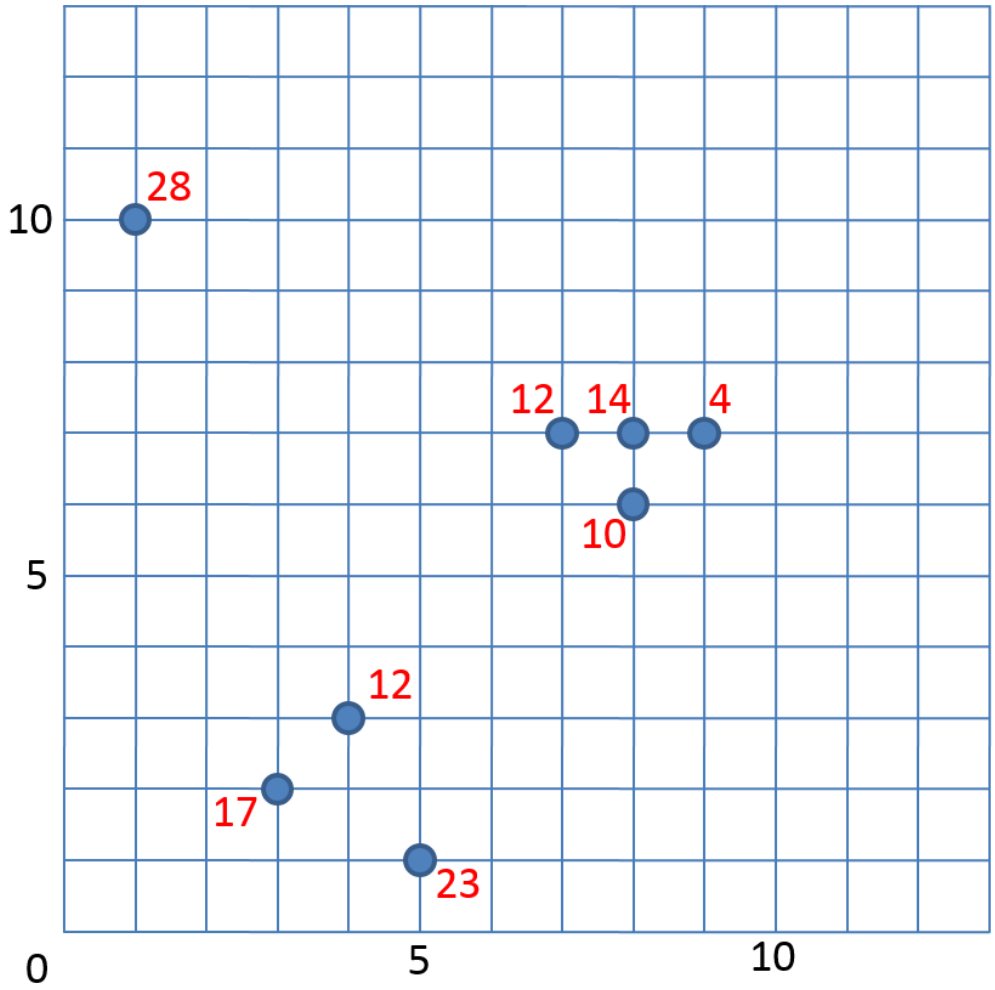
Exercise 9-2 *Spatial Outlier Detection*

In the following relevant spatial positions (e.g. starting positions in an FPS or frequent camp positions in an MMORPG) are given. For every position a score is given additionally which depicts semantic information about the quality of the position (e.g. the average number of frags in an FPS or the average count of EP/coins per hour in an MMORPG).



Parameters:

k = #neighbors [here: = 2]

m = #(outliers to look for) [here: = 3]

Approach:

a) Compute *kNN*-graph (directed edge from p to q exists if and only if *q* is a *kNN* of *p*) [here: using the euclidean distance]

b) For every edge in the *kNN*-graph calculate its weight [here: the absolute score difference]

c) Beginning with the highest weighted edge, delete edges with descending weights from the graph

d) If a point is isolated (having neihter in- nor out-going edges) after the successive removal of edges, it is an outlier

e) Proceed like that until *m* outliers are found

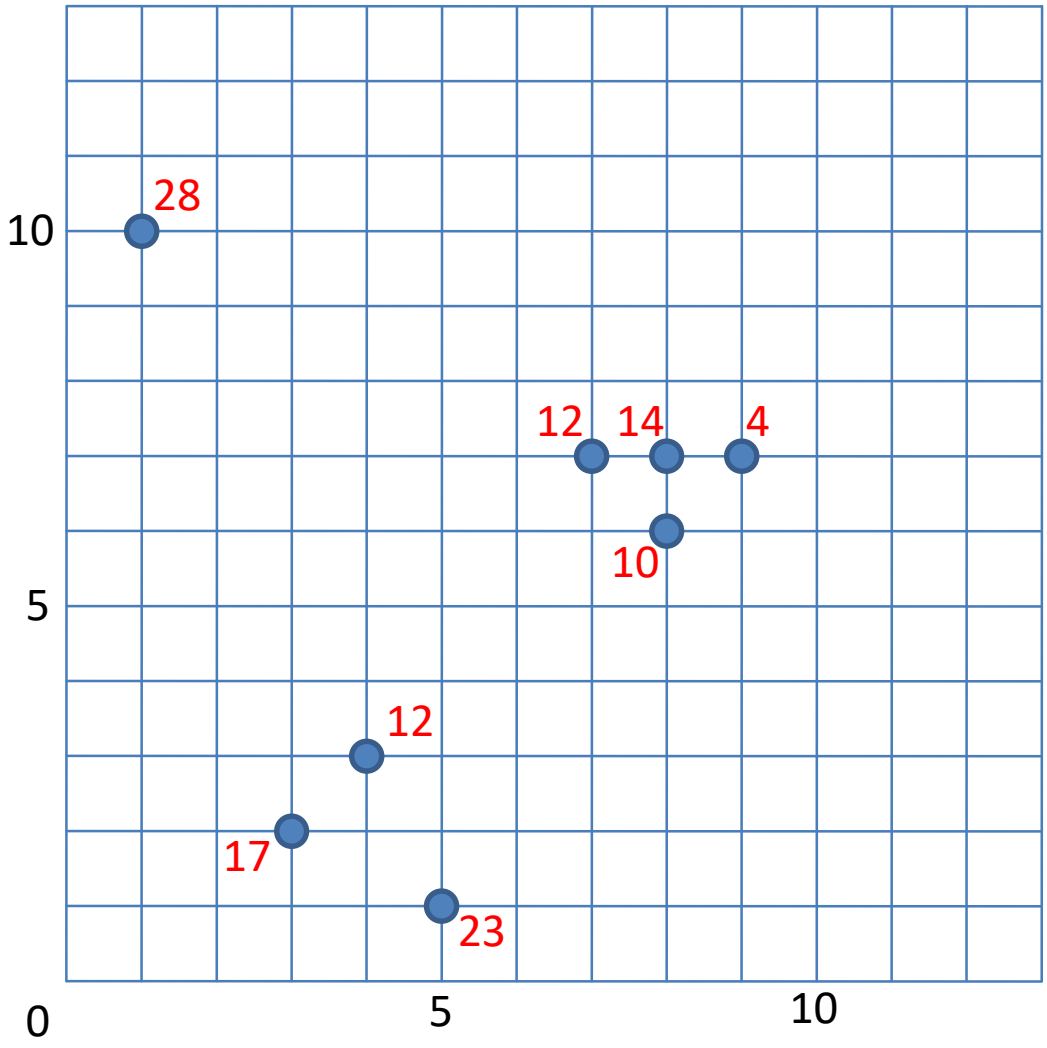
Possible options for equality of *kNN*-distance:

1) Add all points with equal *kNN*-distance to the *kNN*-set (potentially *#kNN >=k*)
2) Choose non-deterministically one of the points with equal *kNN*-distance (=> *#kNN=k*)

Possible options for equality of weighting of edges in the kNN-graph:

1) Delete all edges with equal weight at once
2) Delete one of the edges non-deterministically

We choose strategy 1) and 1)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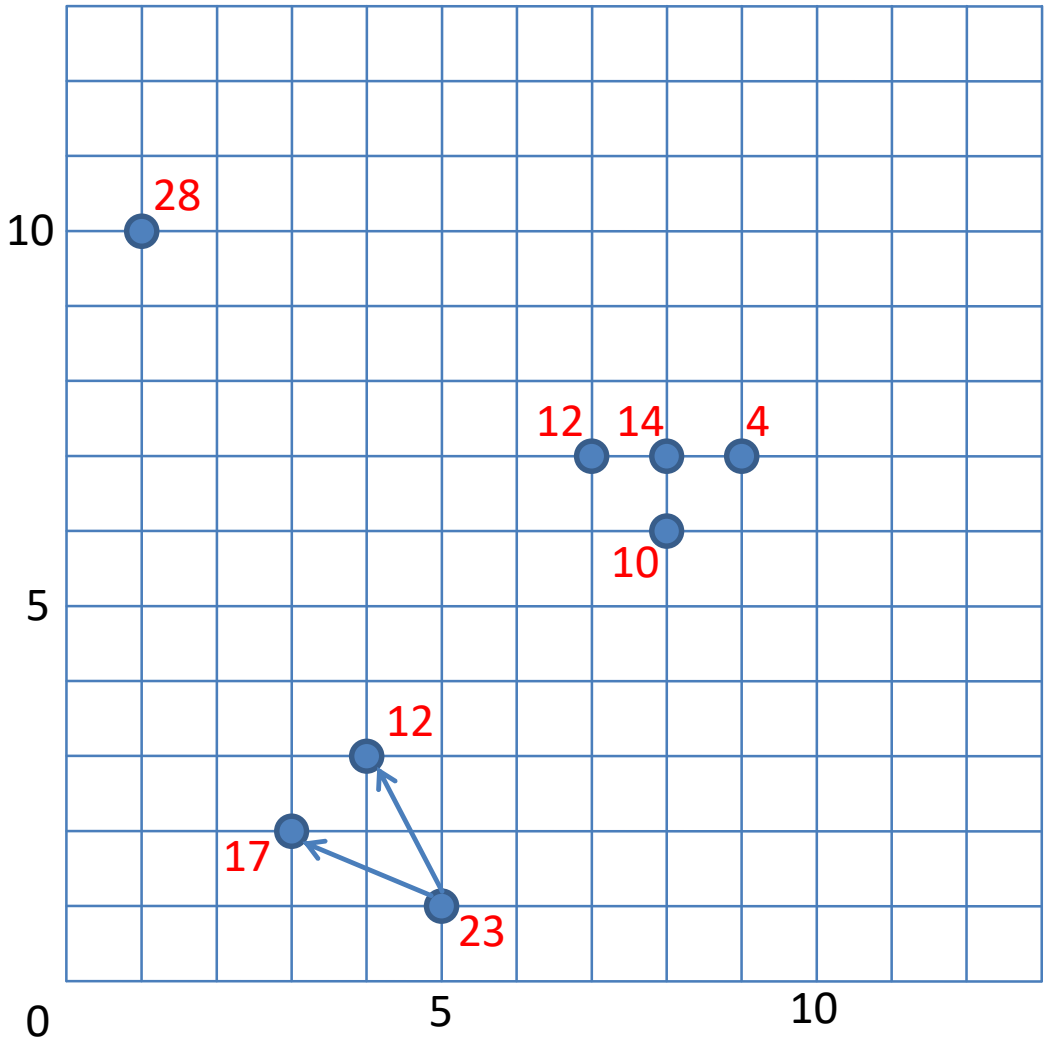
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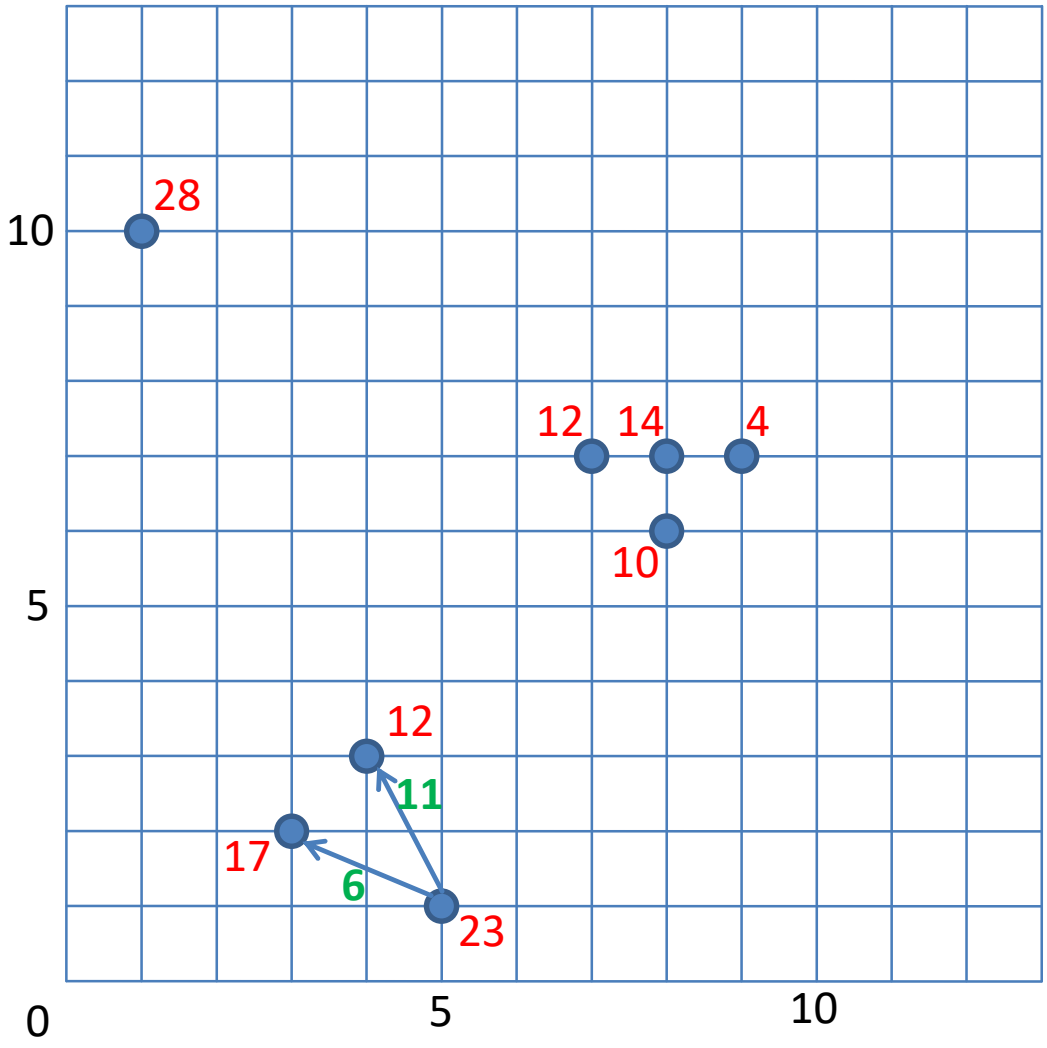
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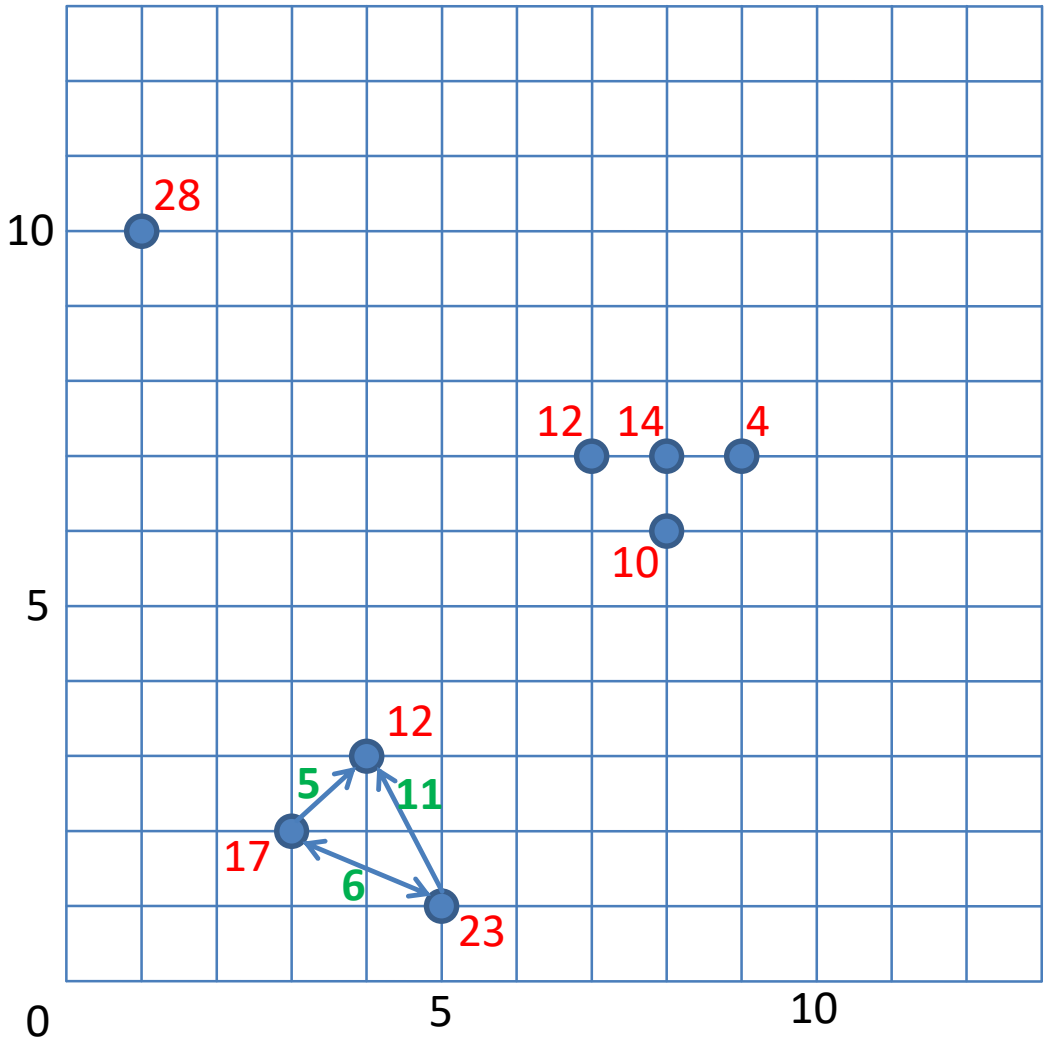
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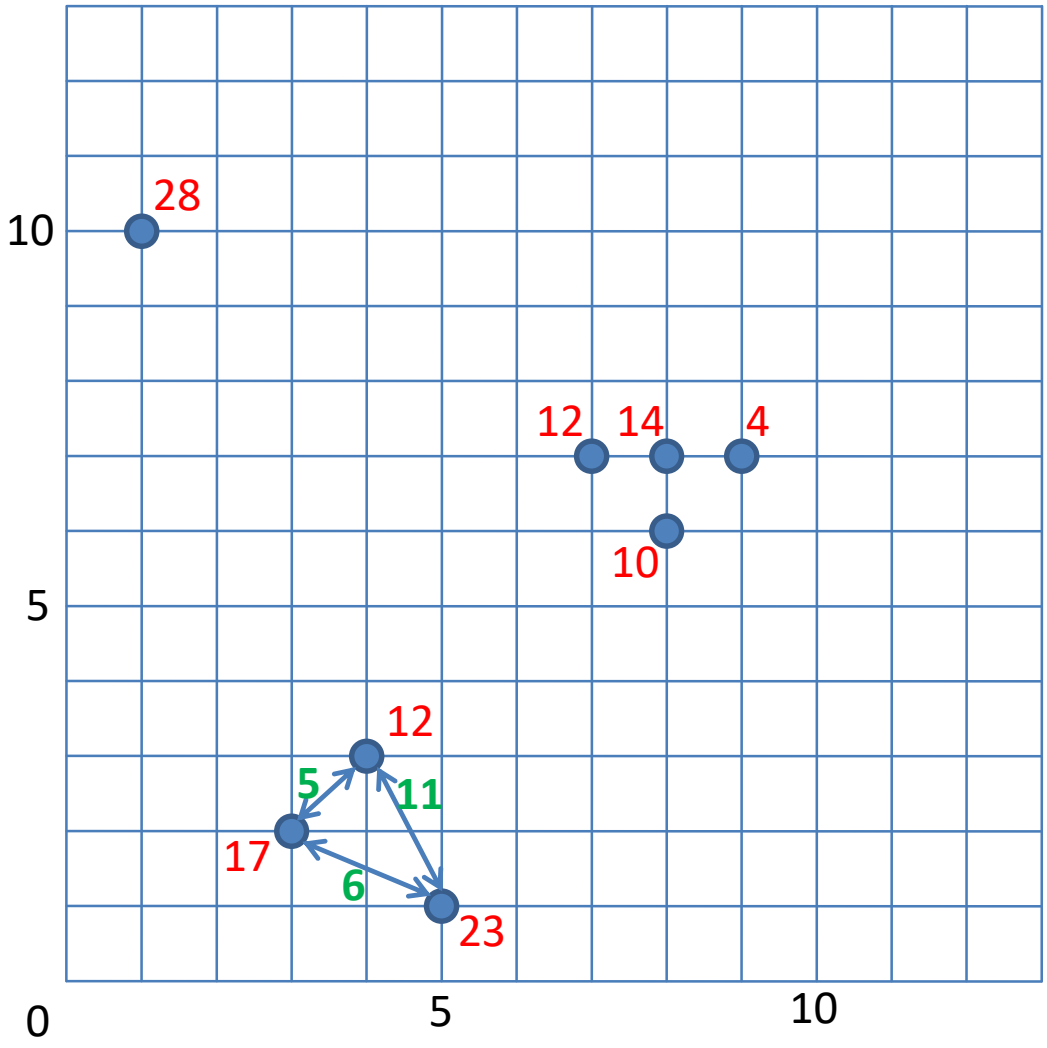
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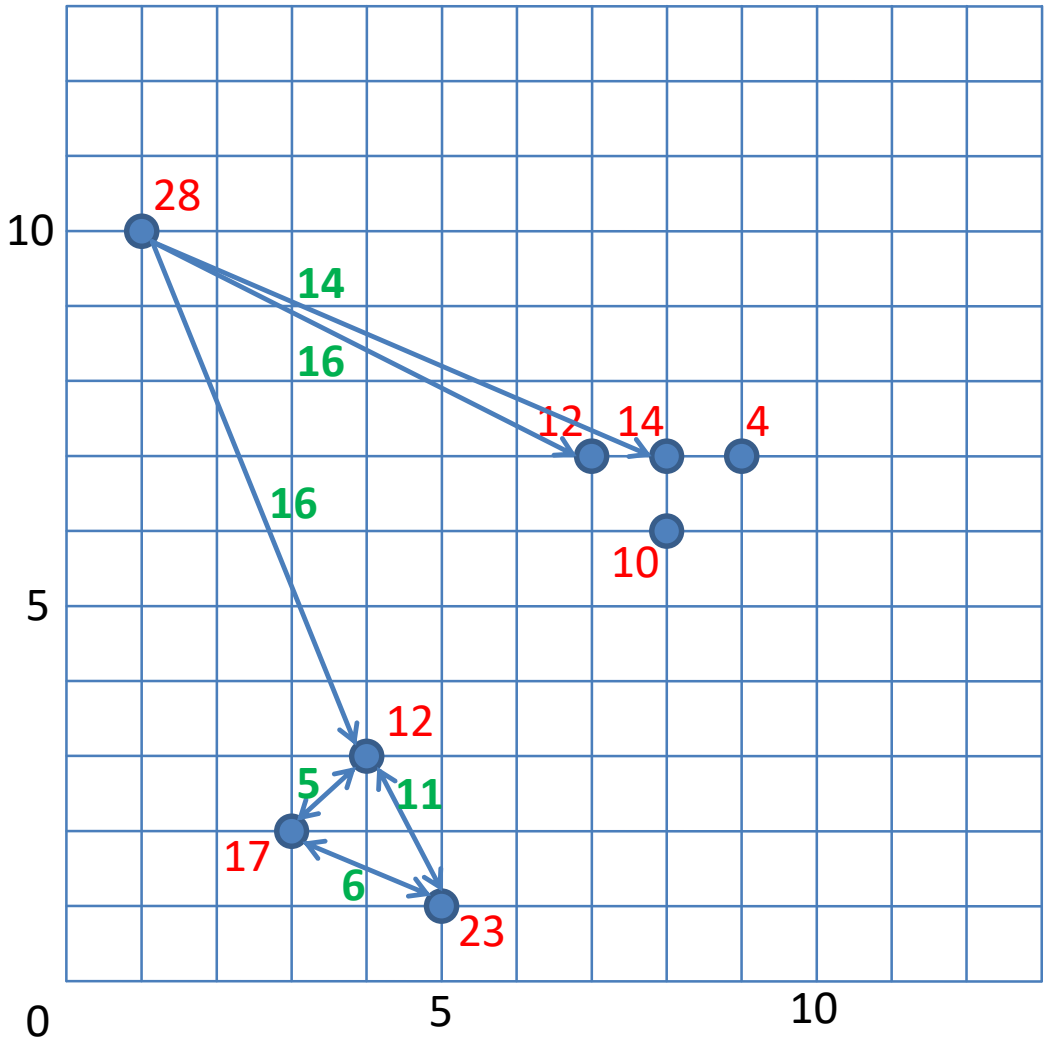
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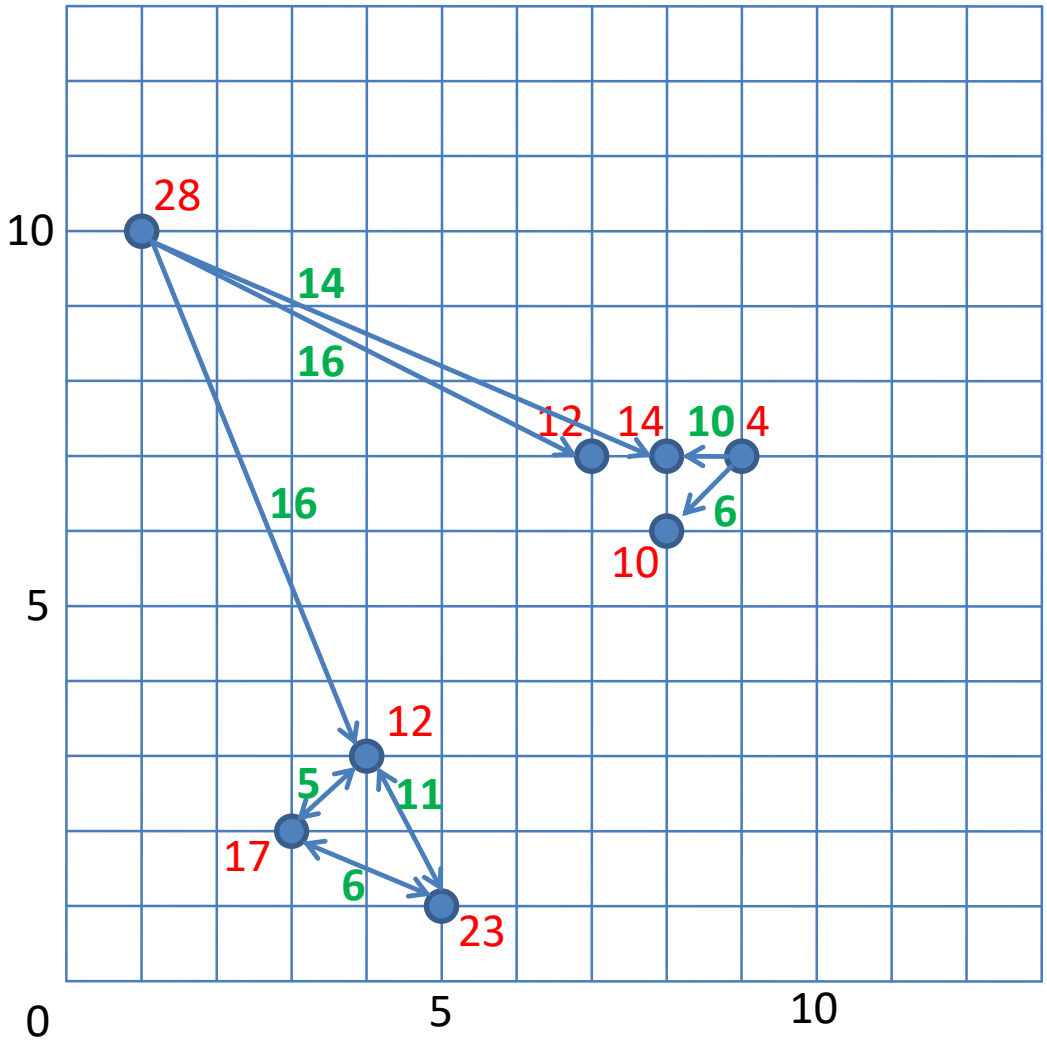
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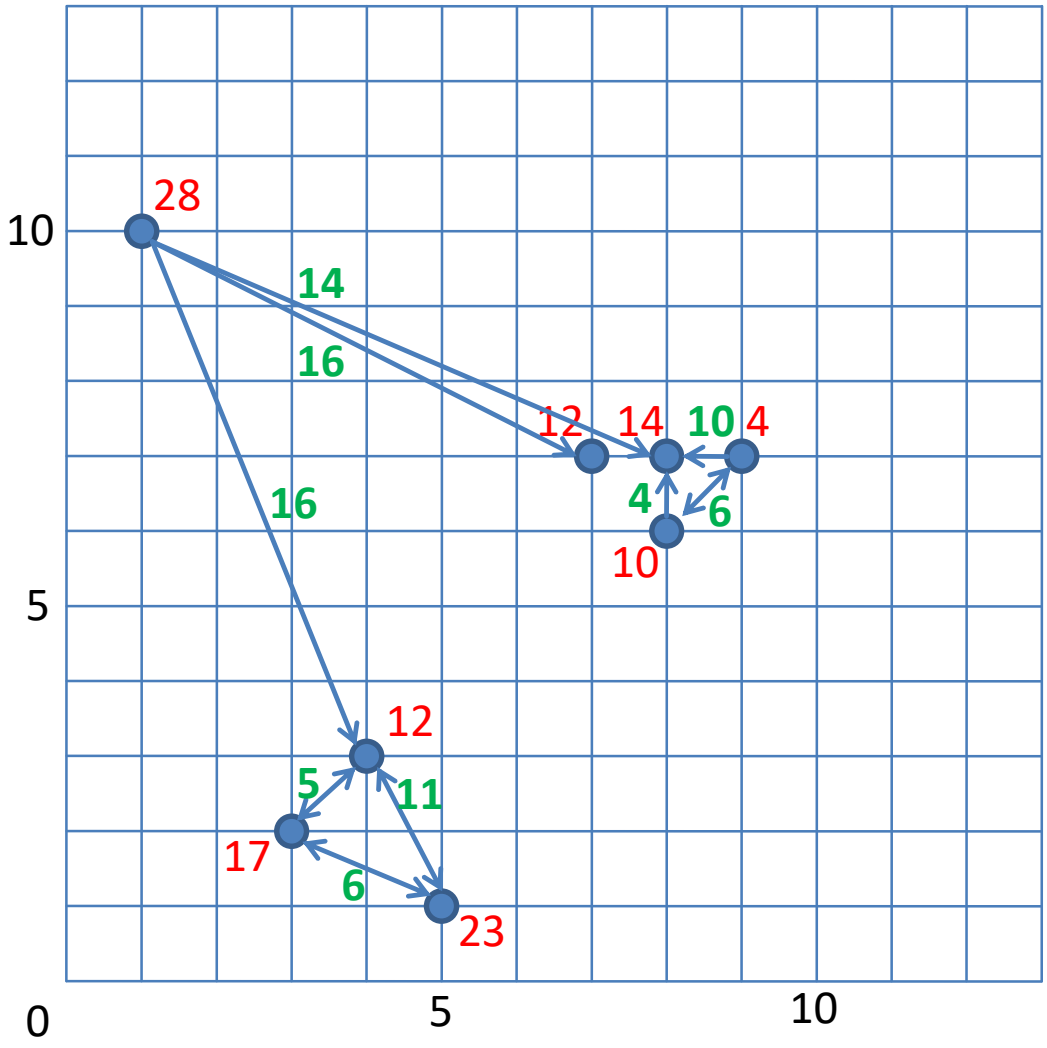
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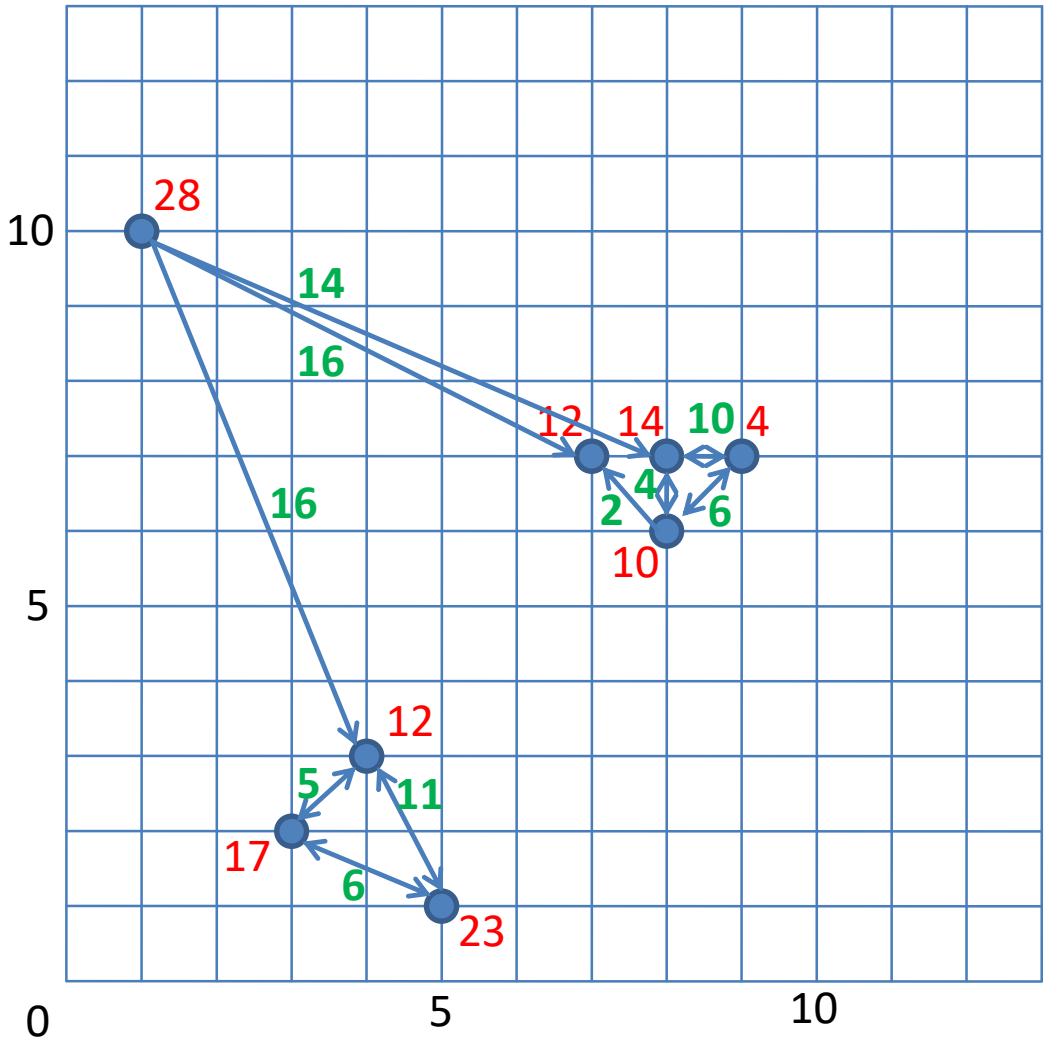
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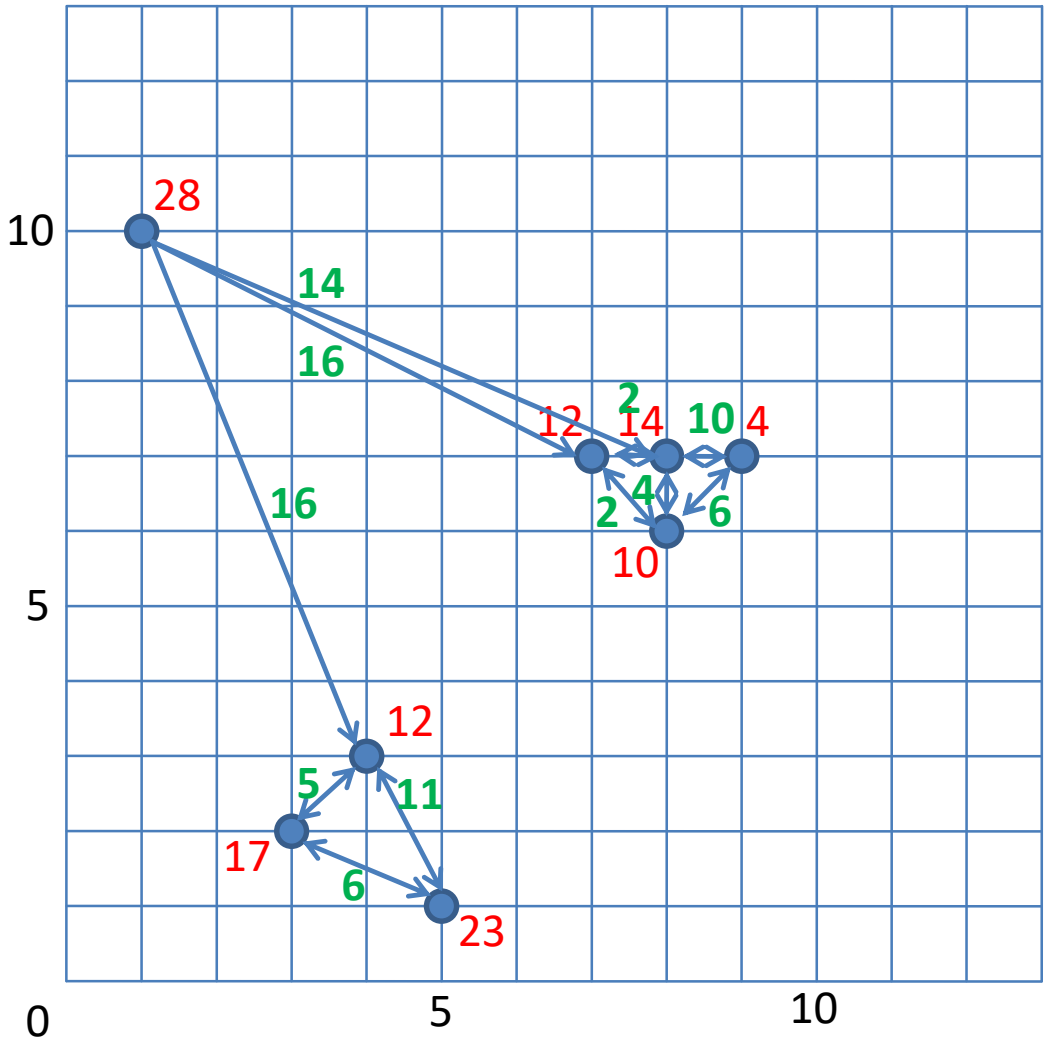
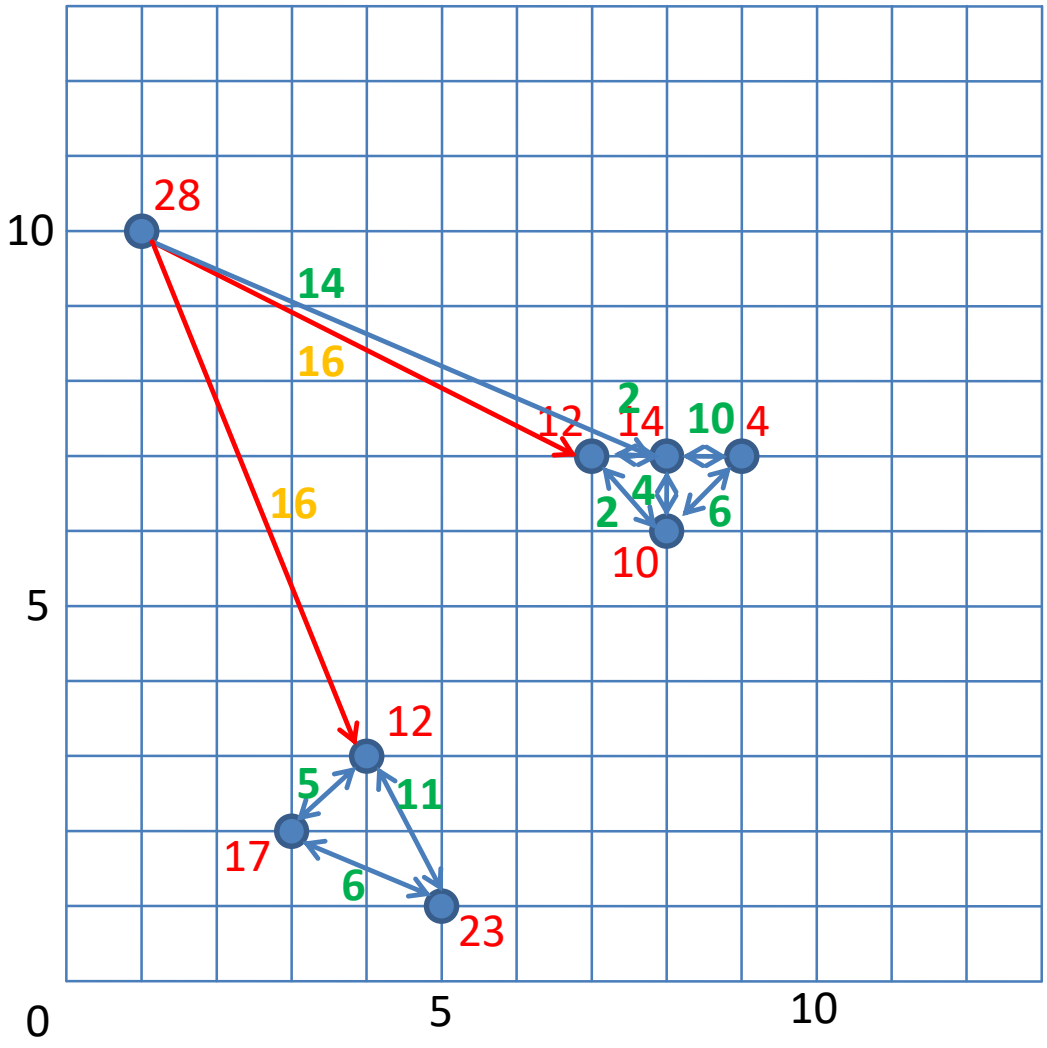
Construction of neighborhood graph finished

Now delete the edges with highest weights (=score difference) in a descending order

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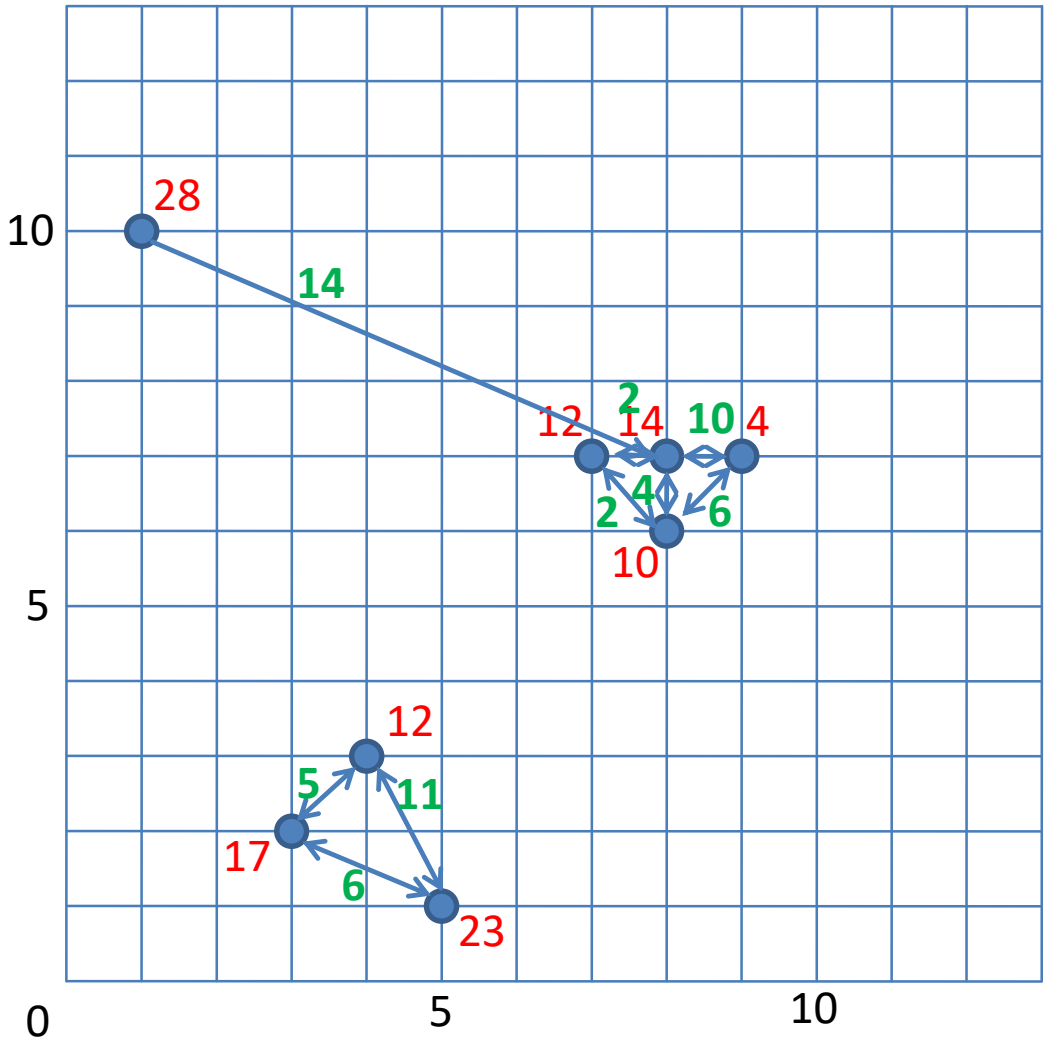
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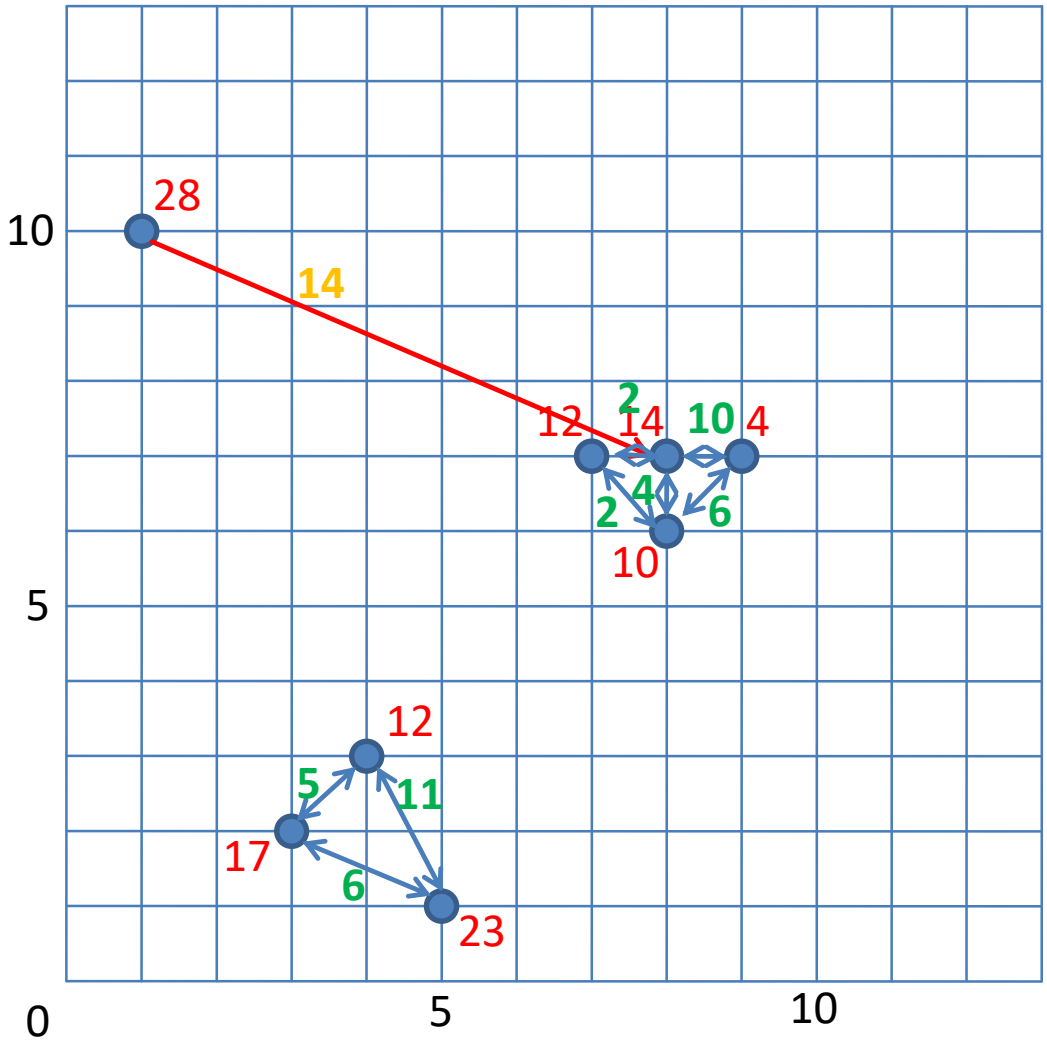
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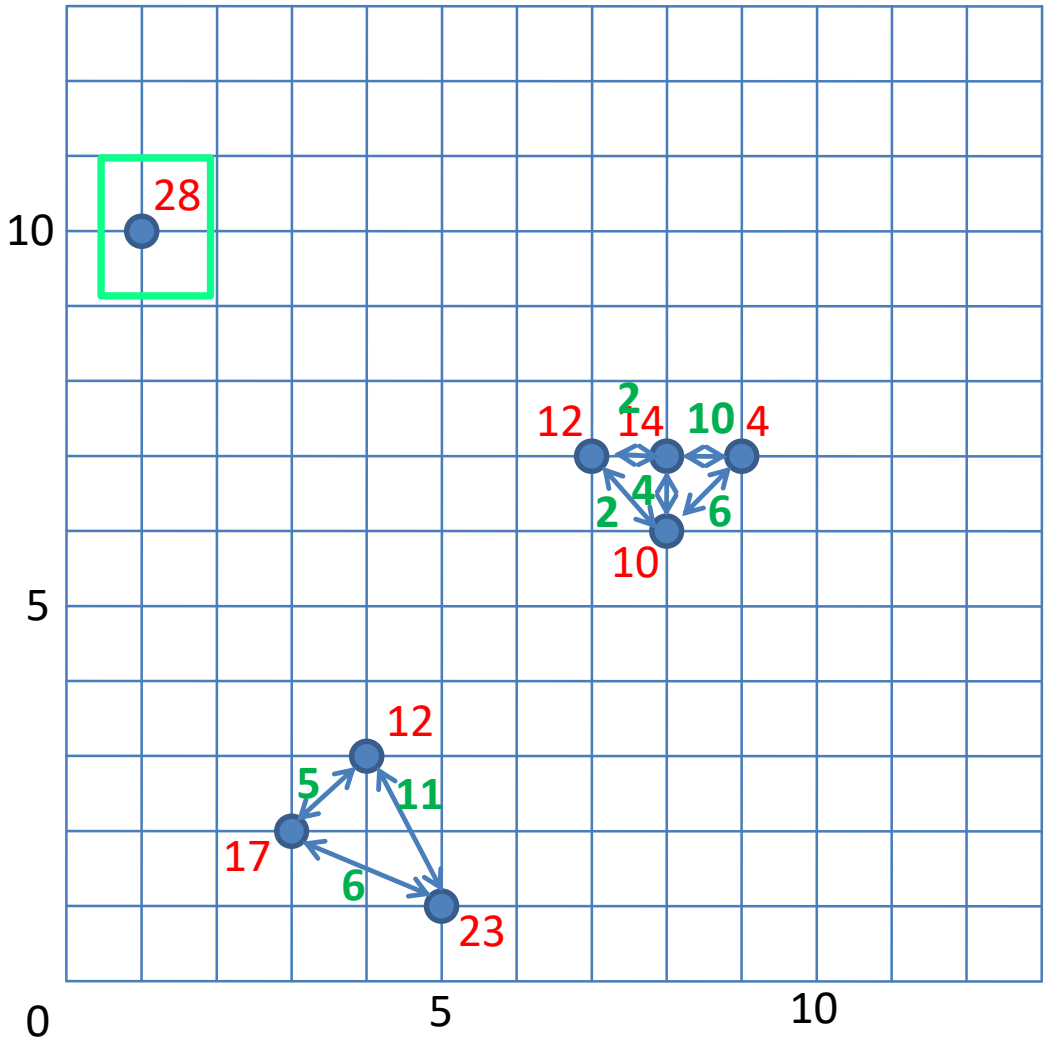
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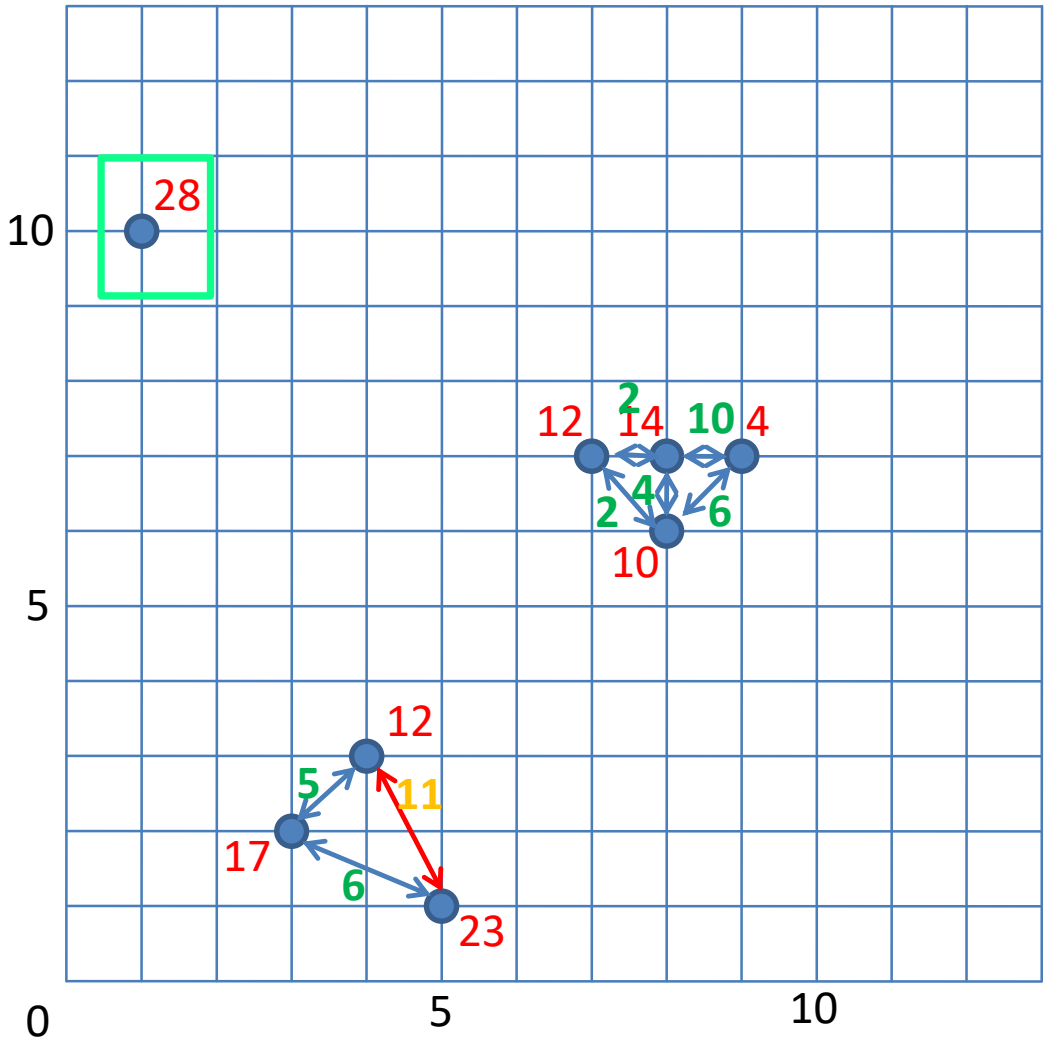
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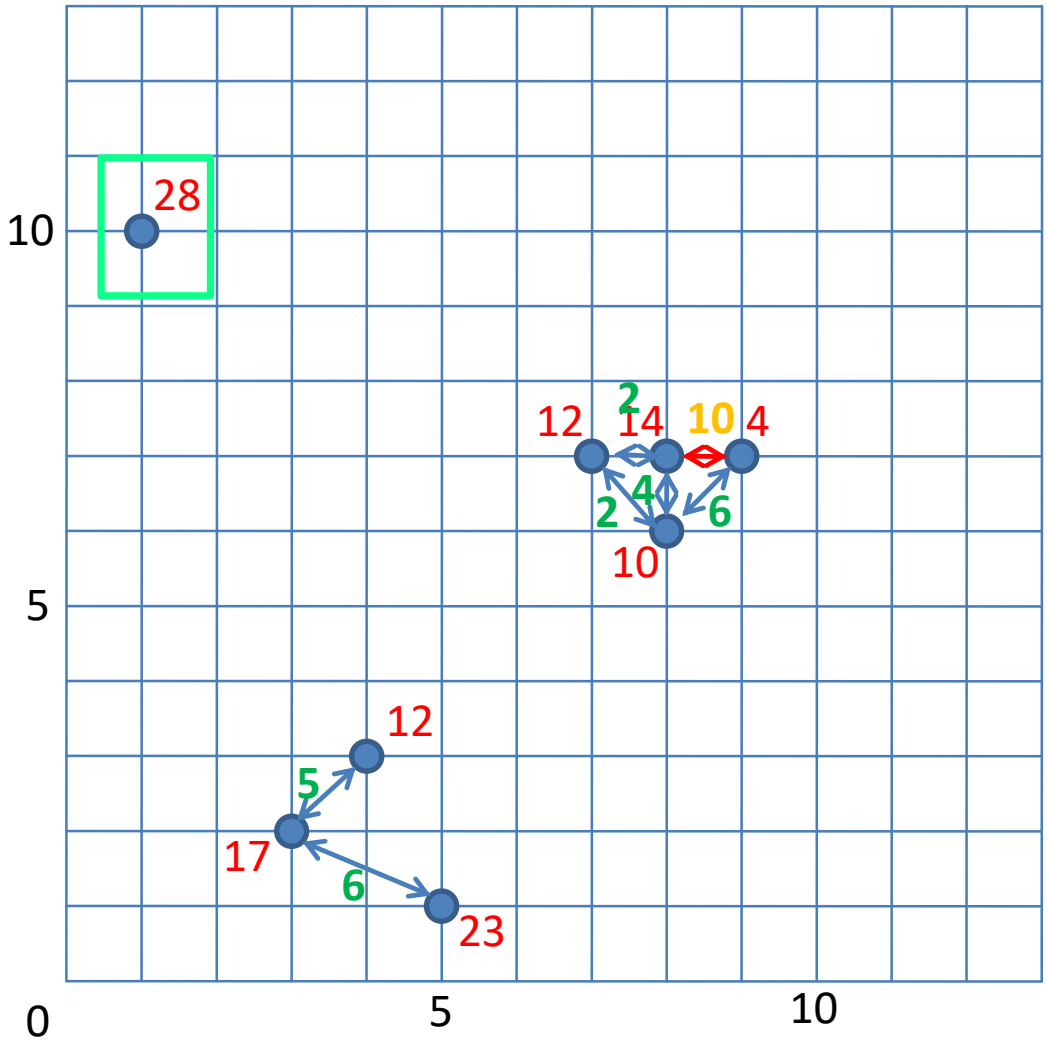
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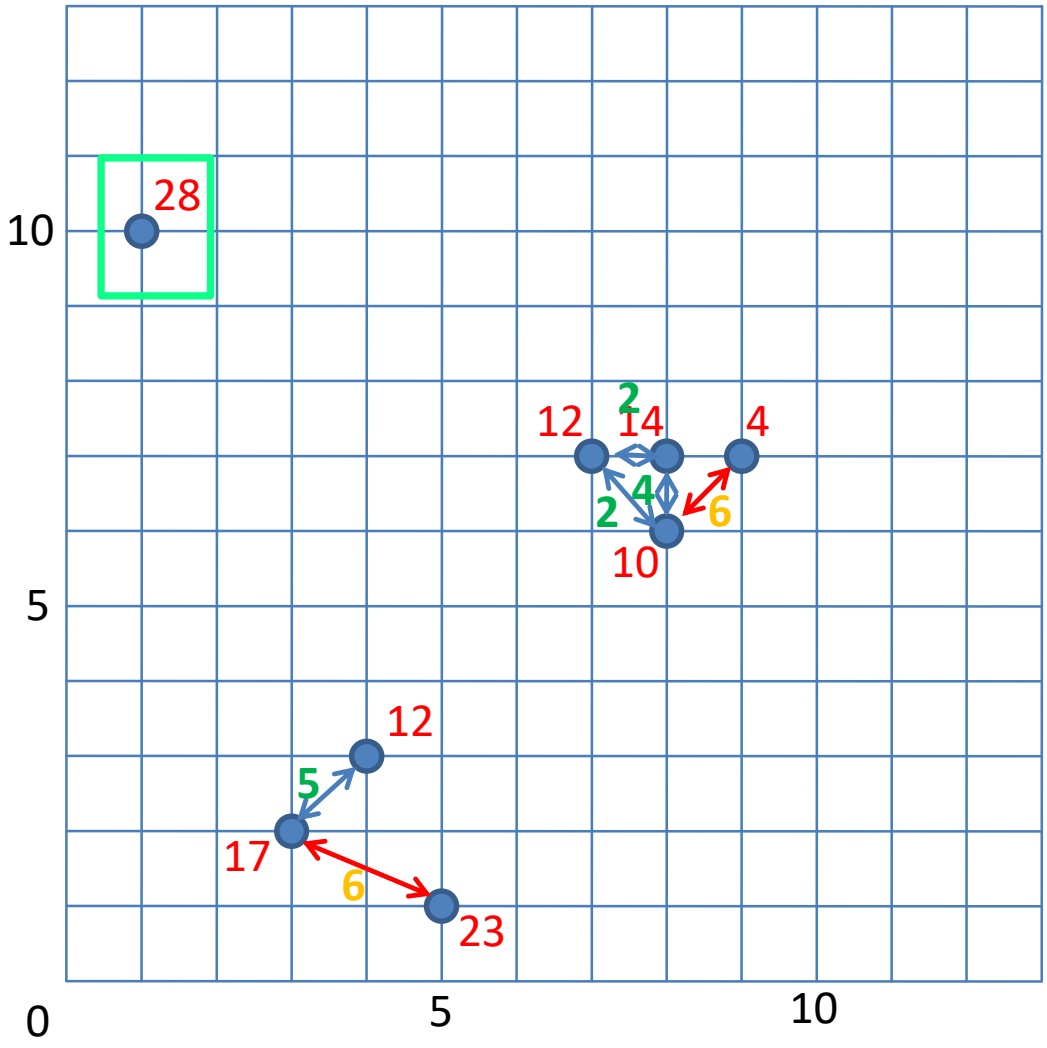
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The three strongest outliers are determined