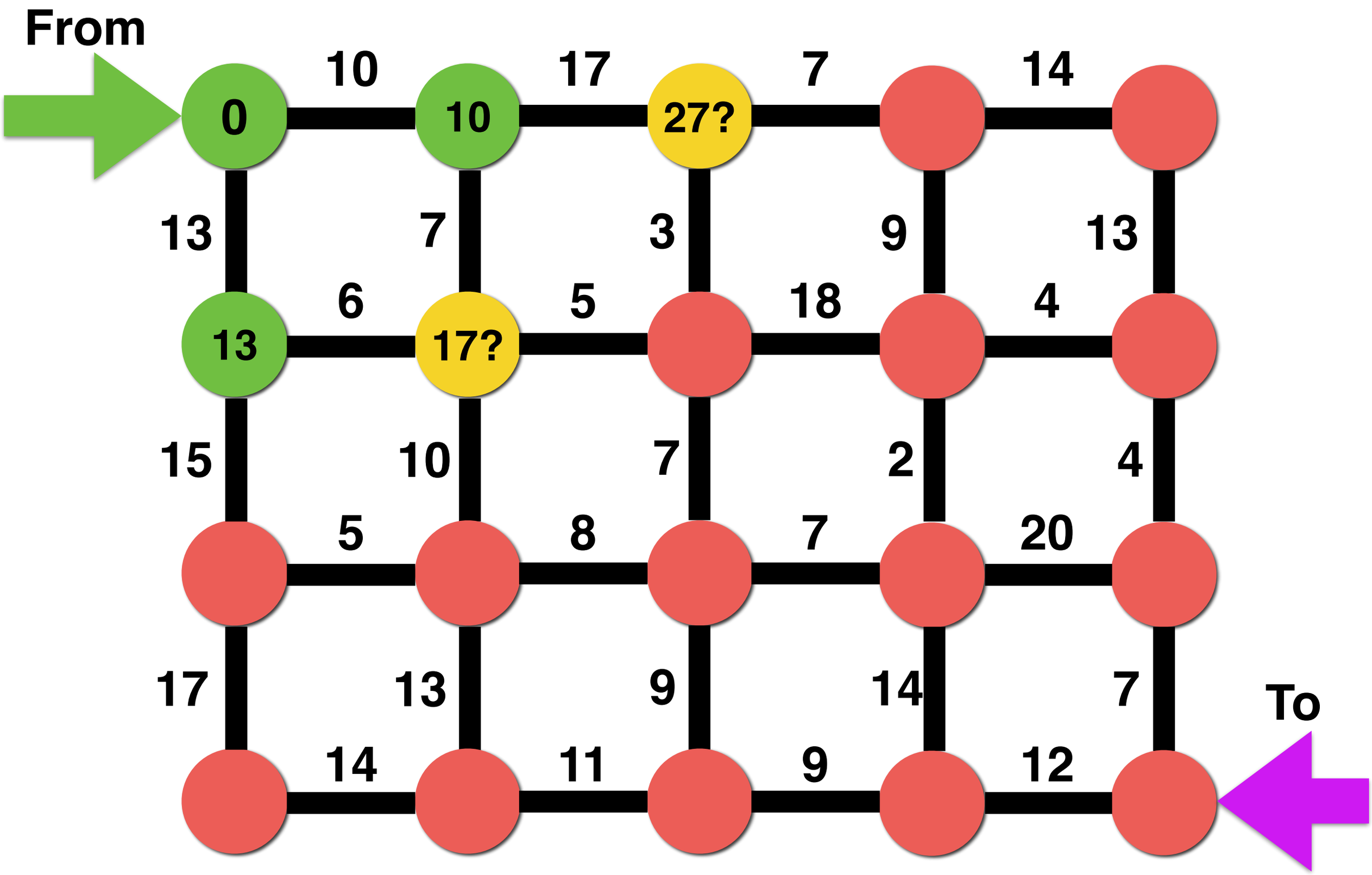
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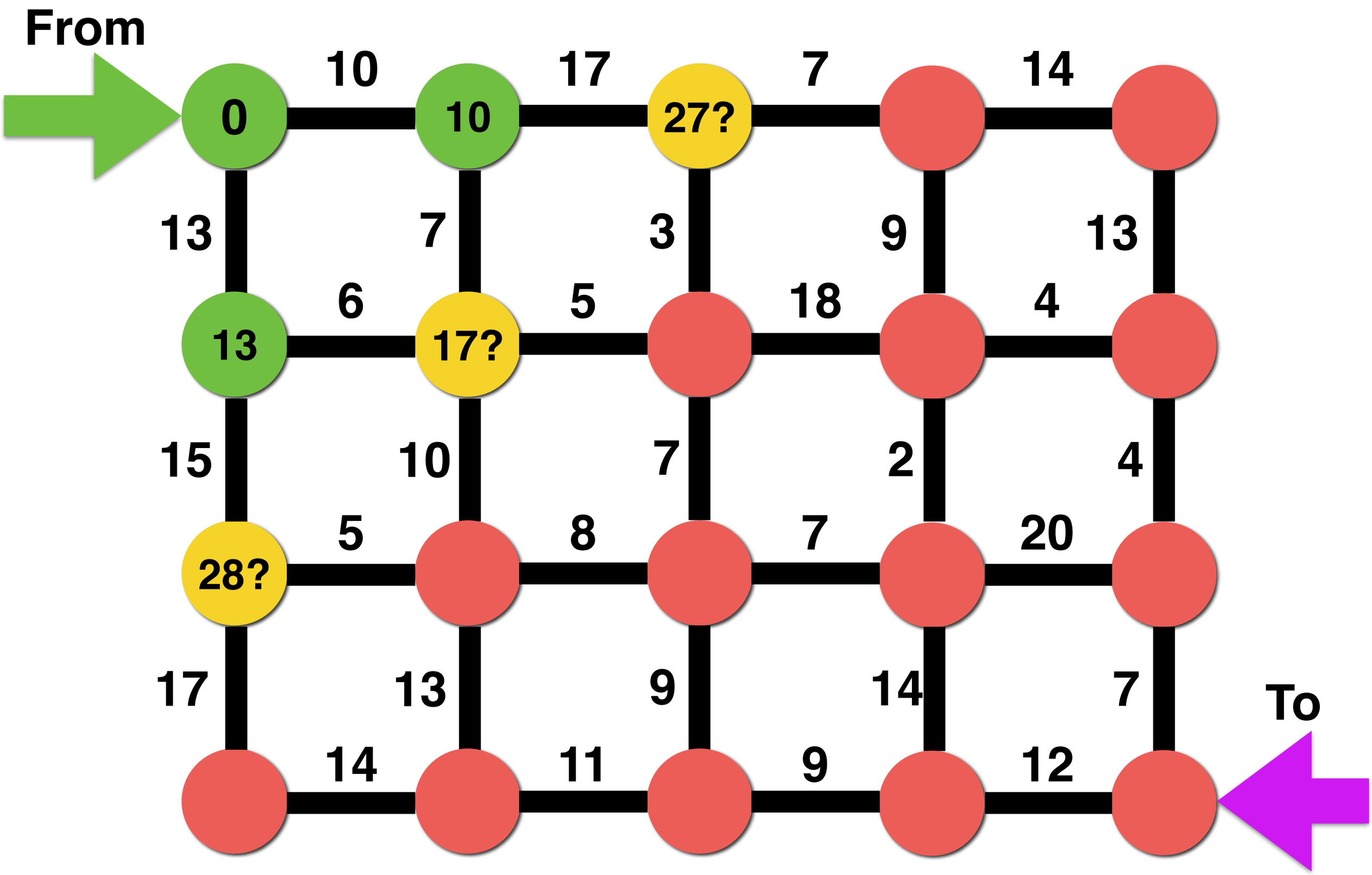
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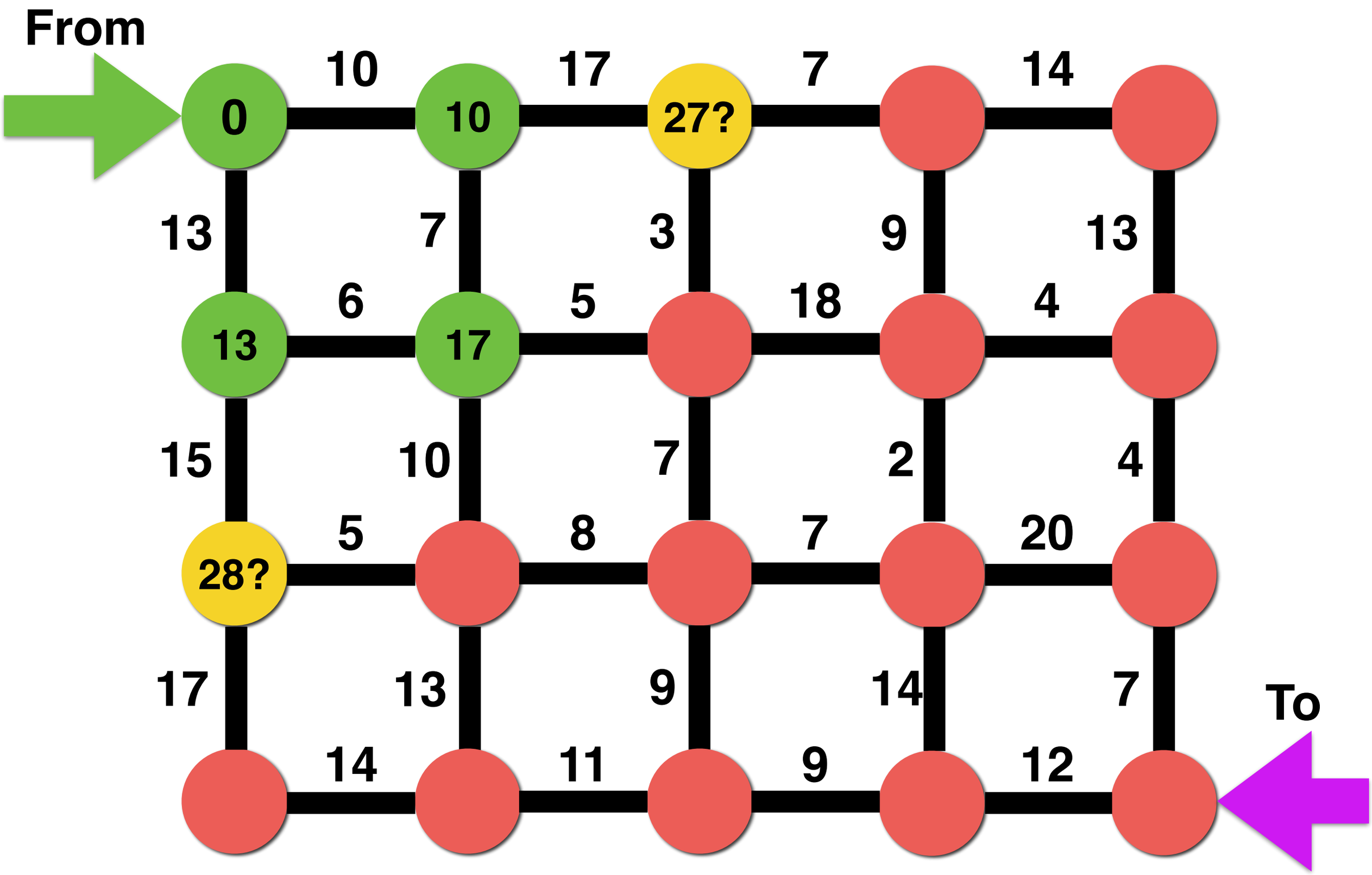
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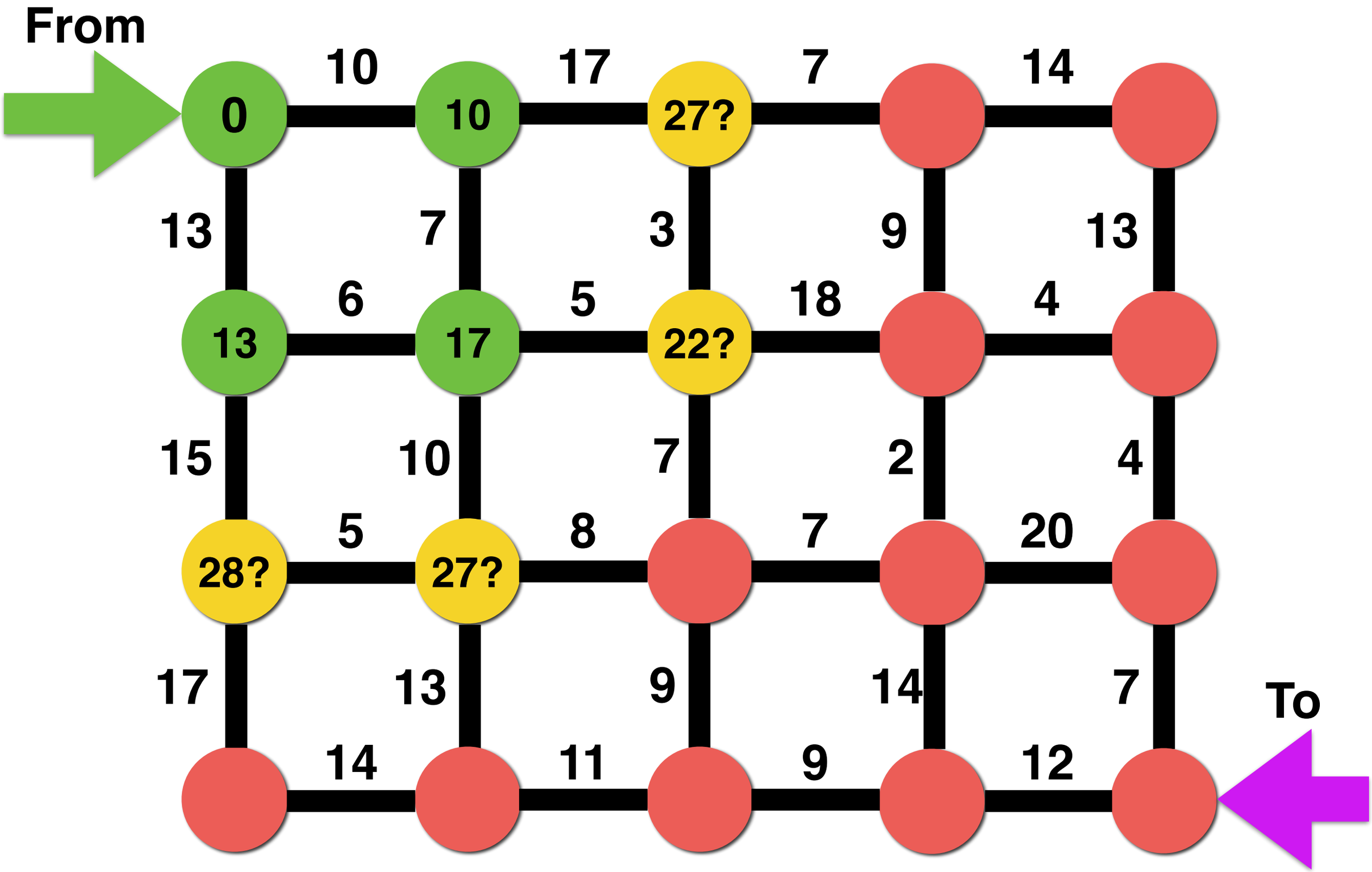
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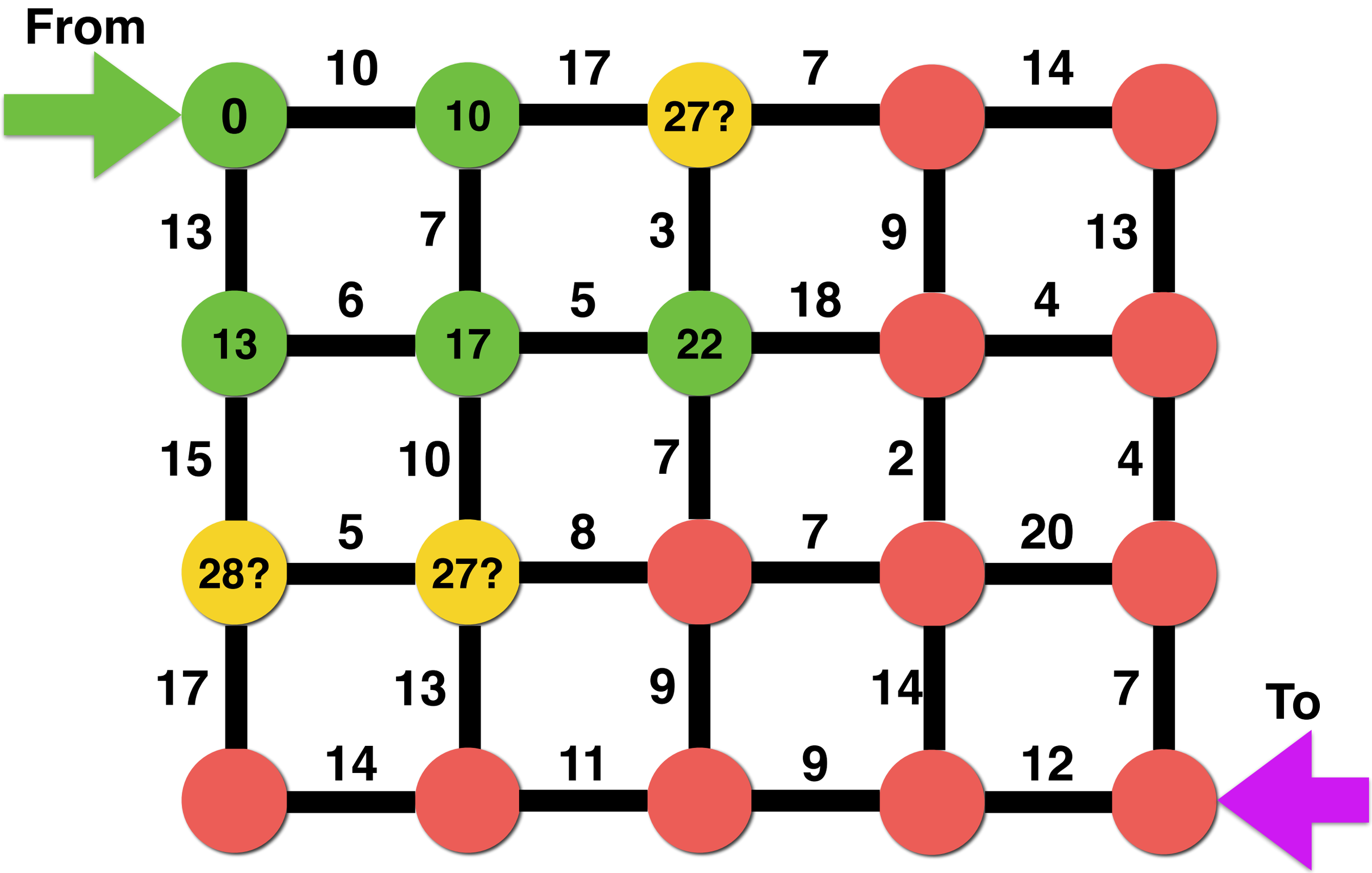
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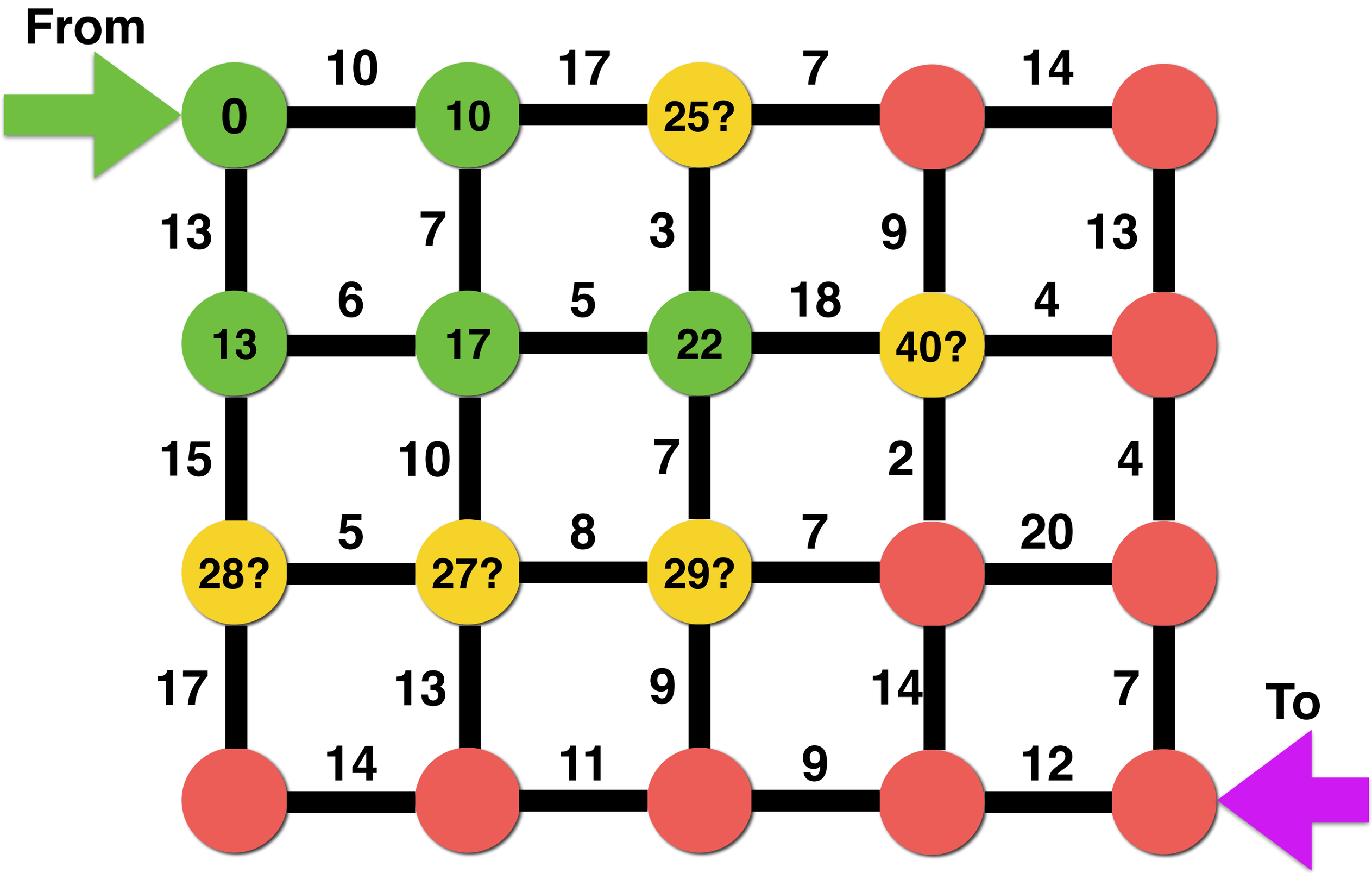
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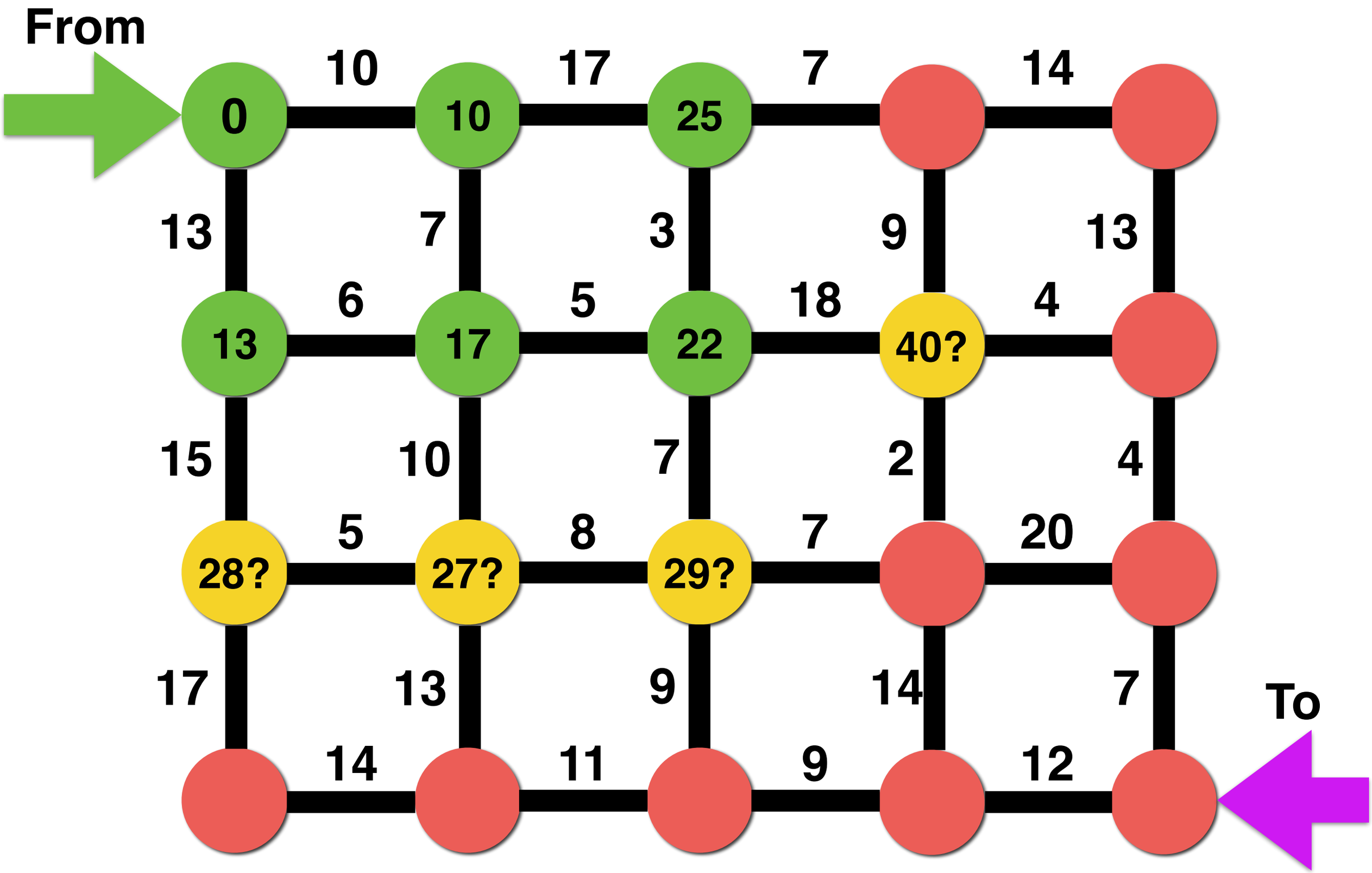
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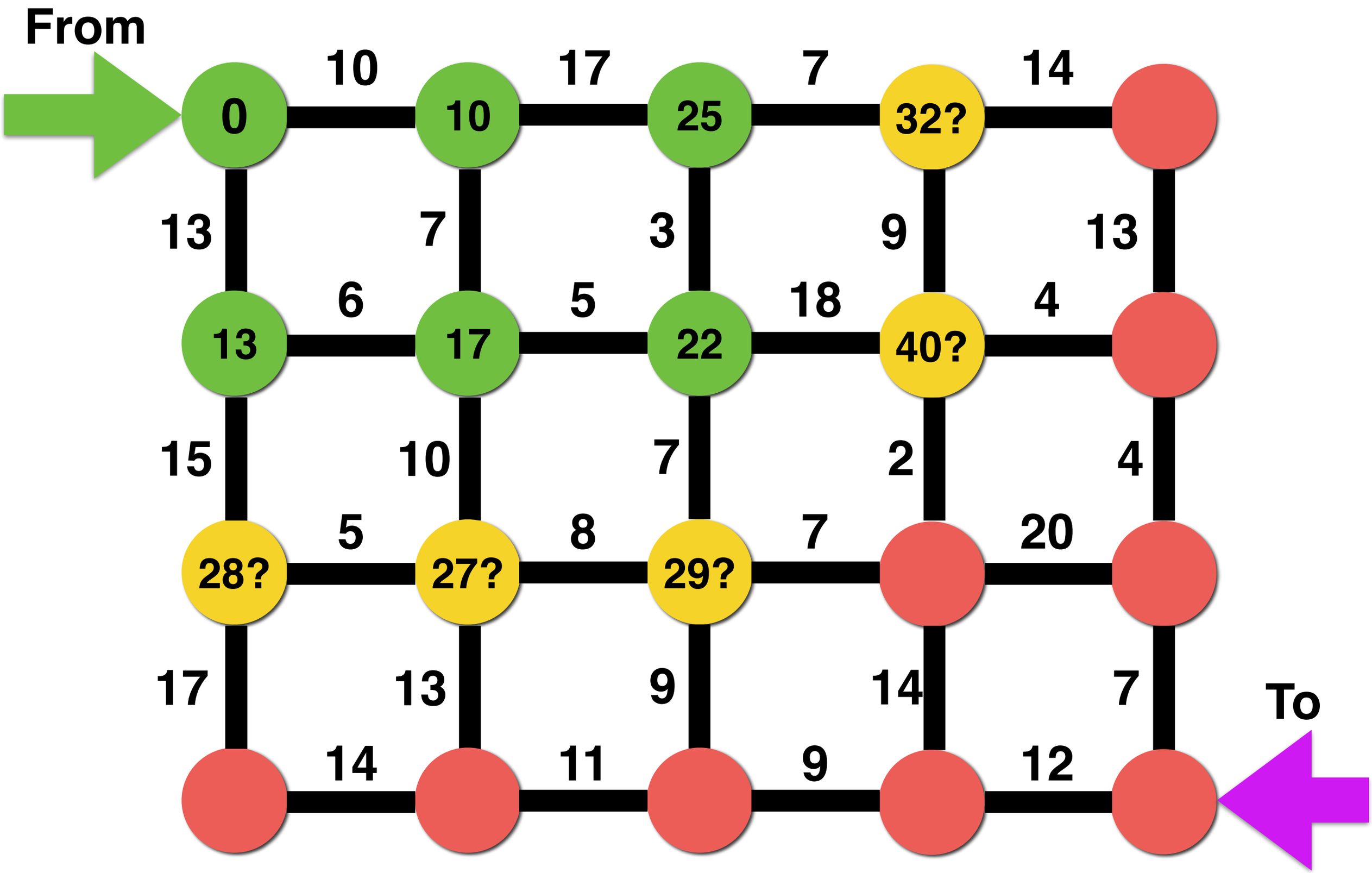
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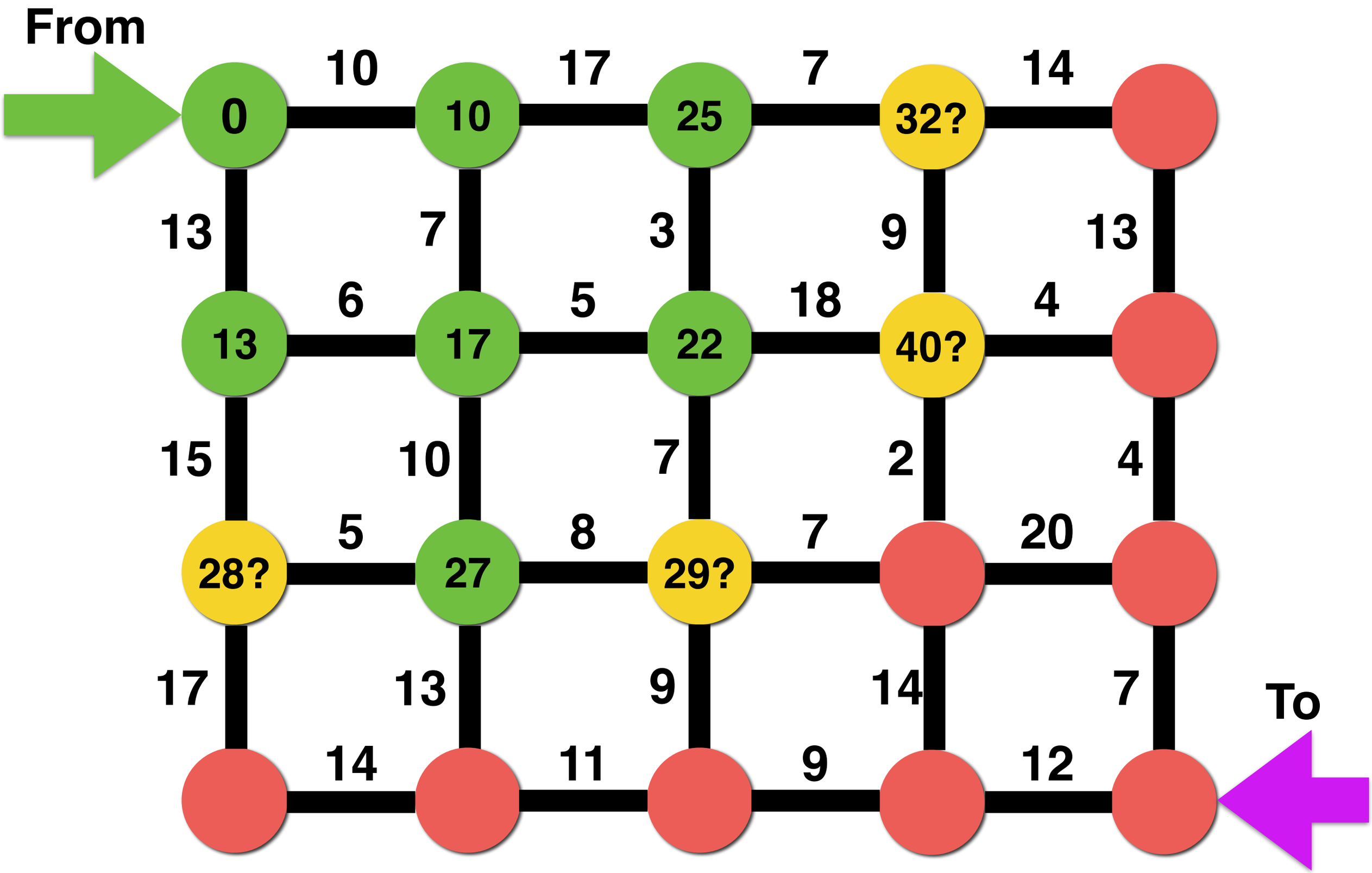
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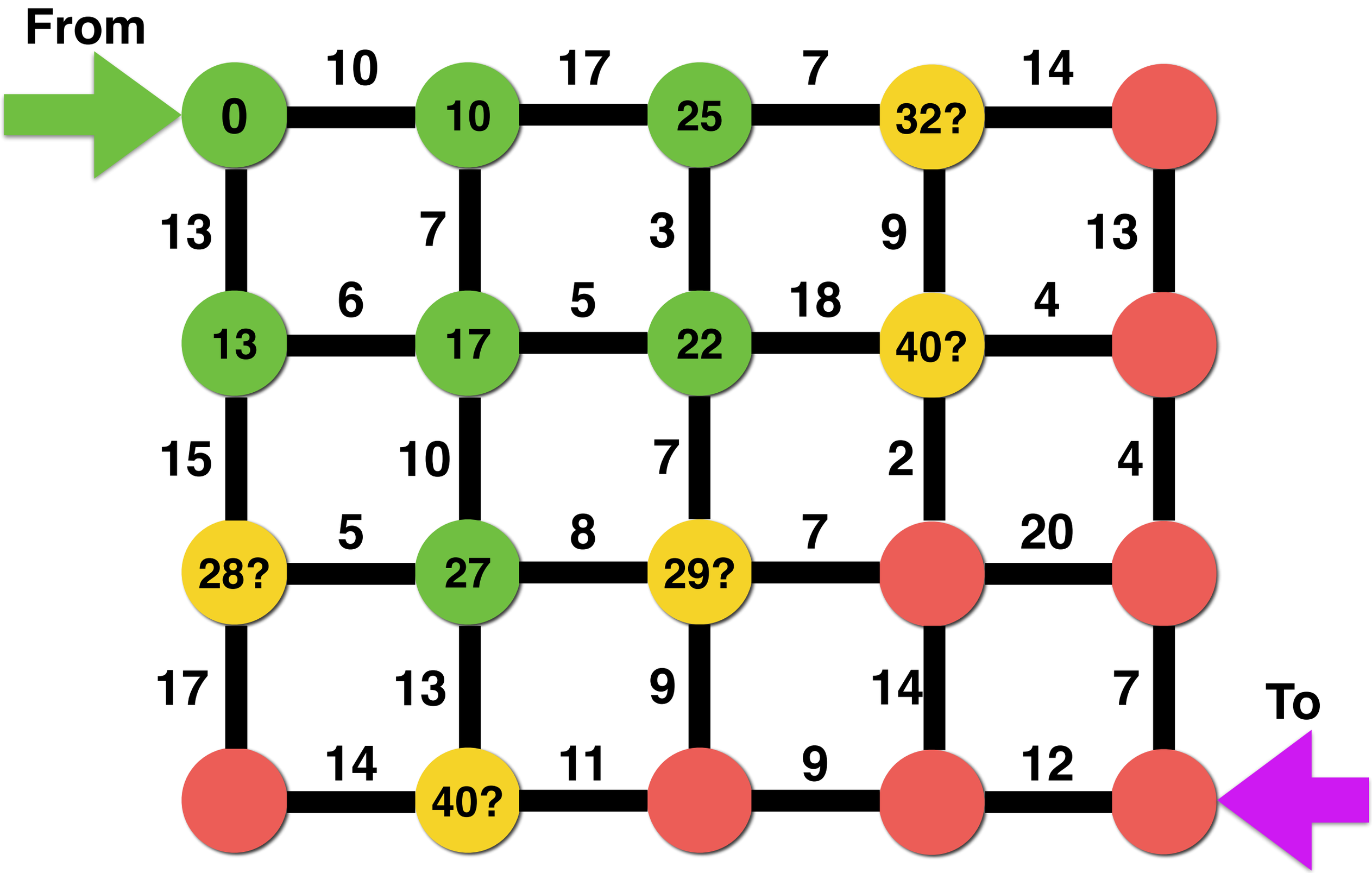
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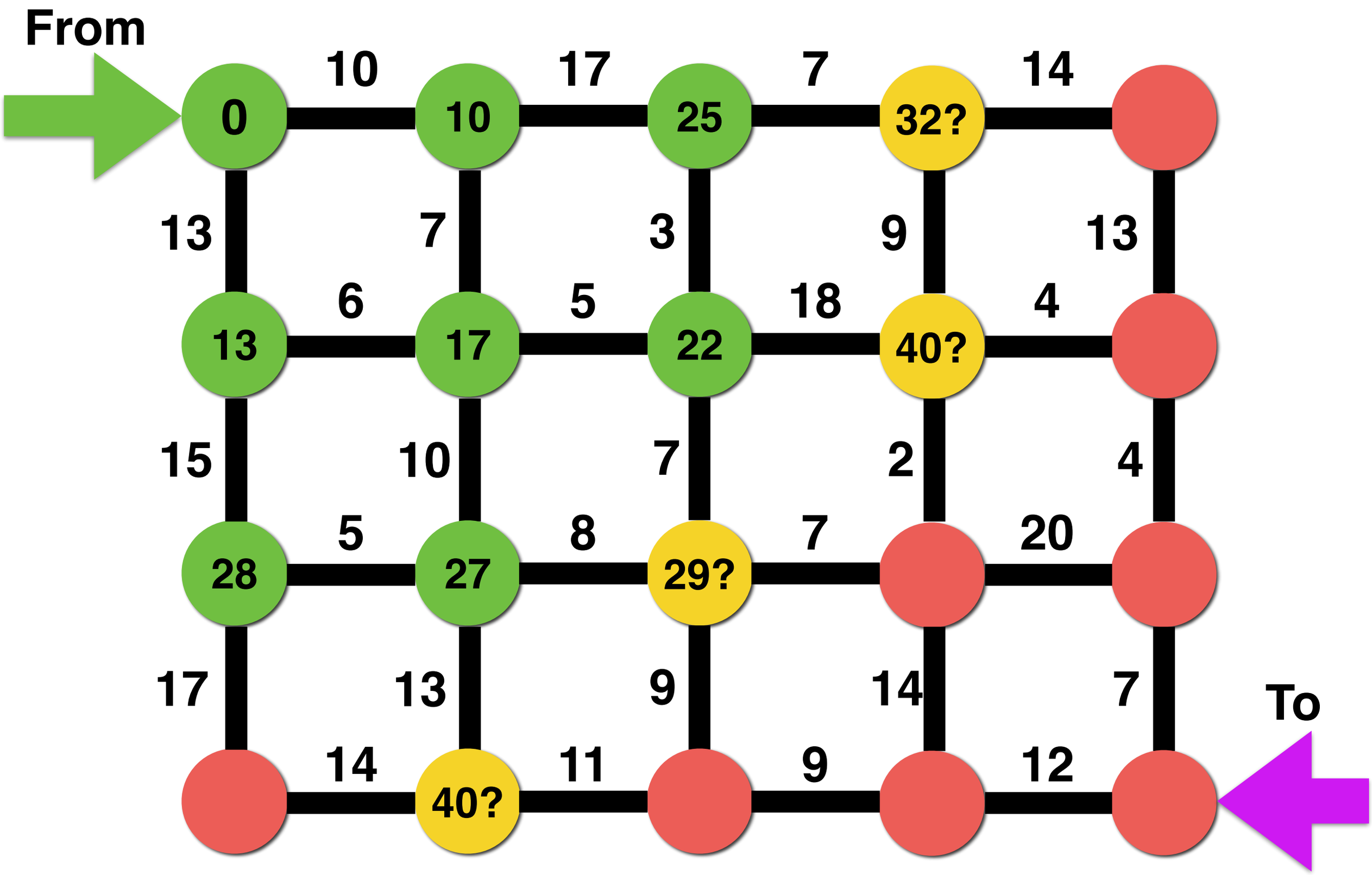
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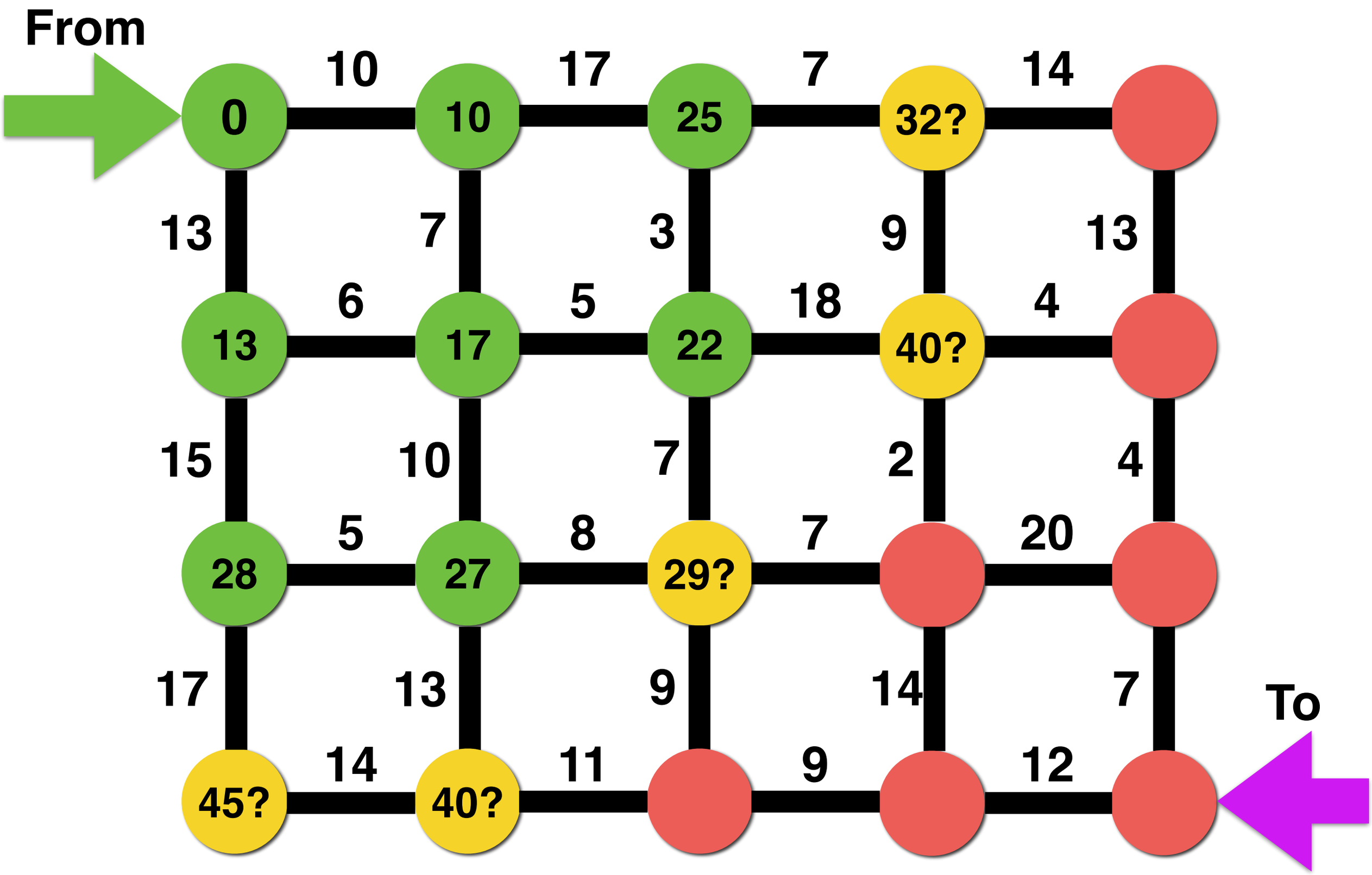
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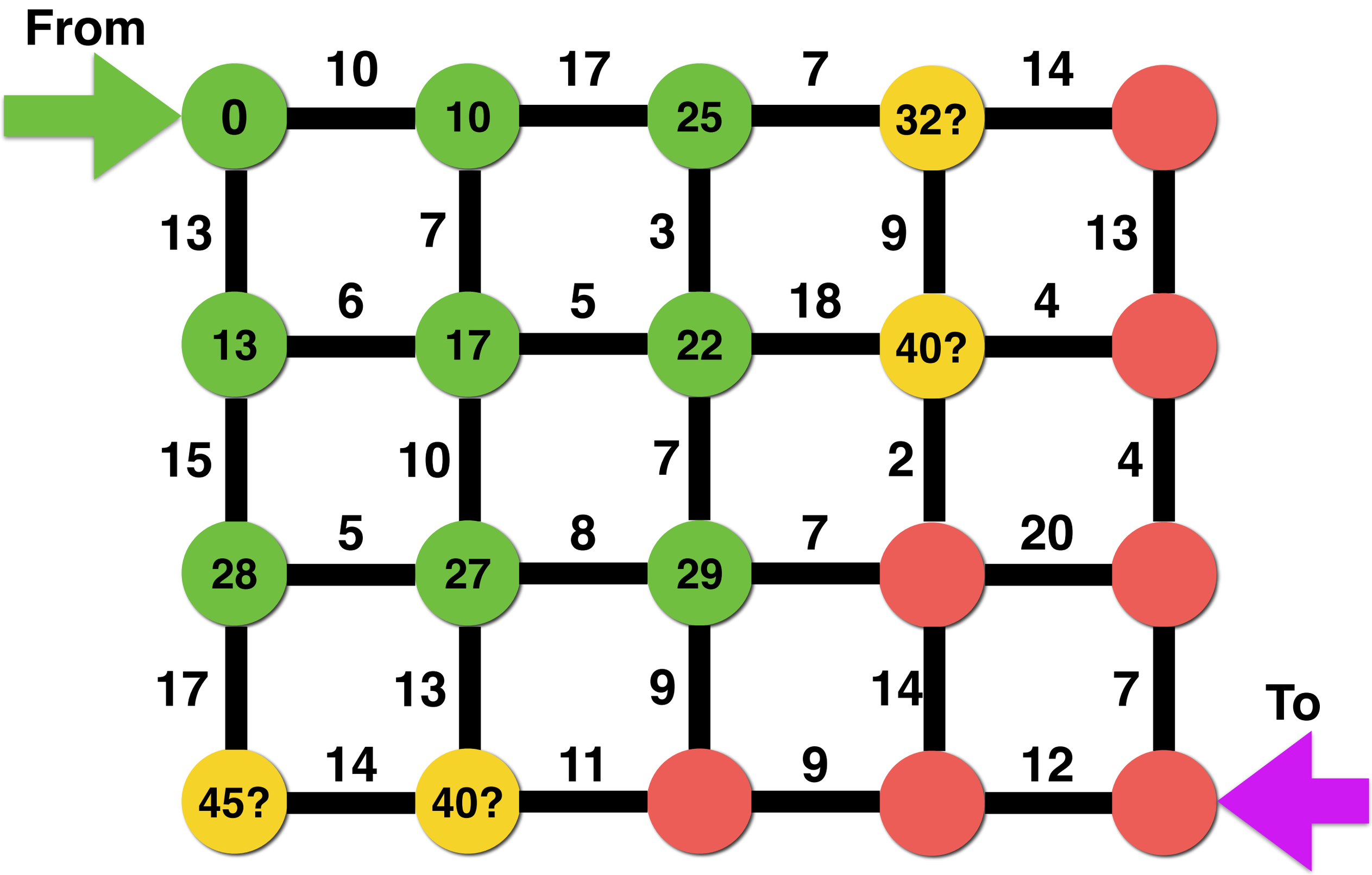
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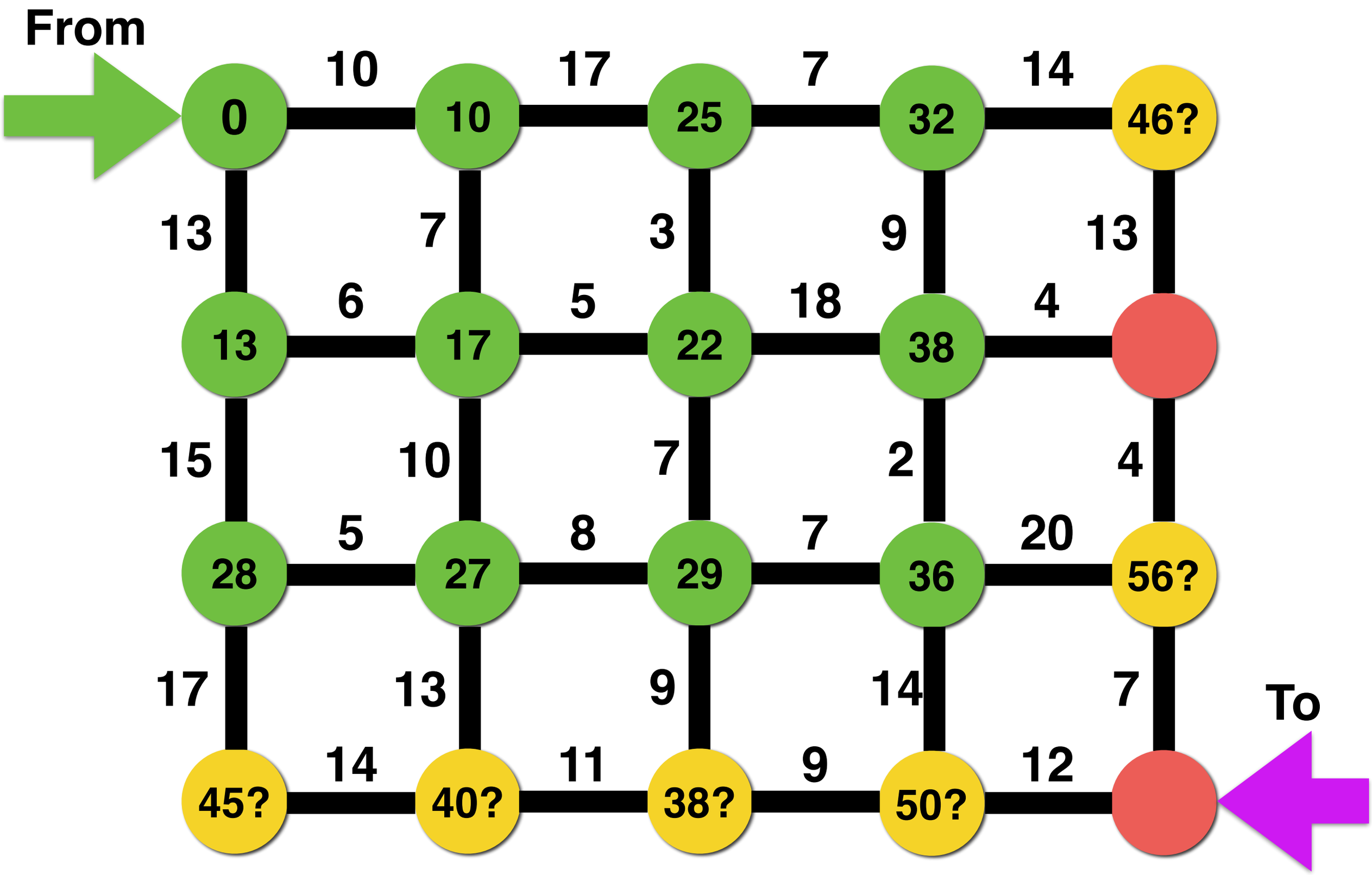
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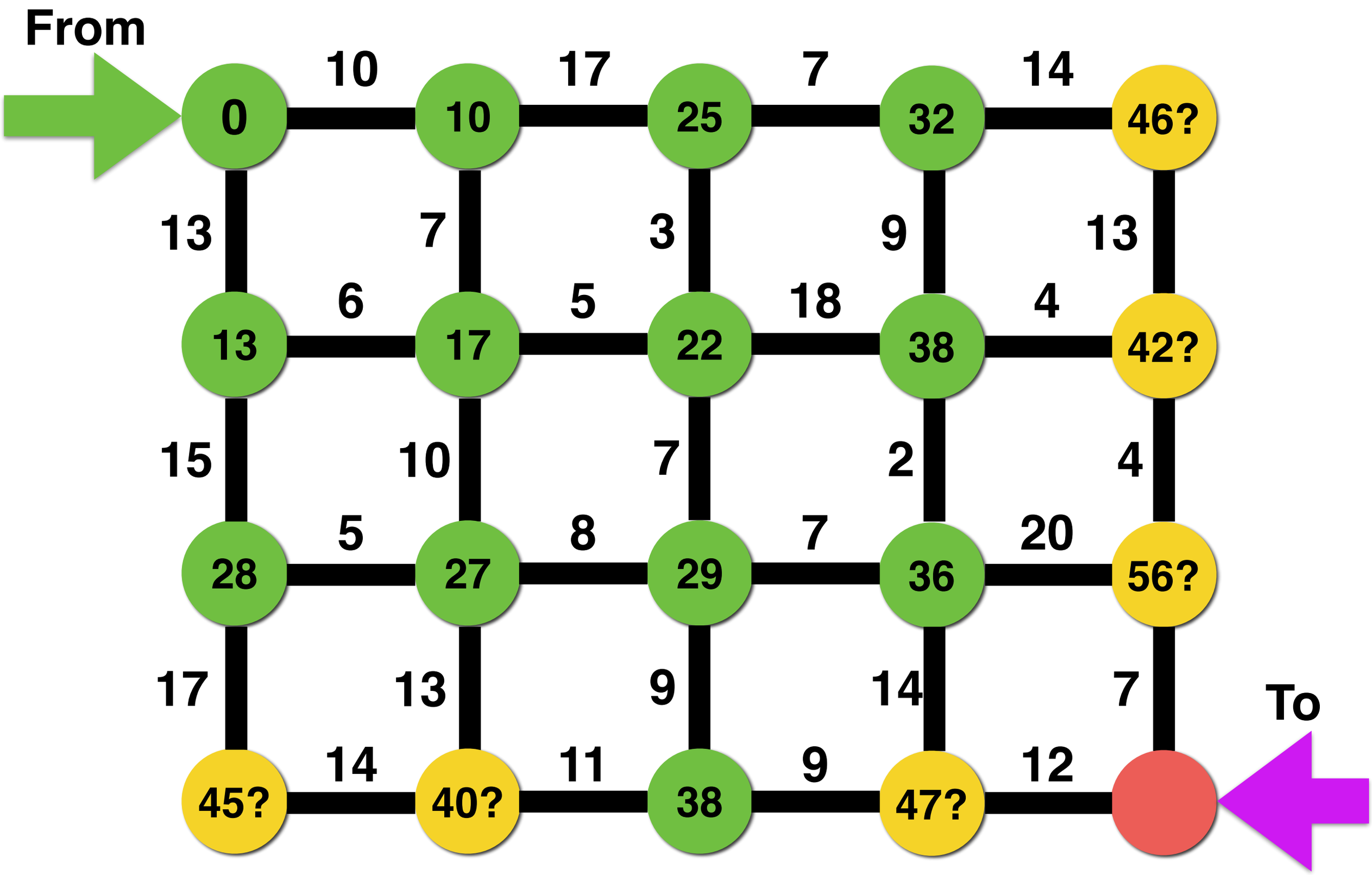
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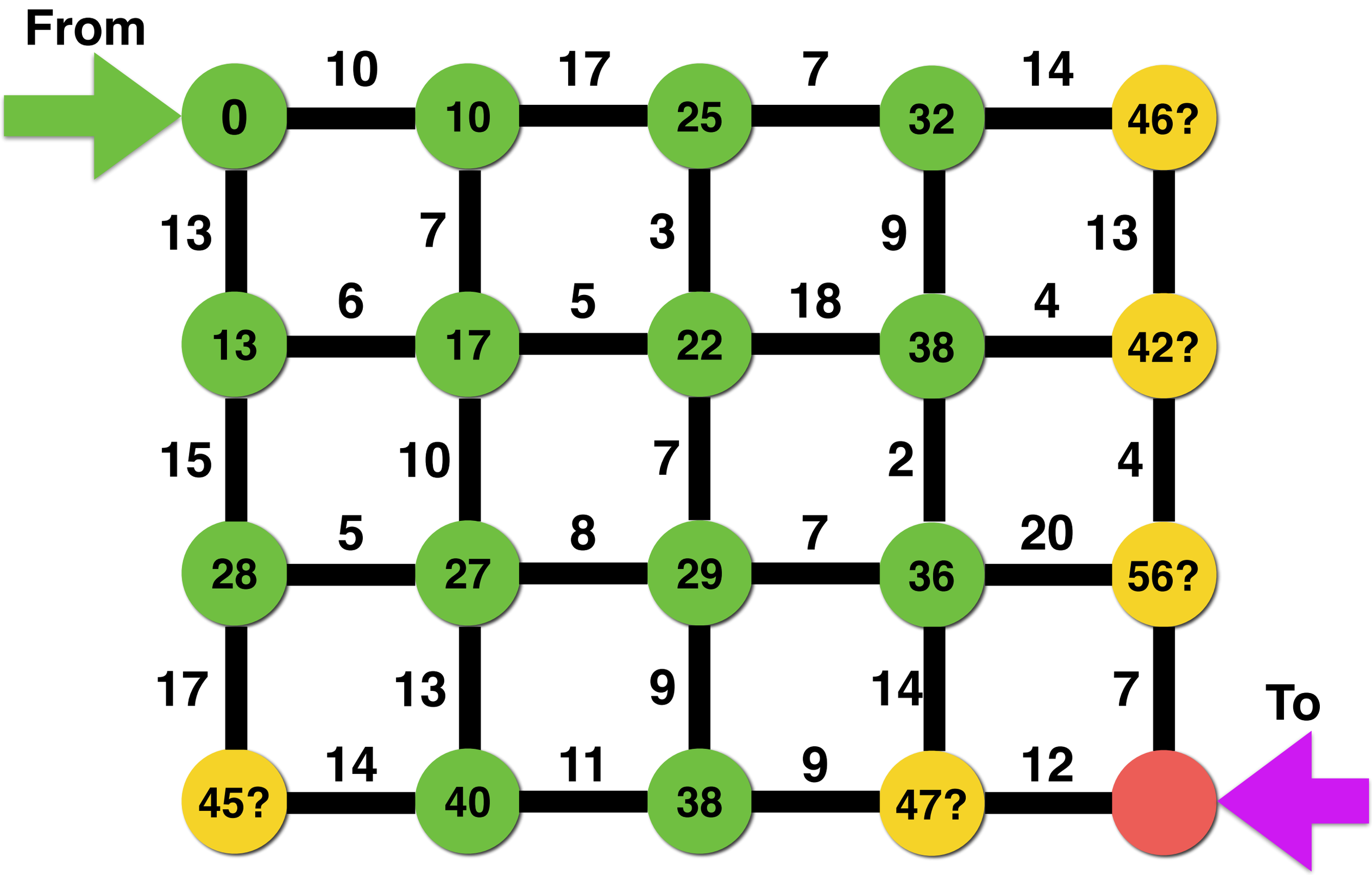
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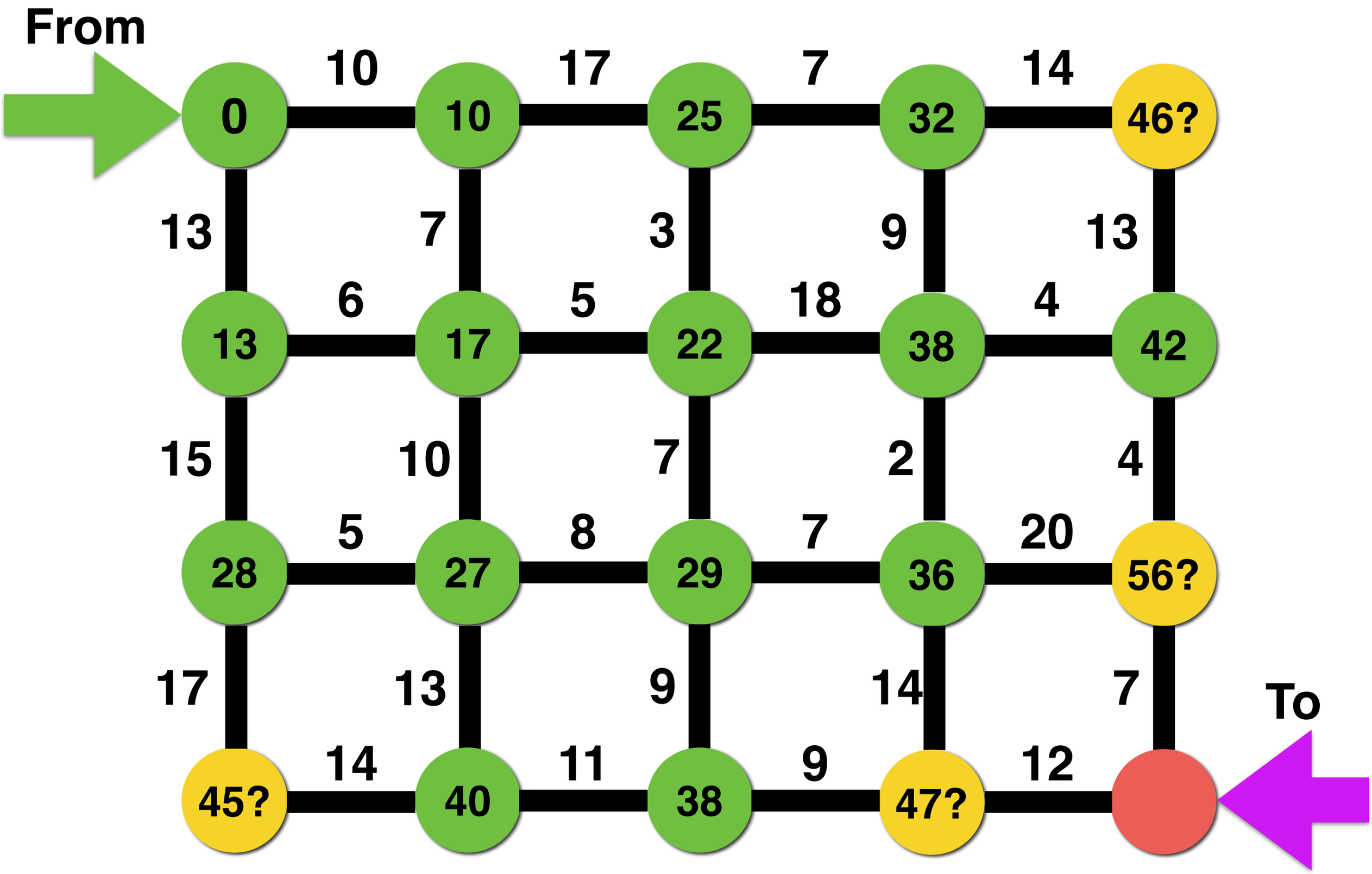
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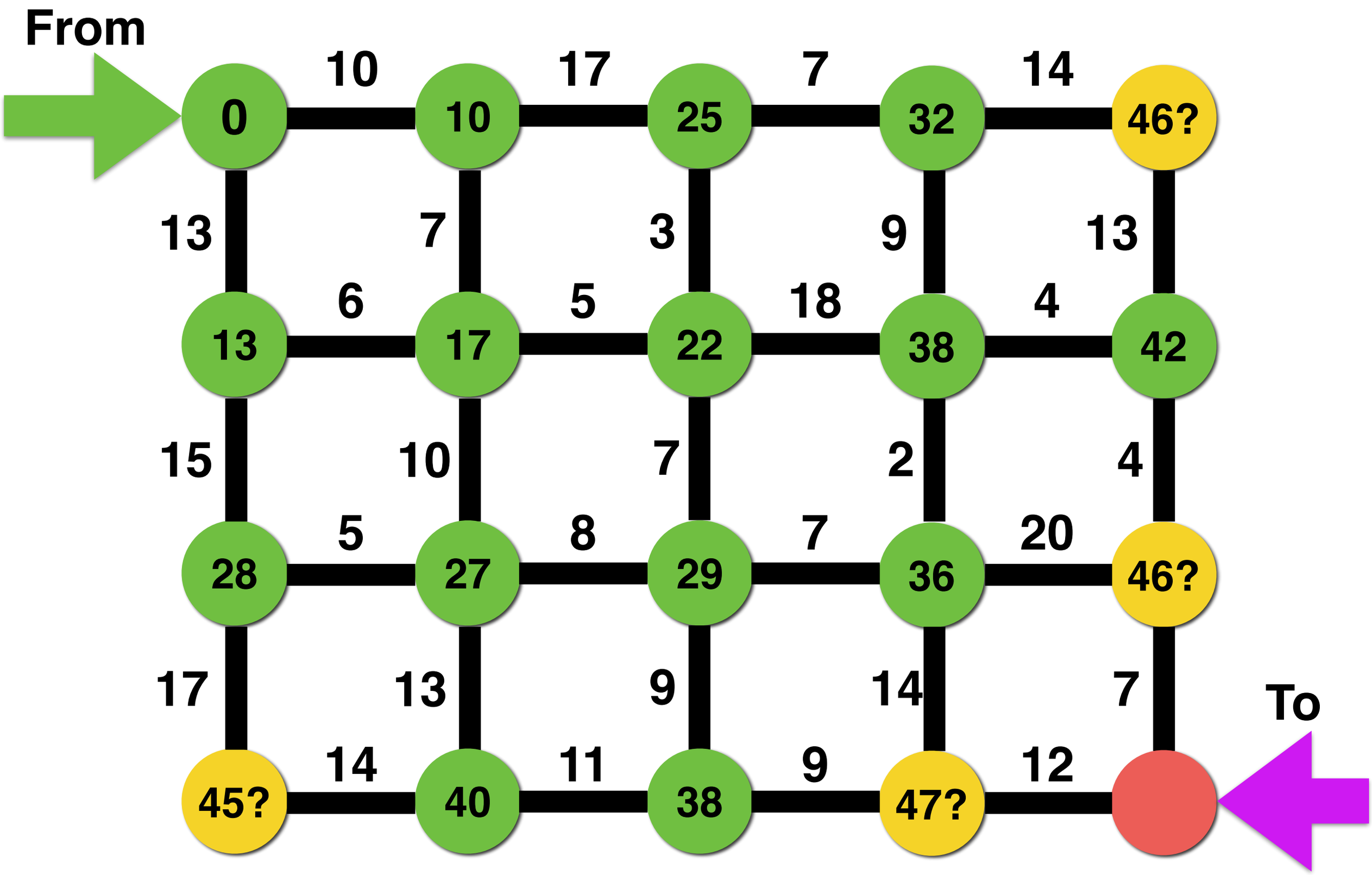
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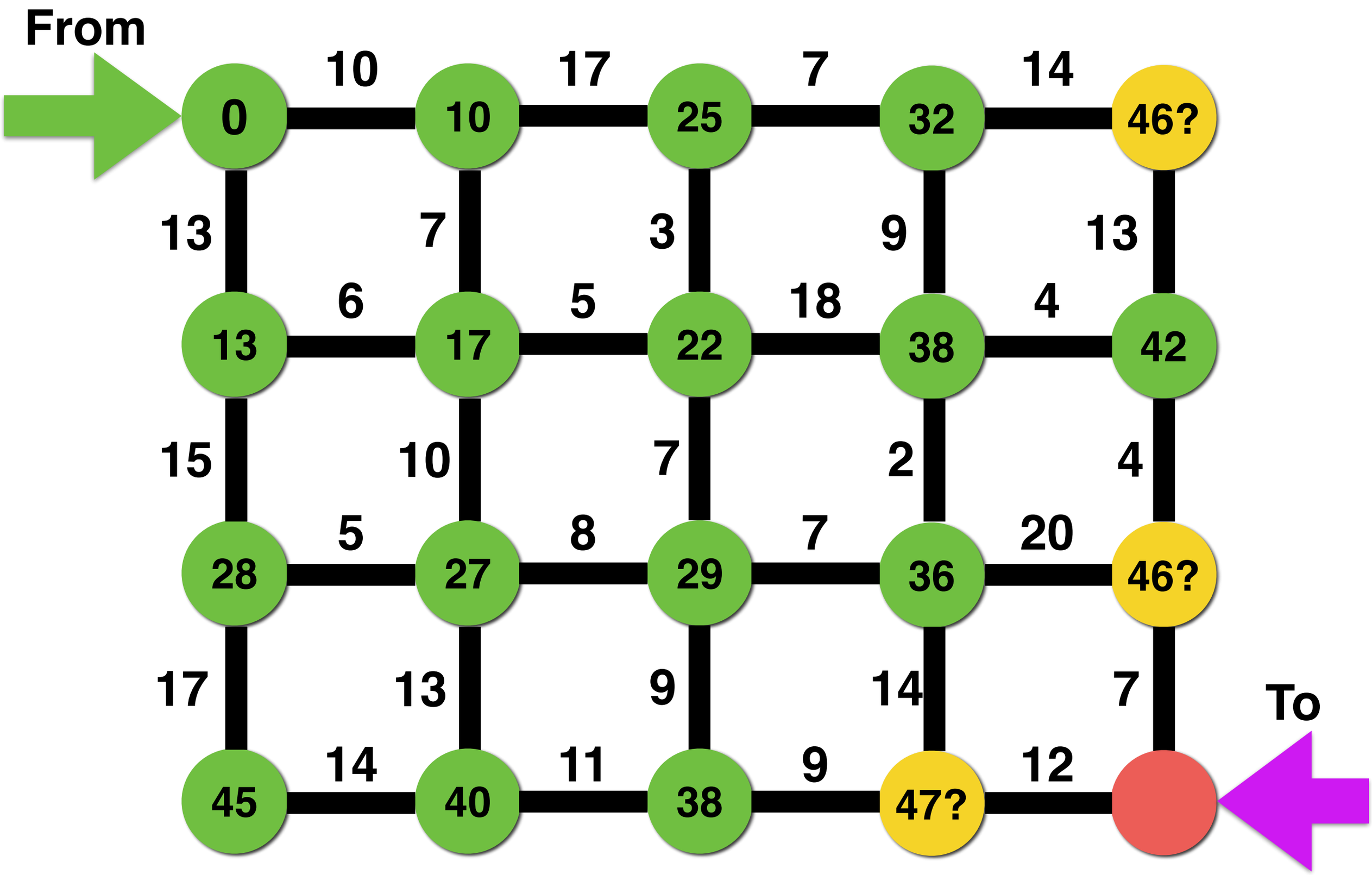
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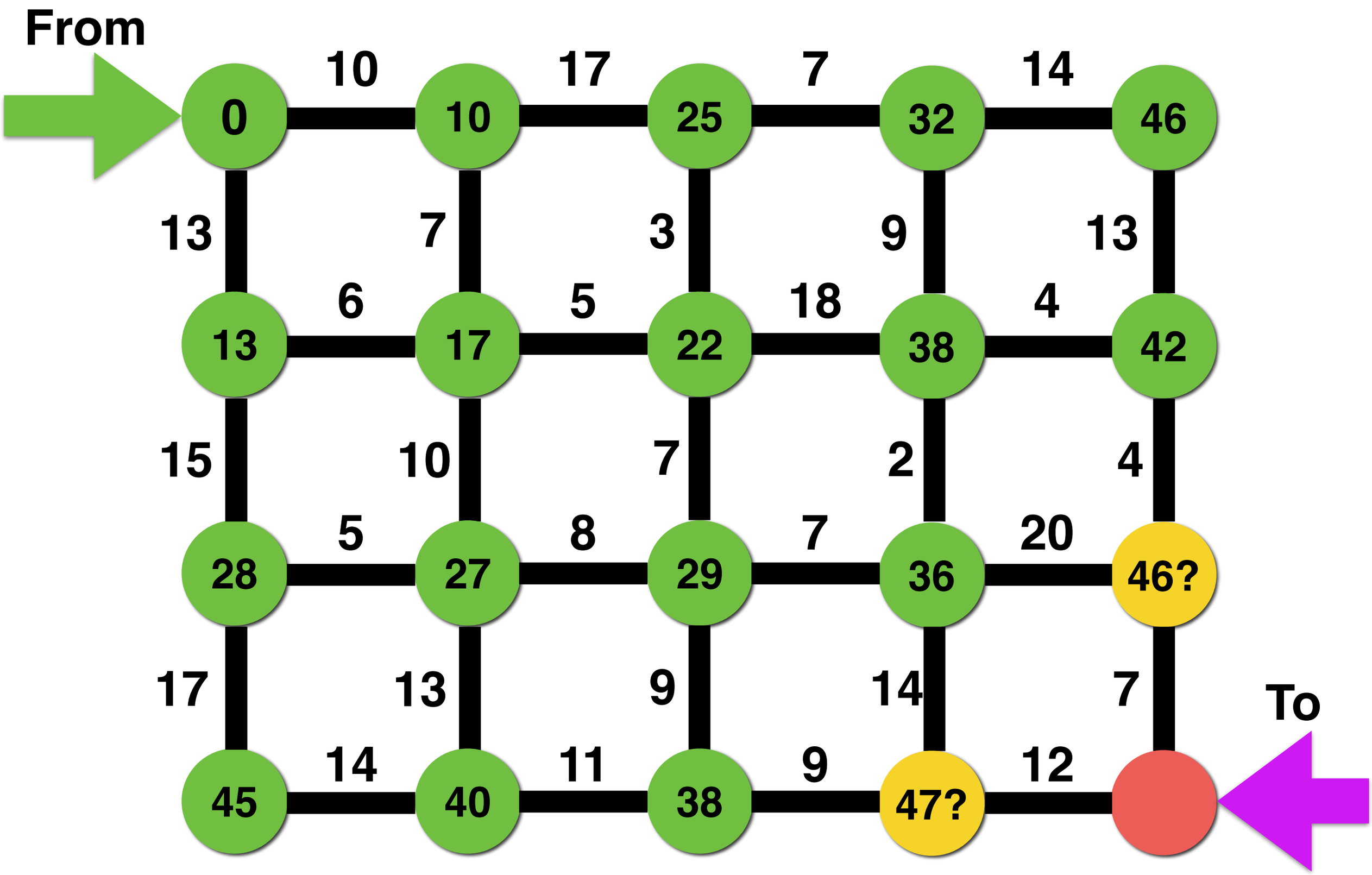
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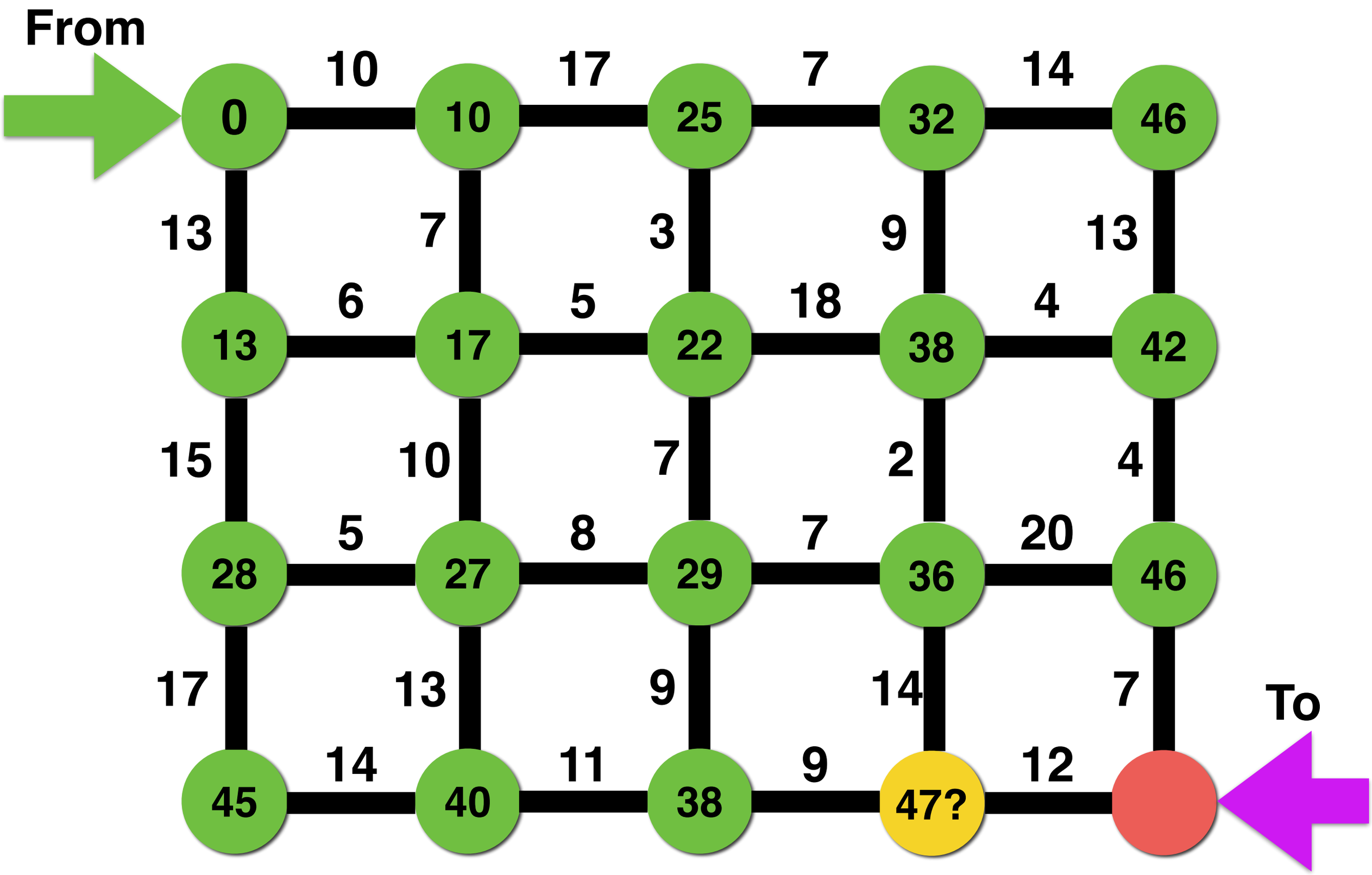
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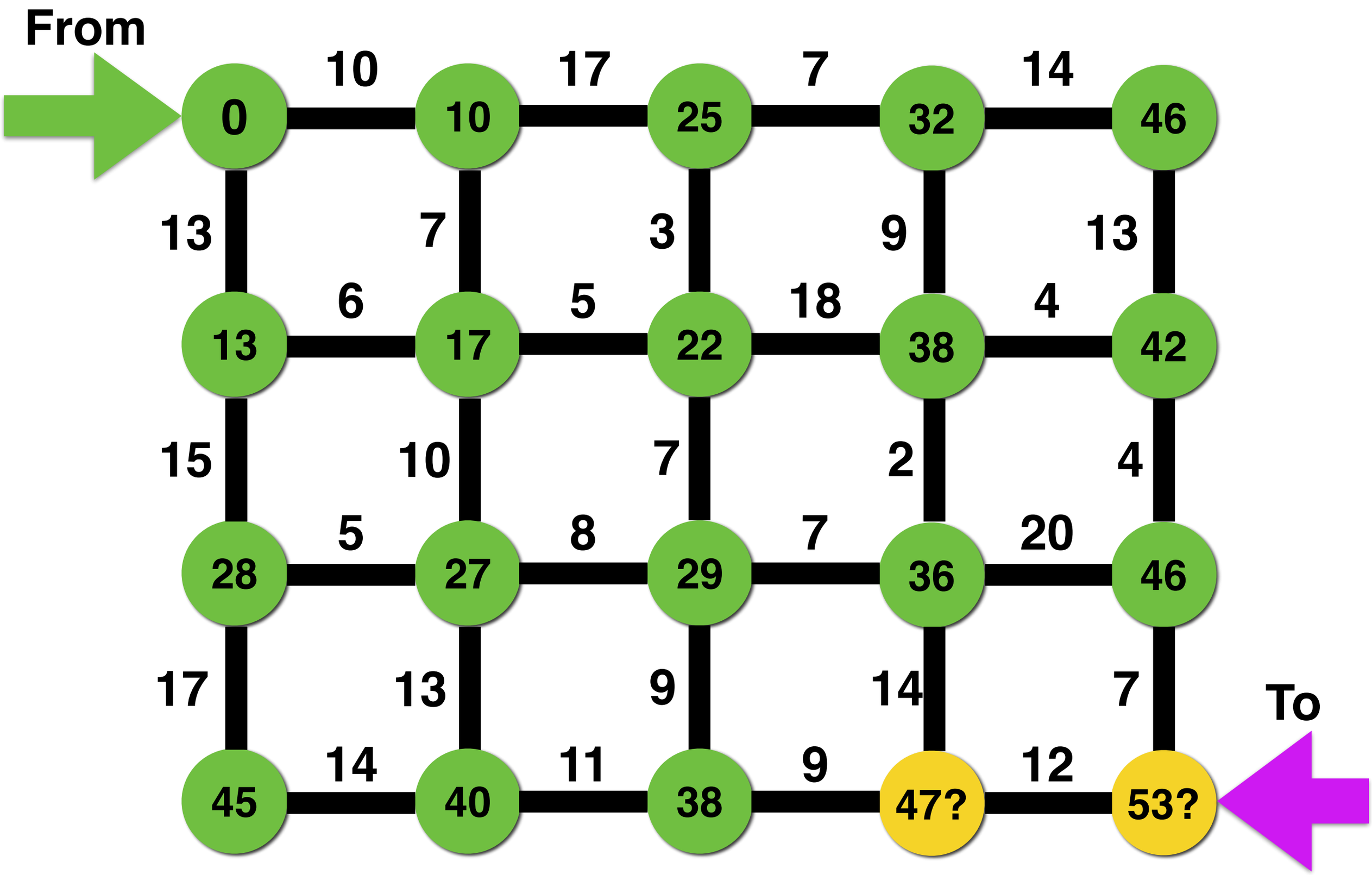
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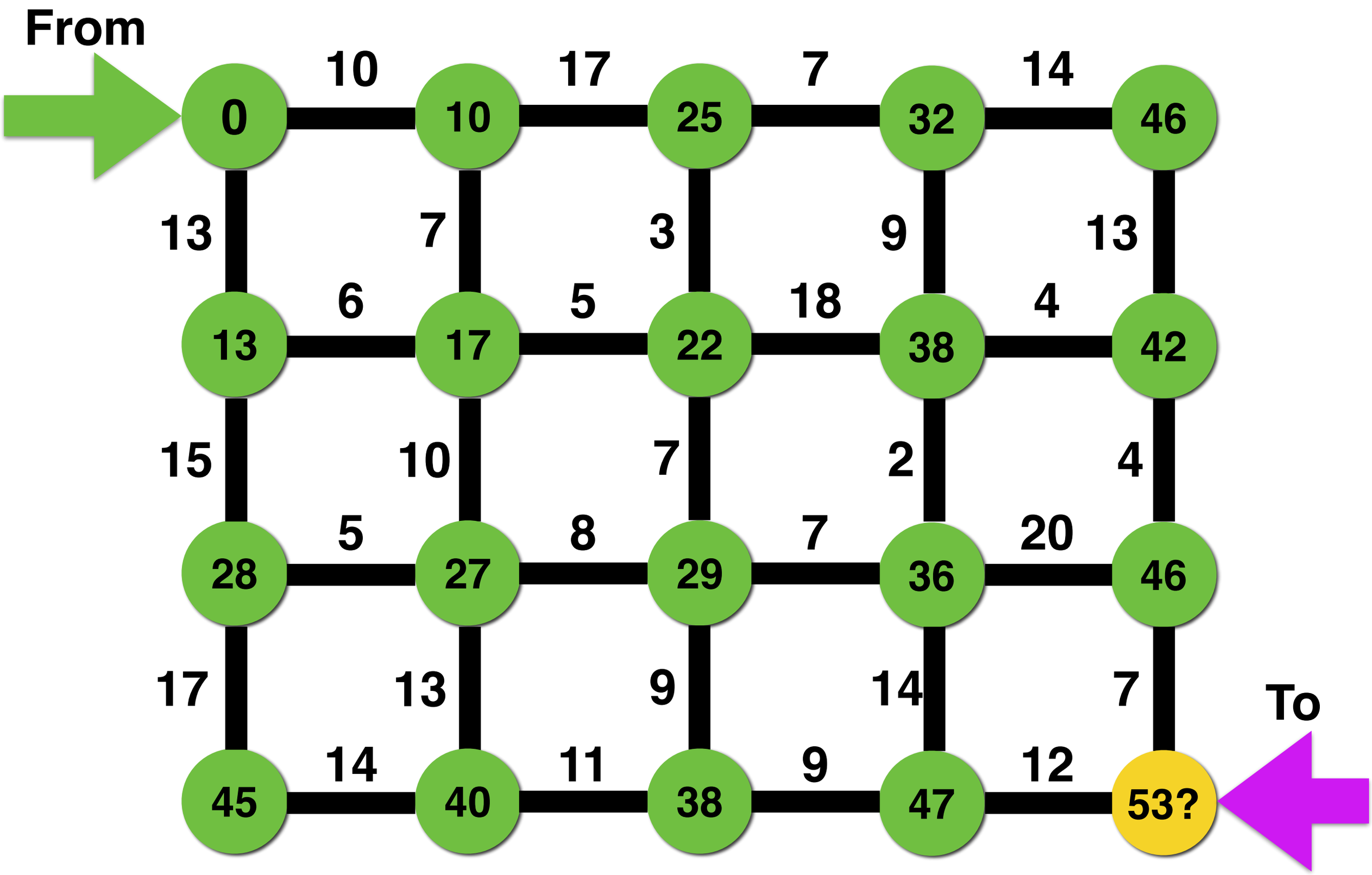
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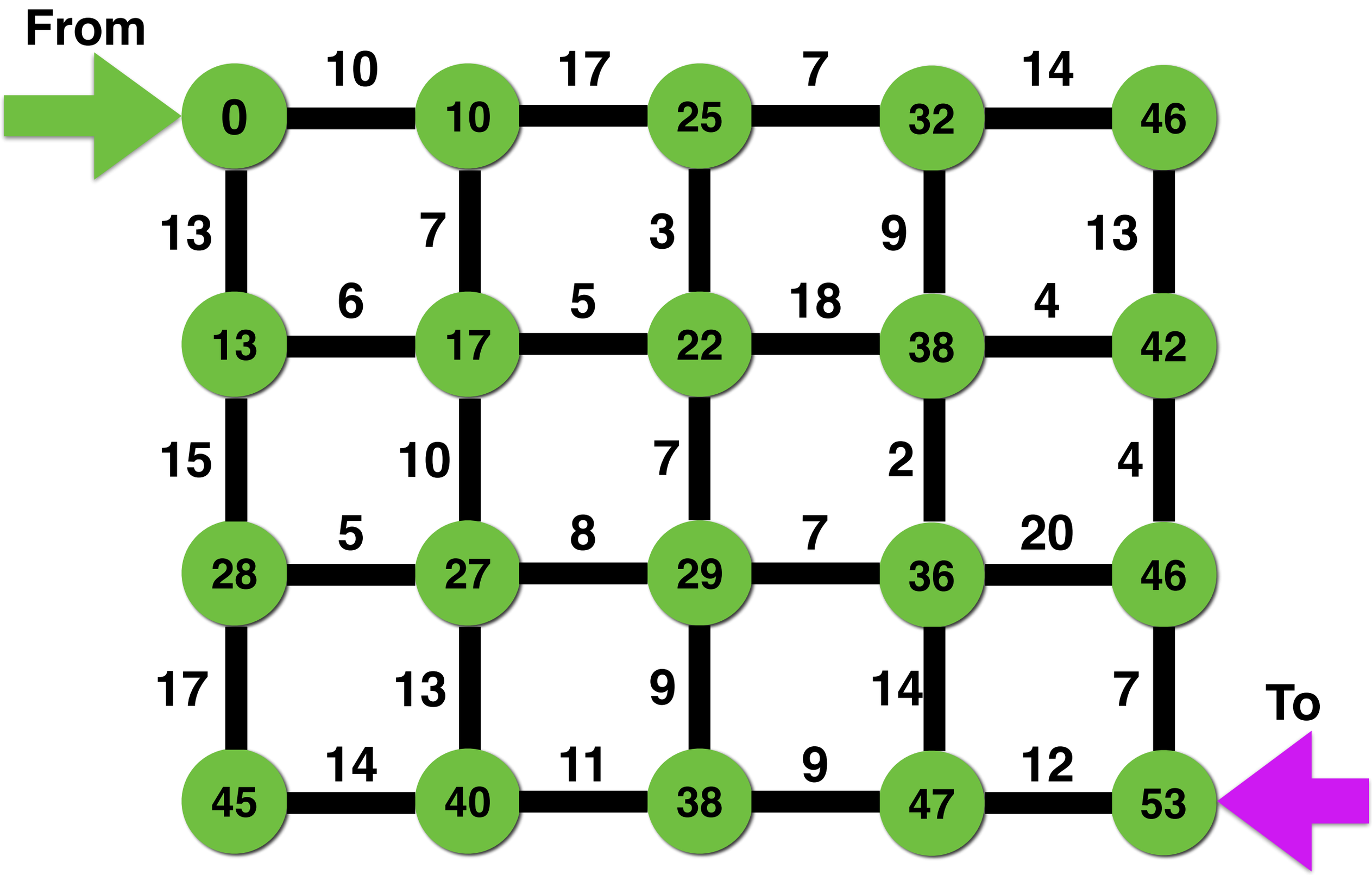
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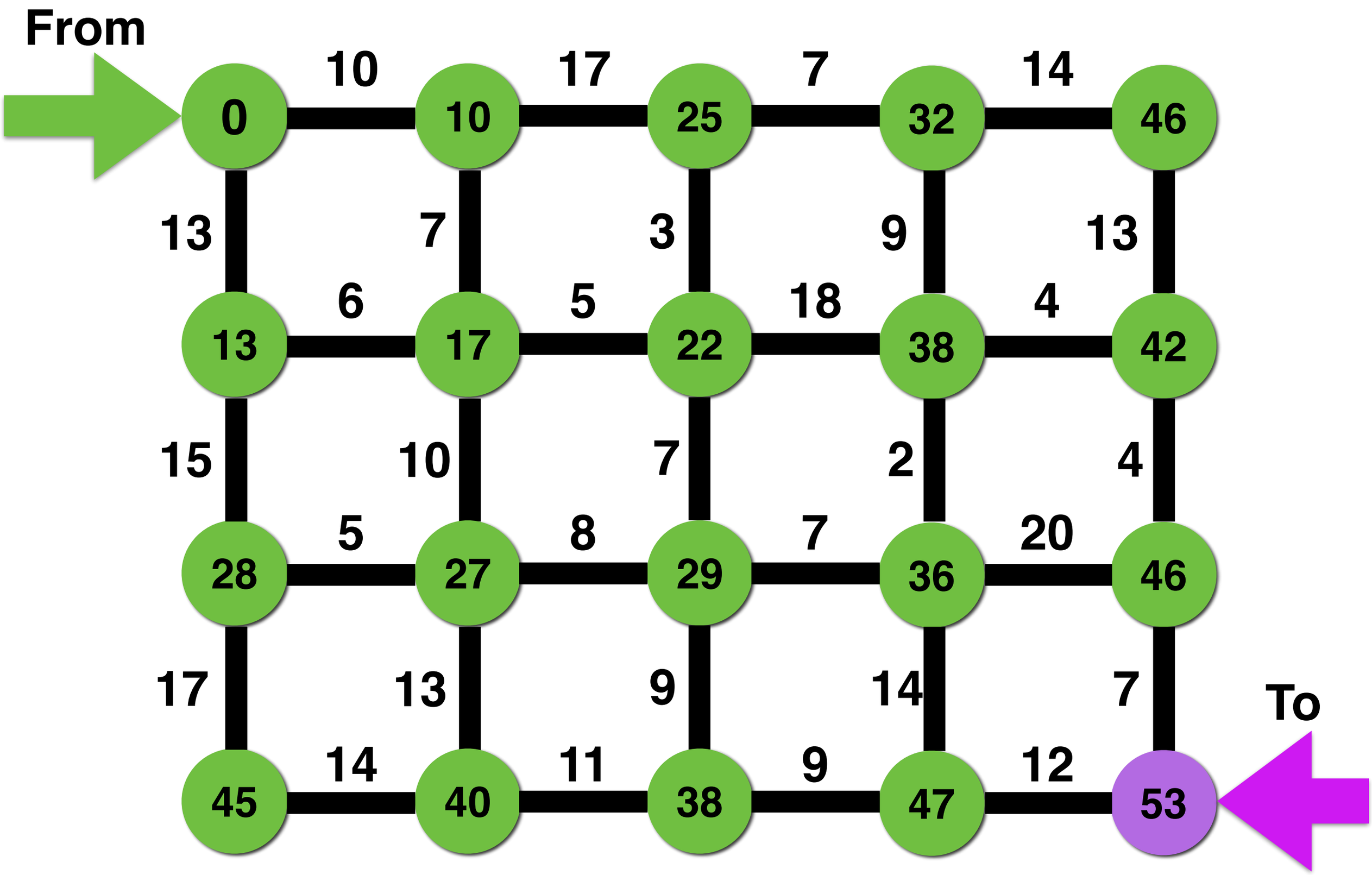
Dijkstra’s Algorithm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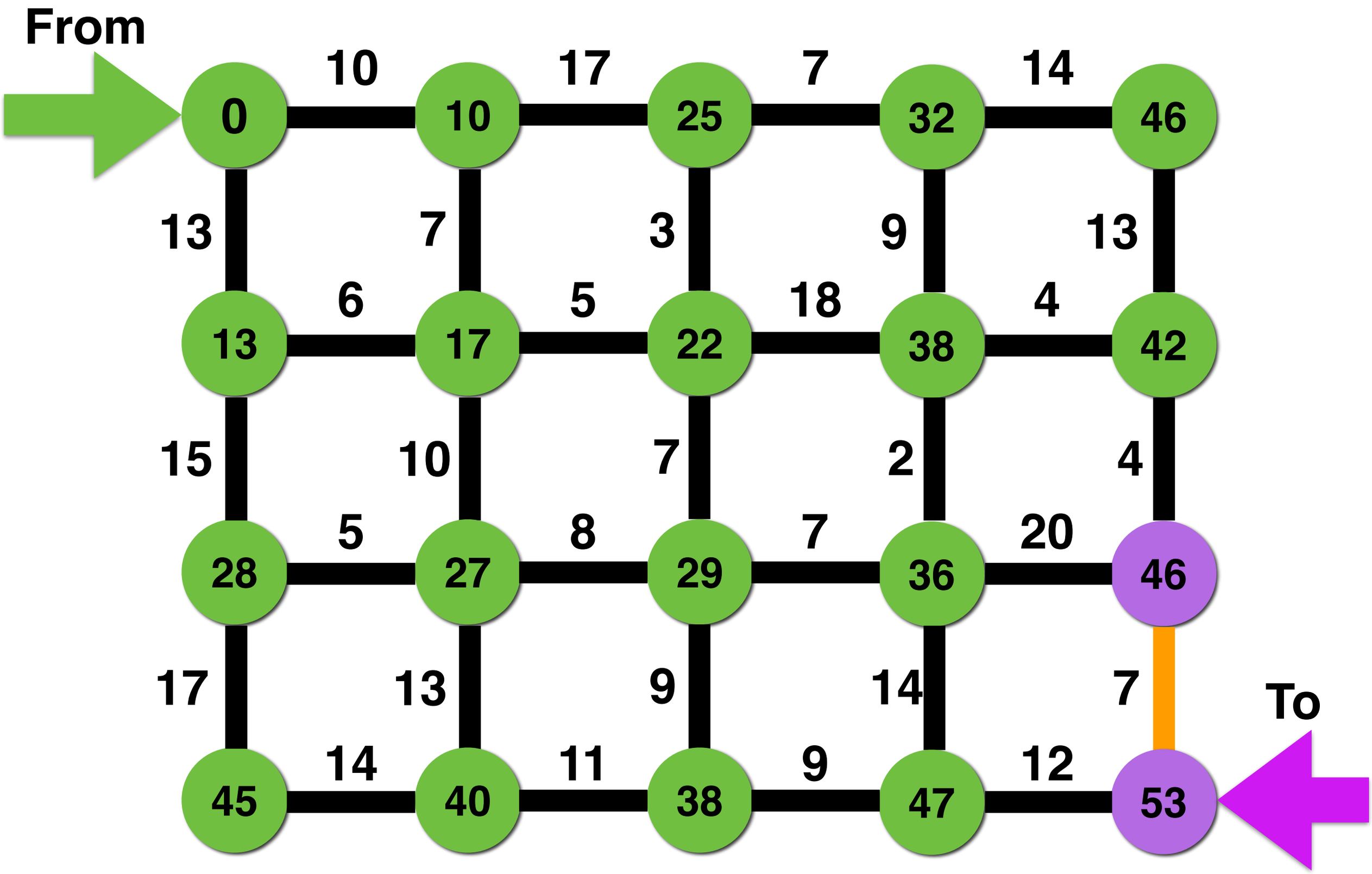
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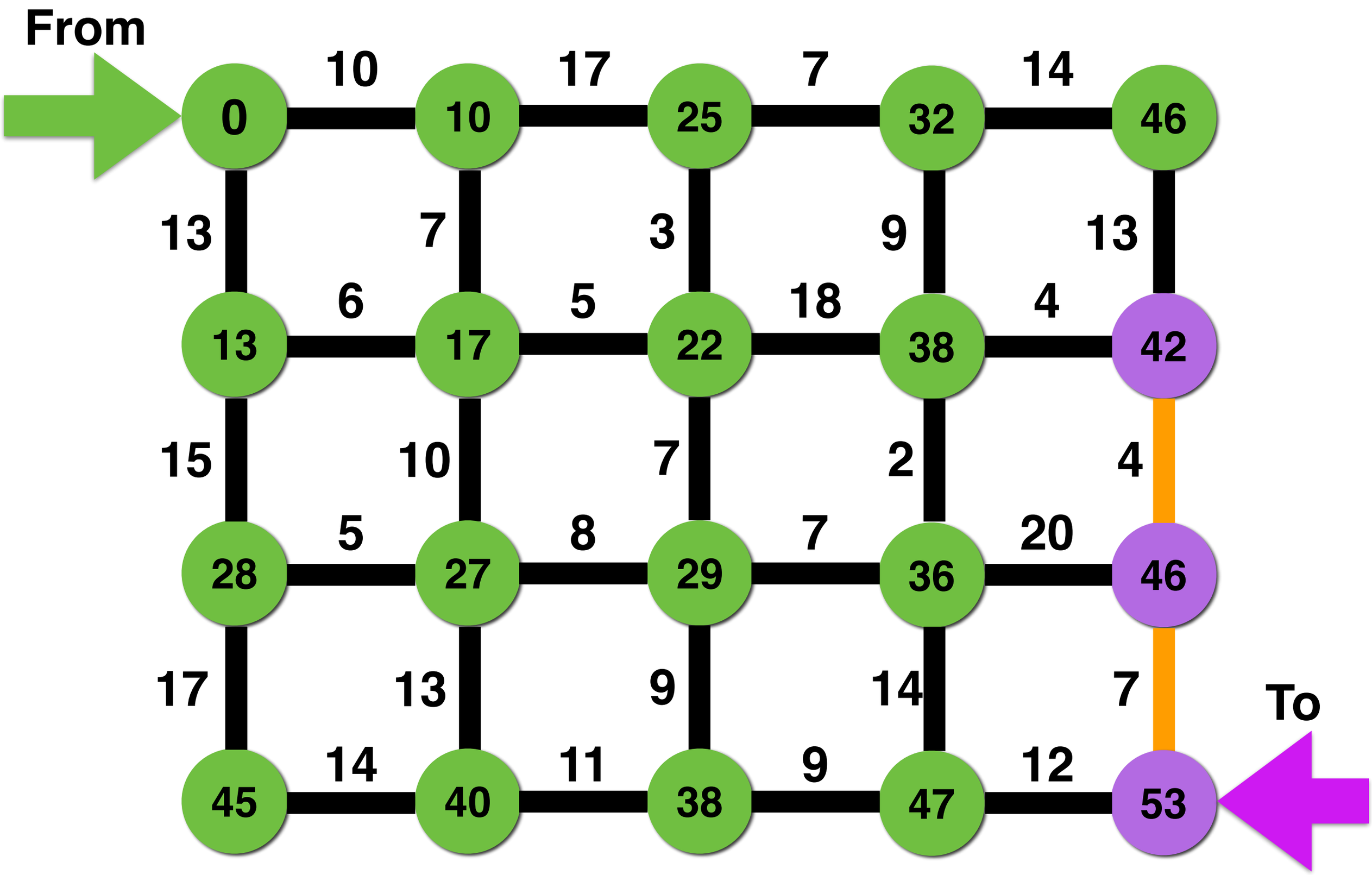
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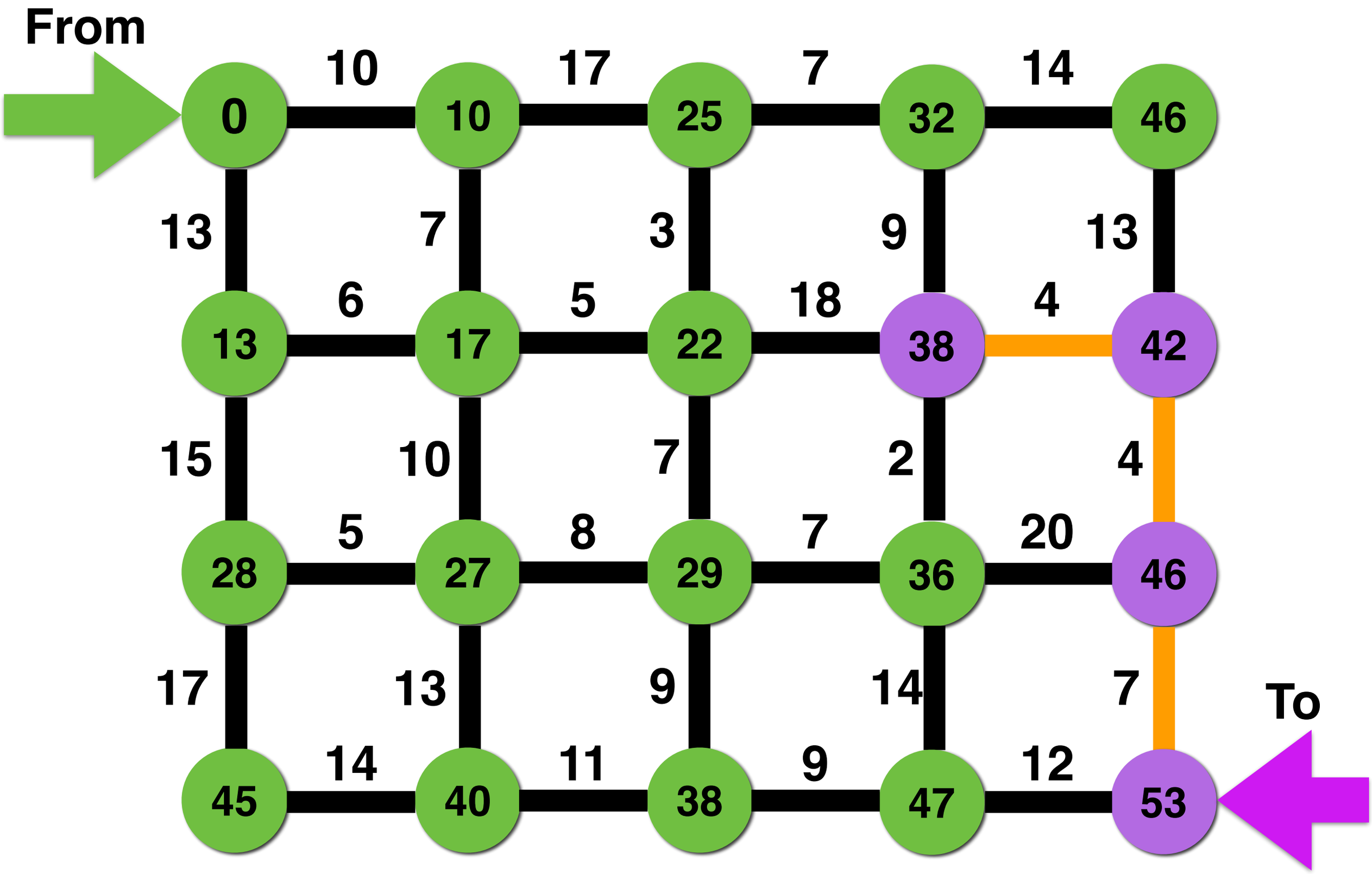
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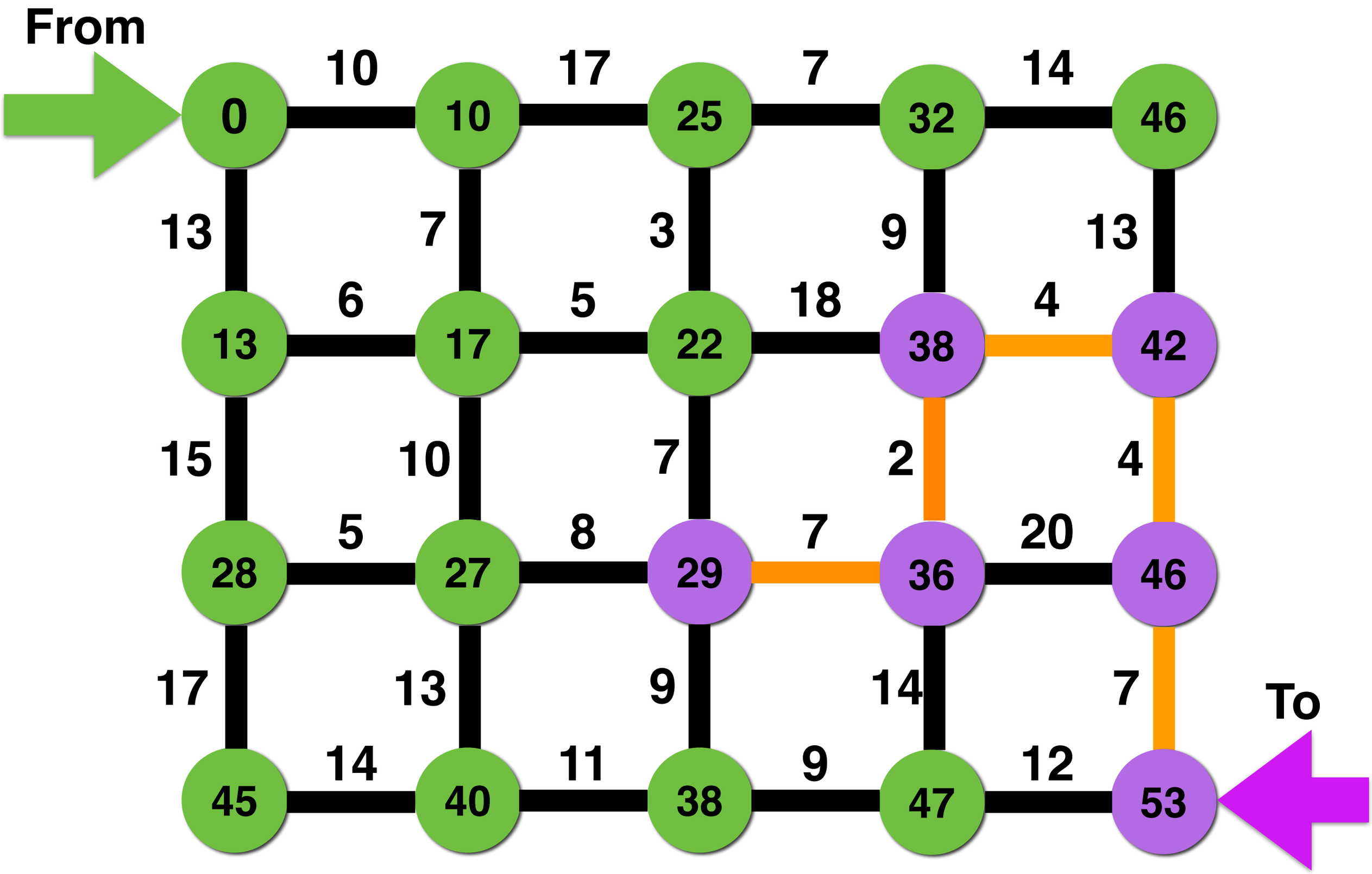
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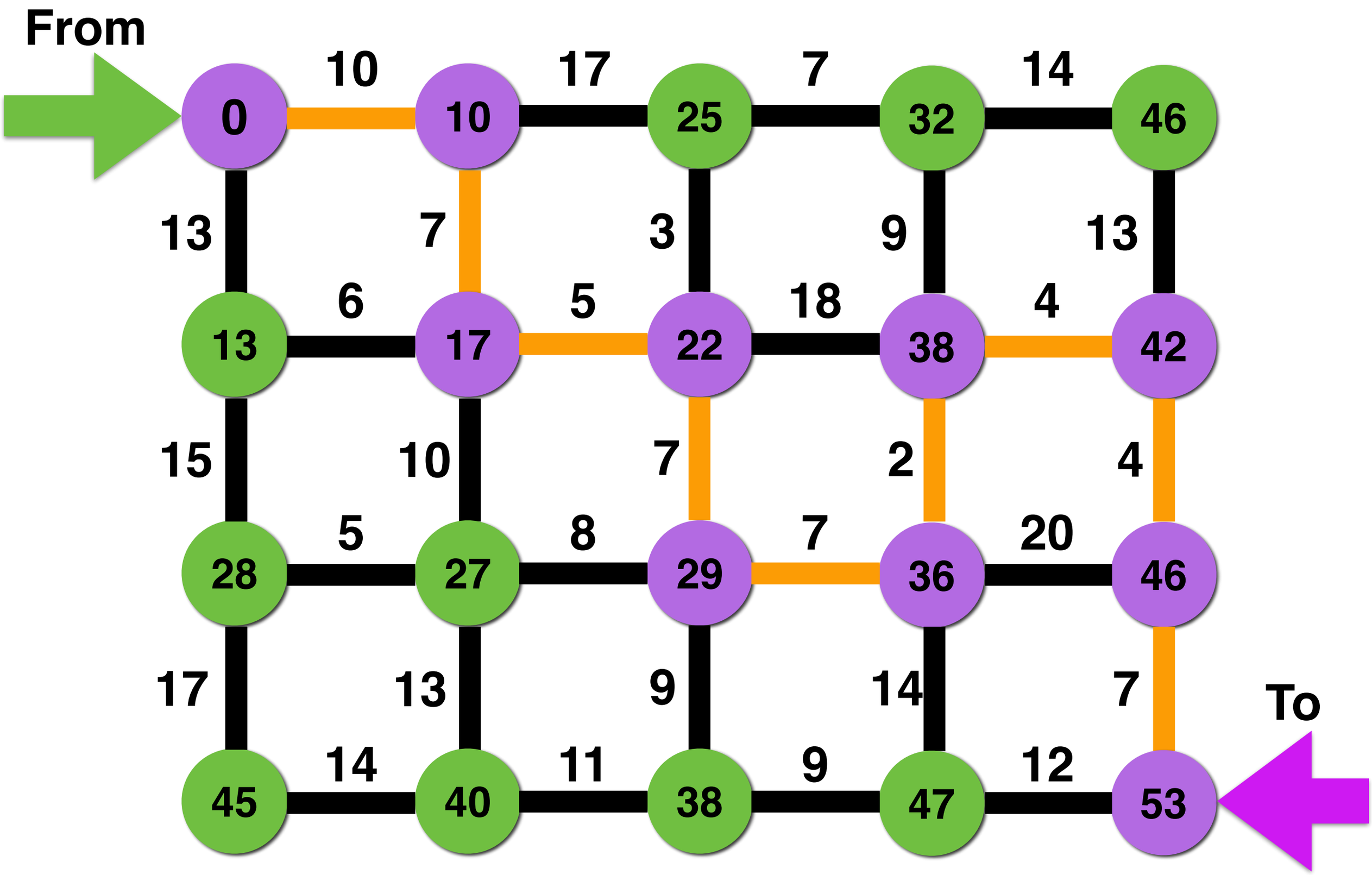
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To

From

a 10 b 17 c 7 d 14 e

13 7 3 9 13

f 6 g 5 h 18 i 4 j

15 10 7 2 4

k 5 l 8 m 7 n 20 o

17 13 9 14 7

p 14 q 11 r 9 s 12 t

To

Pseudocode

```
dist[s] ←o                                  (distance to source vertex is zero)
for  all v ∈ V–{s}
      do  dist[v] ←∞                        (set all other distances to infinity)
S←∅                                         (S, the set of visited vertices is initially empty)
Q←V                                         (Q, the queue initially contains all vertices)
while Q ≠∅                                  (while the queue is not empty)
do   u ← mindistance(Q,dist)                (select the element of Q with the min. distance)
     S←S∪{u}                                (add u to list of visited vertices)
      for all v ∈ neighbors[u]
            do  if   dist[v] > dist[u] + w(u, v)        (if new shortest path found)
                  then     d[v] ←d[u] + w(u, v)         (set new value of shortest path)
                                                        (if desired, add traceback code)

return dist
```

Reference

(1) http://web.stanford.edu/class/cs106b
(2) http://computer.howstuffworks.com/google-algorithm.htm
(3) http://fortune.com/2012/07/30/amazons-recommendation-secret/
(4) https://en.wikipedia.org/wiki/Dijkstra%27s_algorithm