Lab 7: Minimum Spanning Trees.

Due date: Thursday, May 27, in-class.

Lab Assignment

Assignment Preparation

This is a paper-and-pencil lab!

The main goal of this lab is to prepare you for the second midterm exam, by allowing you to practice the manual execution of the two MST algorithms covered in class: Kruskal's and Prim's.

This lab can be done **in pairs**. If you do it in pairs, submit only one copy of deliverables, but put both names on it.

Assignment

The worksheets below show five different graphs. For each graph, simulate the work of Prim's and Kruskal's algorithms. For Prim's algorithm, the root node is specified for you.

For **Prim's** algorithm, on each step show:

- Nodes removed from the priority queue.
- Edges included in the MST.
- Edges that currently determine ”parent” relations in the priority queue.
- Best distances and parent relation for each node in priority queue.

For **Kruskal's** algorithm, on each step show:

- Edges included in the MST.

- ”Parent” of each node in the disjoint set structure. (These can be determined in a number of ways. When two nodes are united, the ”parent” for each can be picked in two different ways. Pick a way and be consistent throughout your run).

More work. You can also simulate the runs of the Depth-First Search and Breadth-First search on the supplied graphs. For each run, pick the start node, indicate the state of the the queue/stack on each step, and the order in which the nodes are visited.

Additionally, by turning the graphs from undirected into directed acyclic (by adding an arrow to each edge and making sure, there are no cylces), you can simulate the run of the topological sort algorithm.

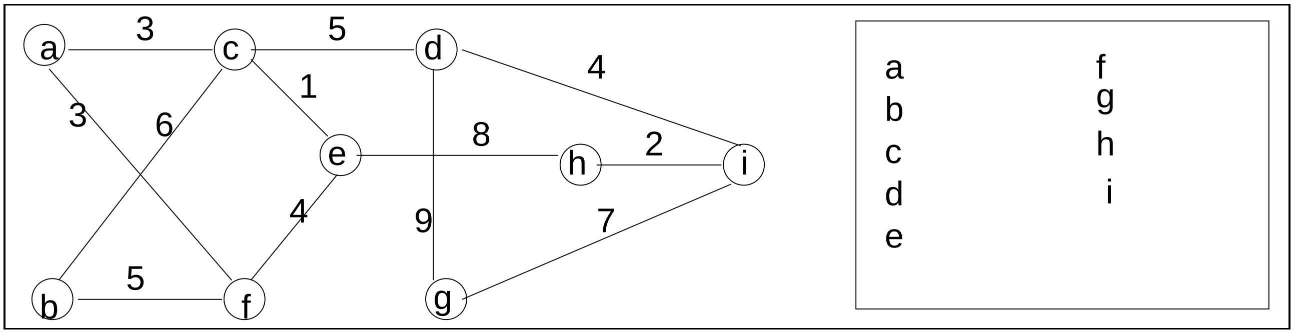
Extra worksheets are provided at the back.

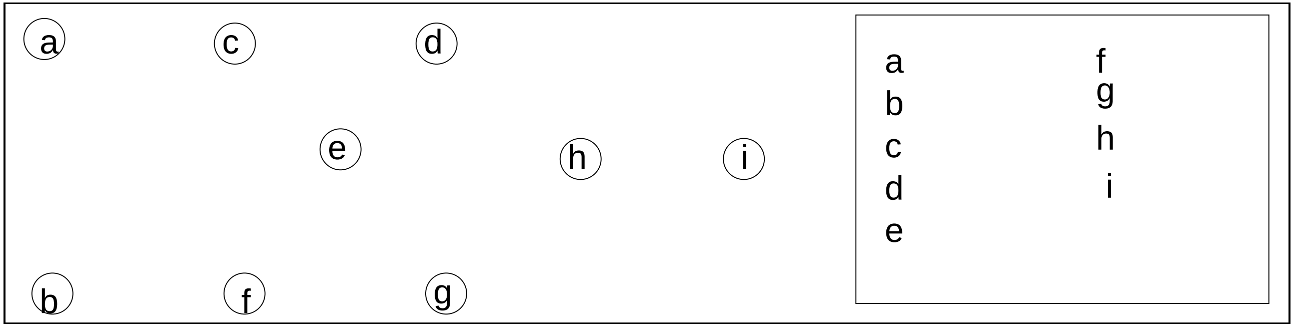
Deliverables

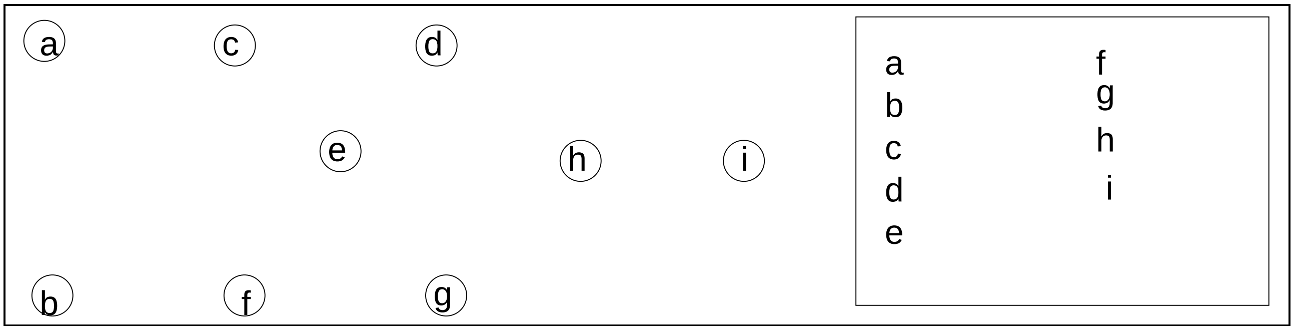
Submit the hardcopy of the worksheets attached to this lab. Put your name(s) on them.

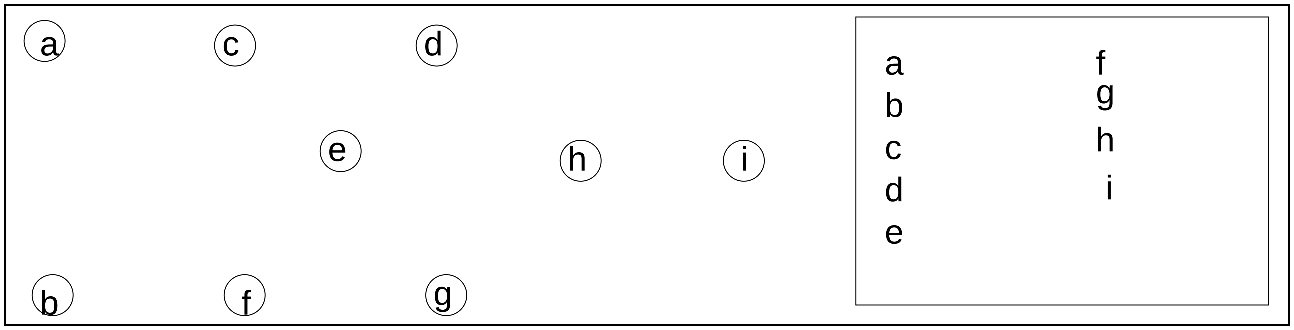
Good Luck!

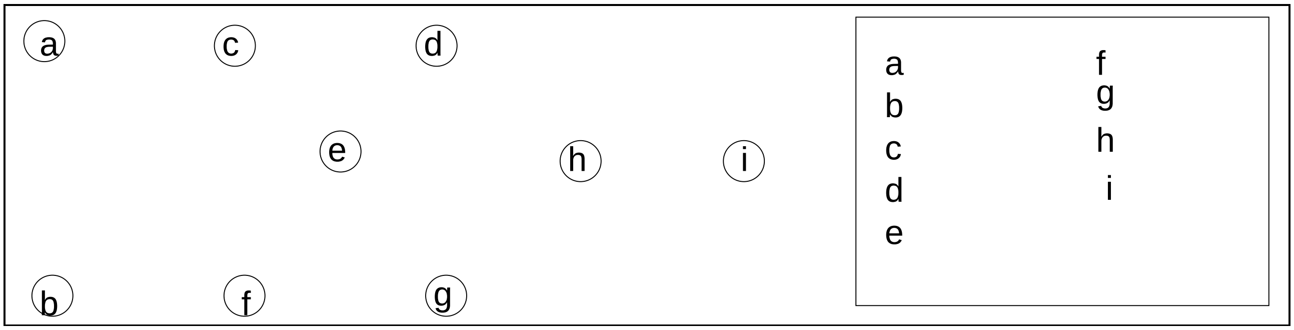
Graph 1. Prim's Algorithm. Root node = a.

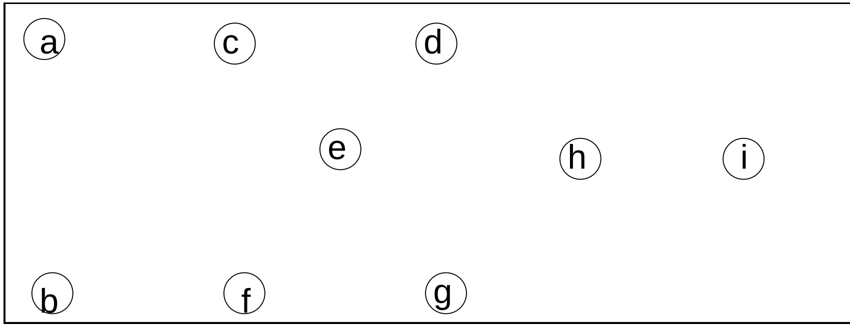












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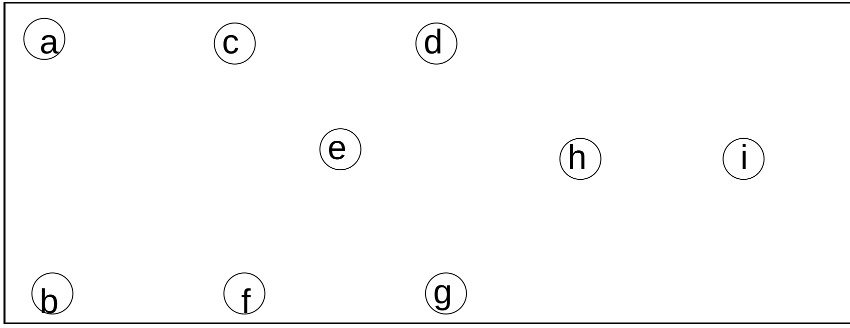

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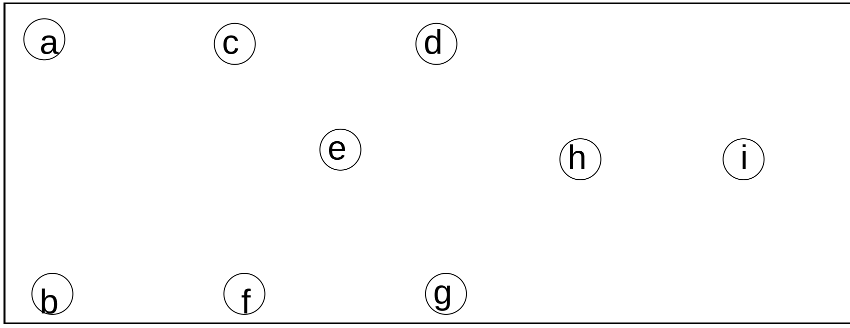

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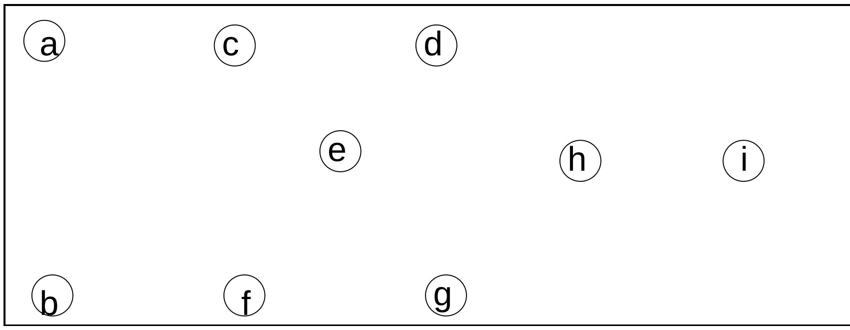

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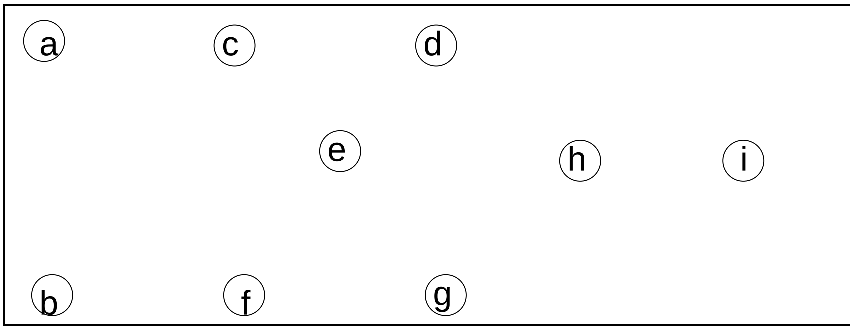

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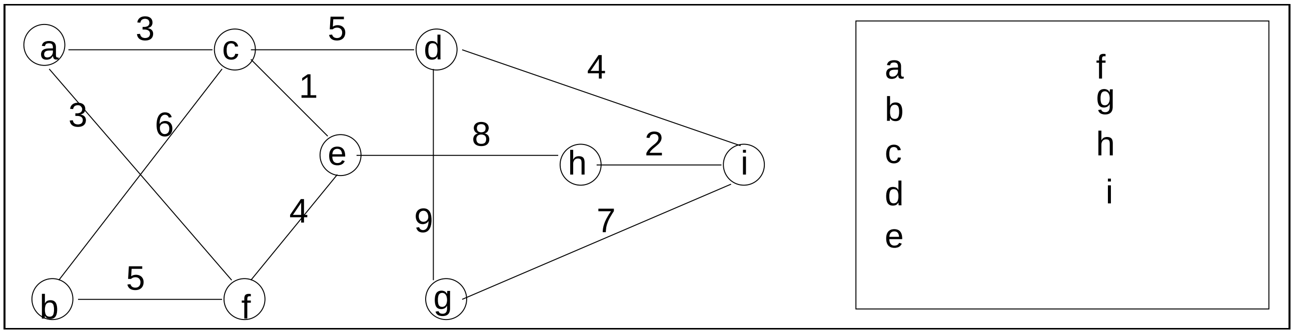
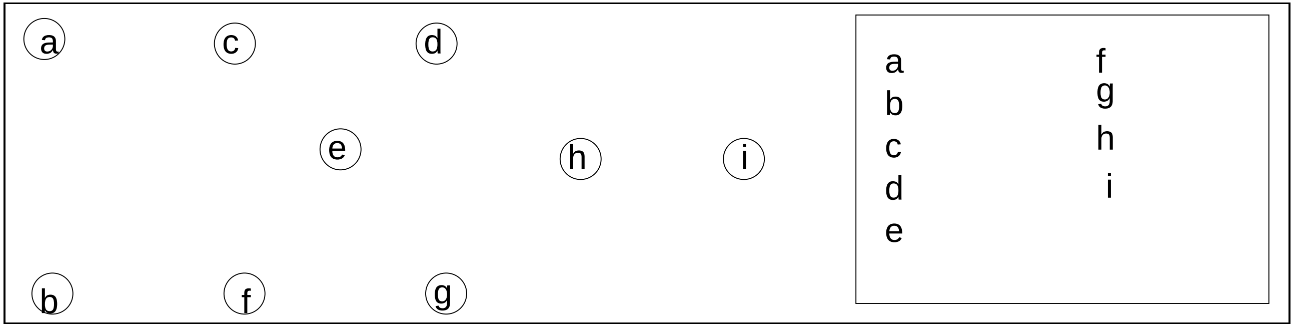
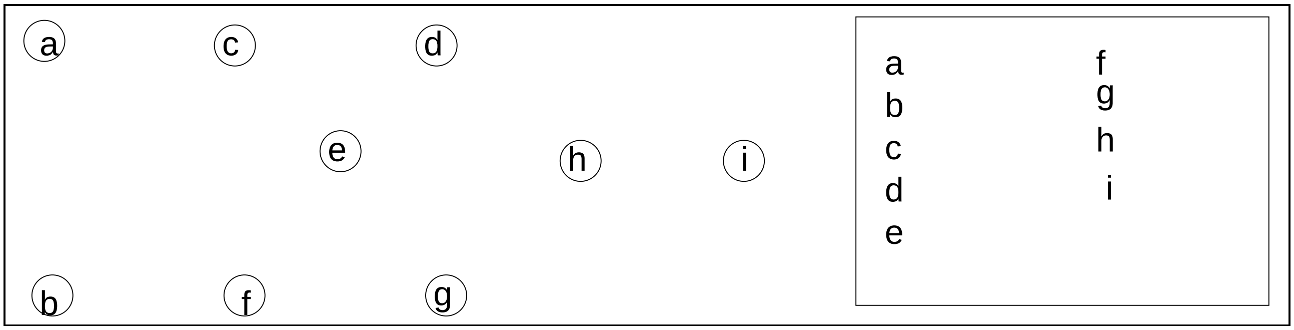
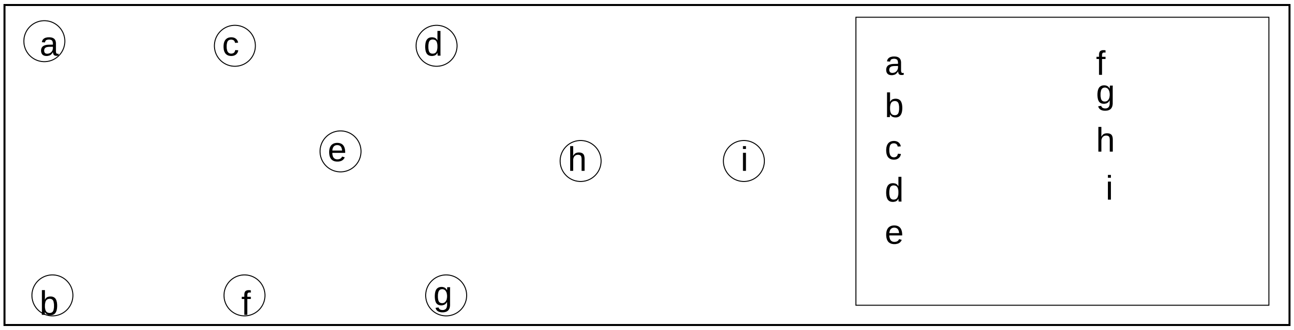
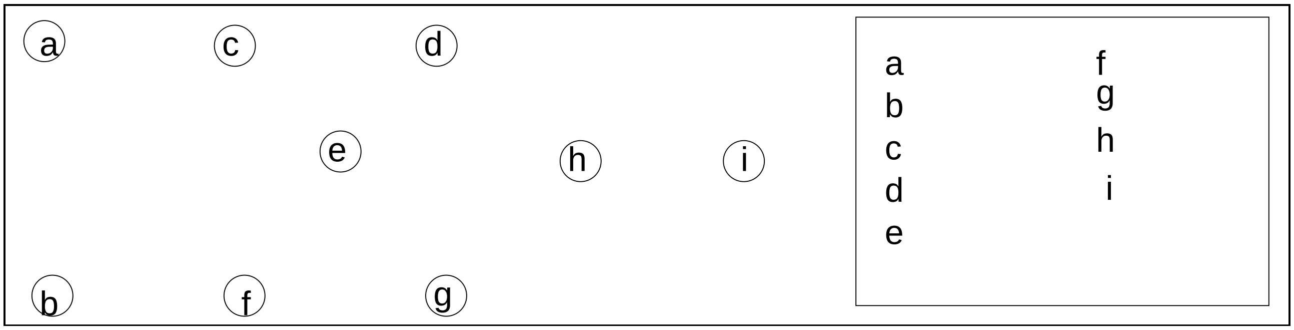
Graph 1. Kruskal's Algorithm.

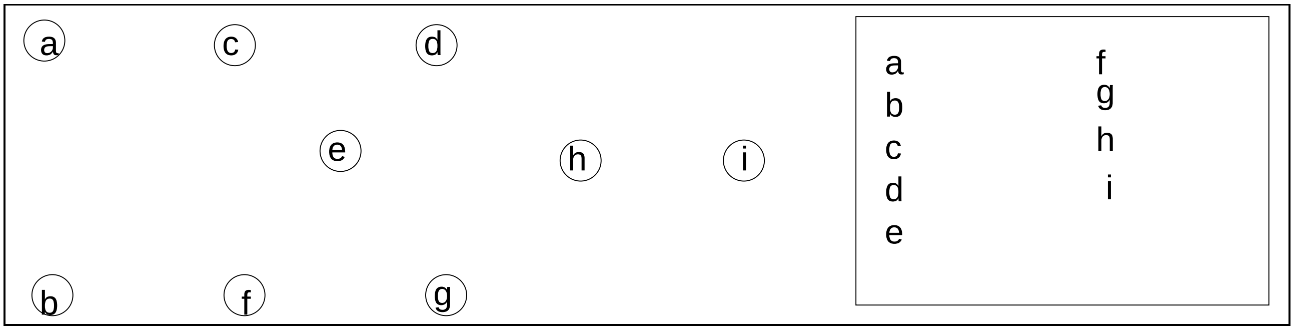








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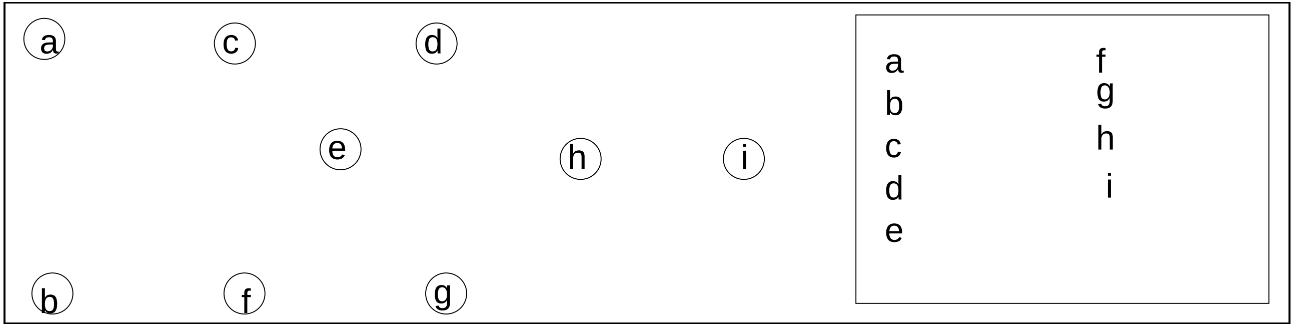
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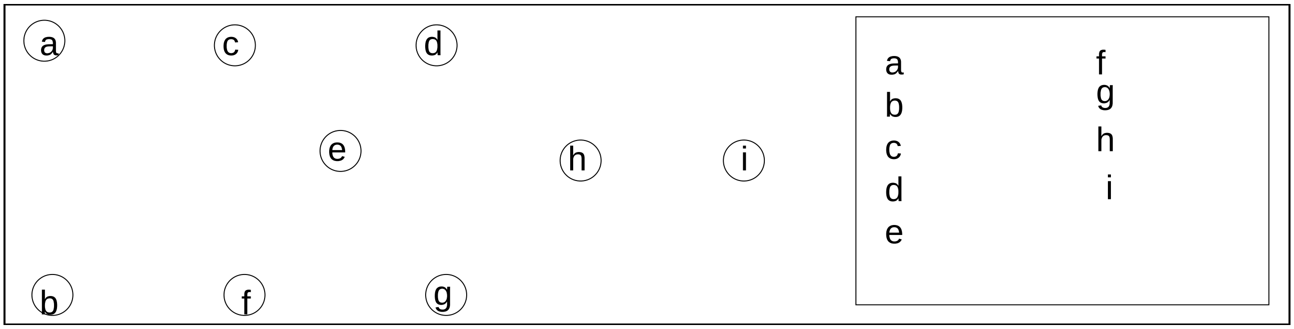
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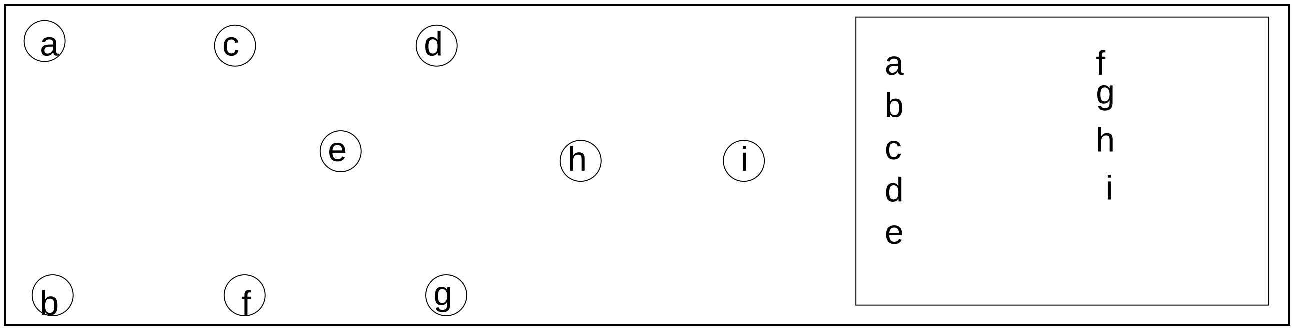
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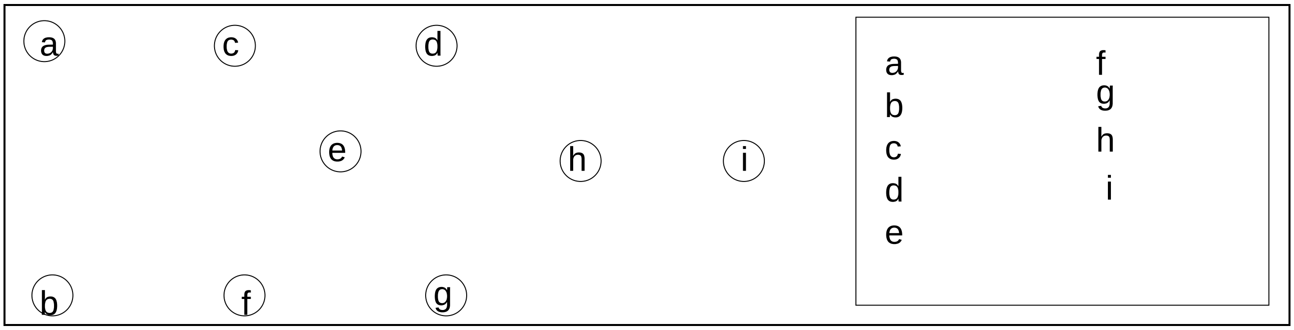
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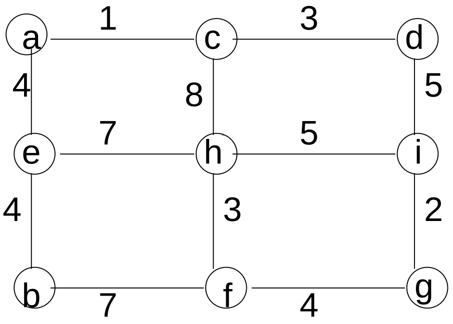
Graph 2. Prim's Algorithm. Root node = a.



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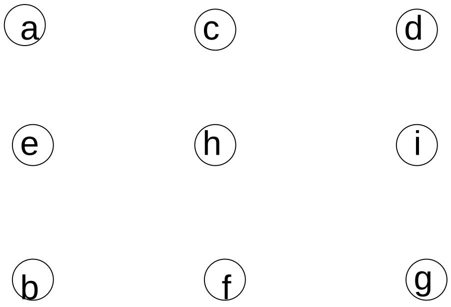

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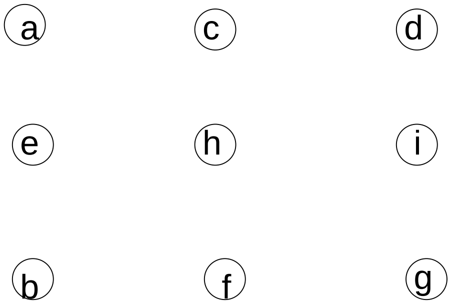

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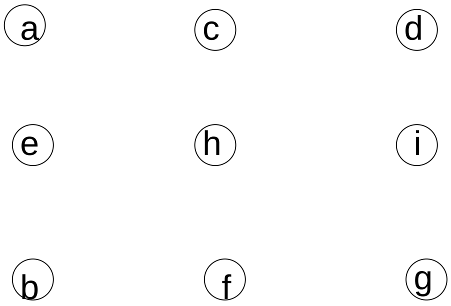

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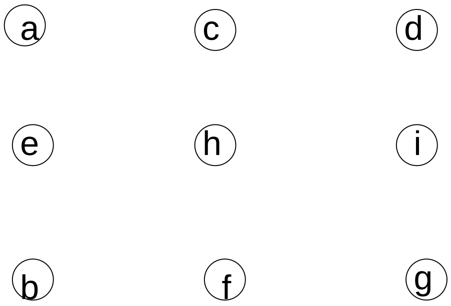

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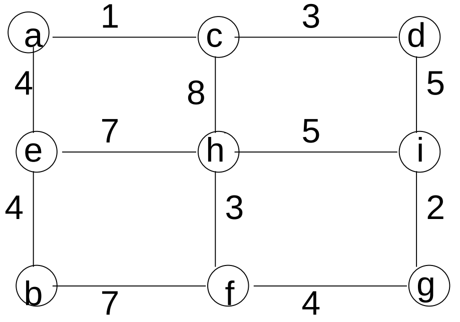
Graph 2. Kruskal's Algorithm.



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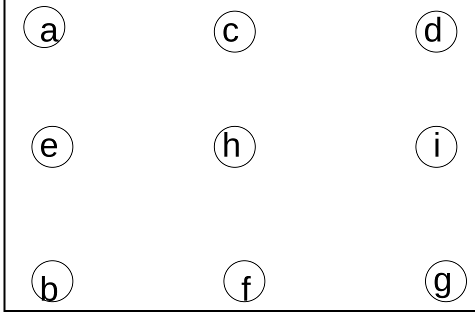

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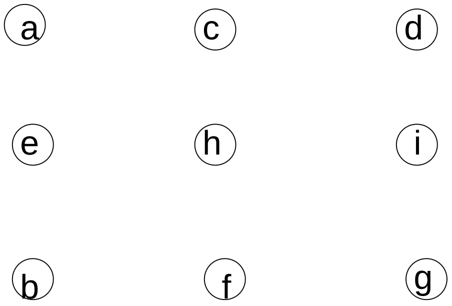

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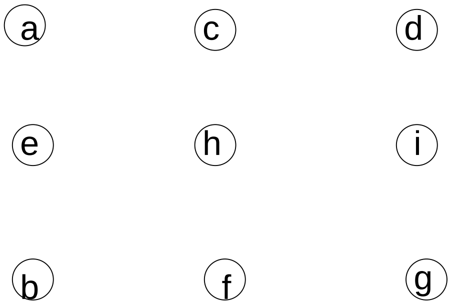

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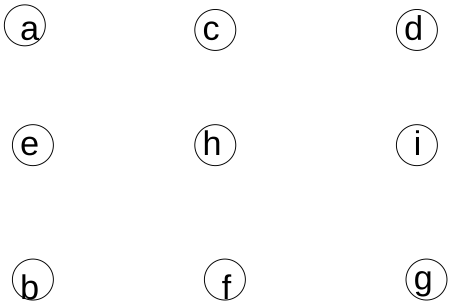

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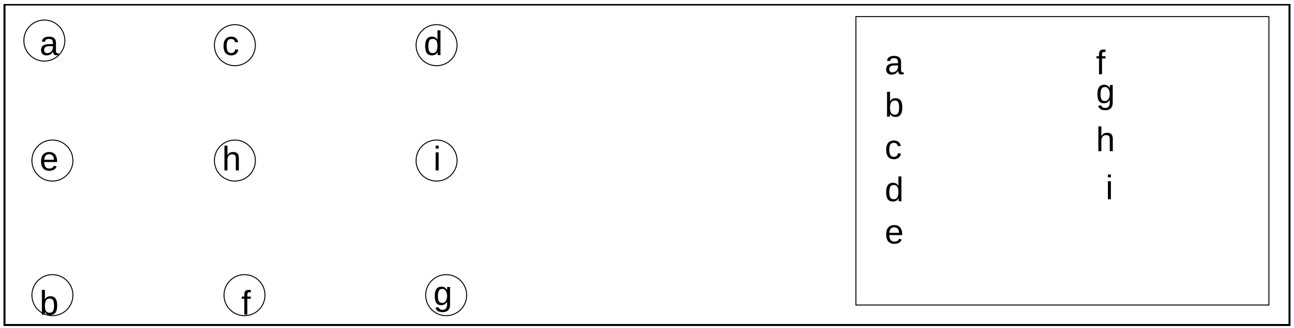
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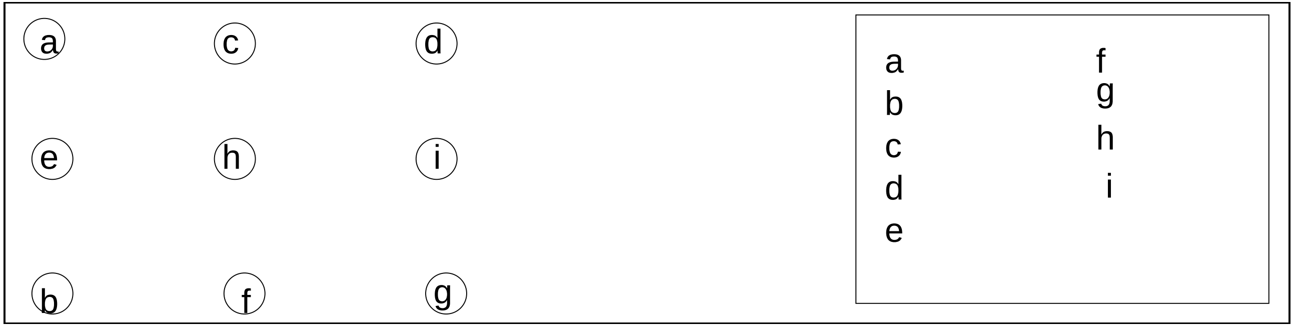
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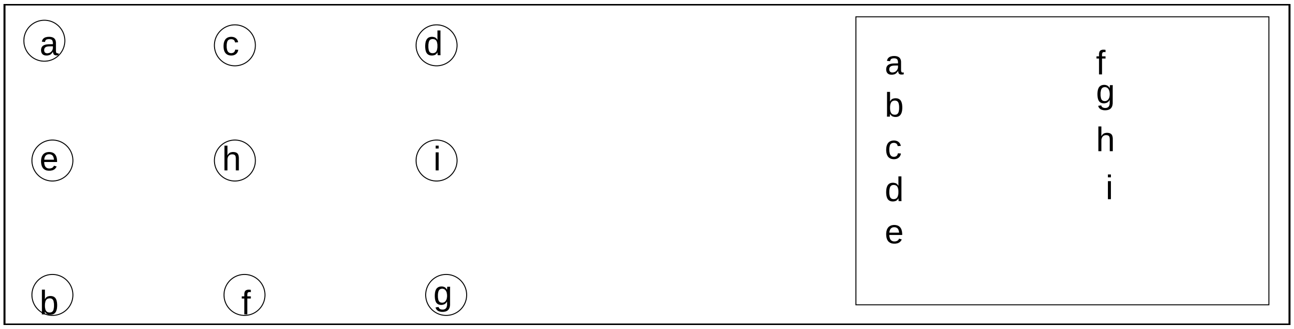
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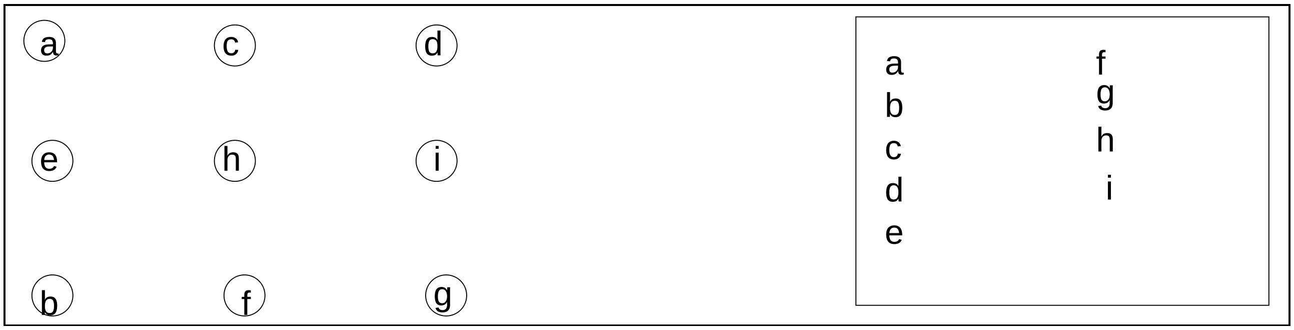
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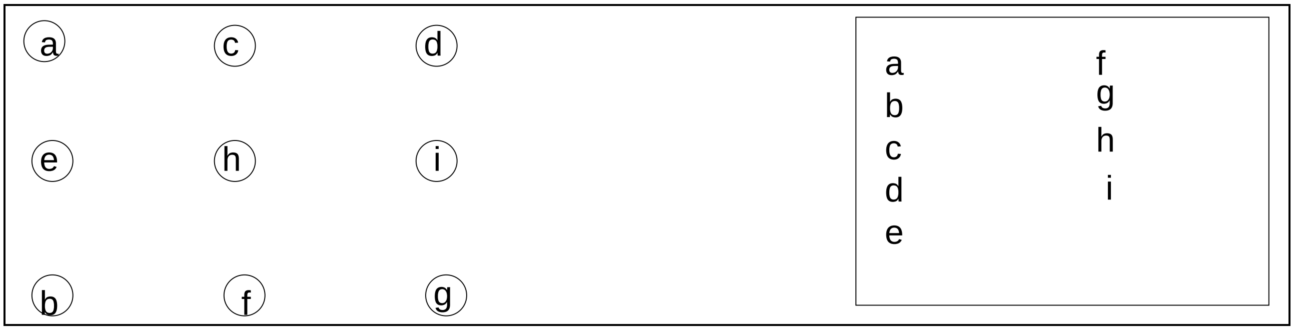
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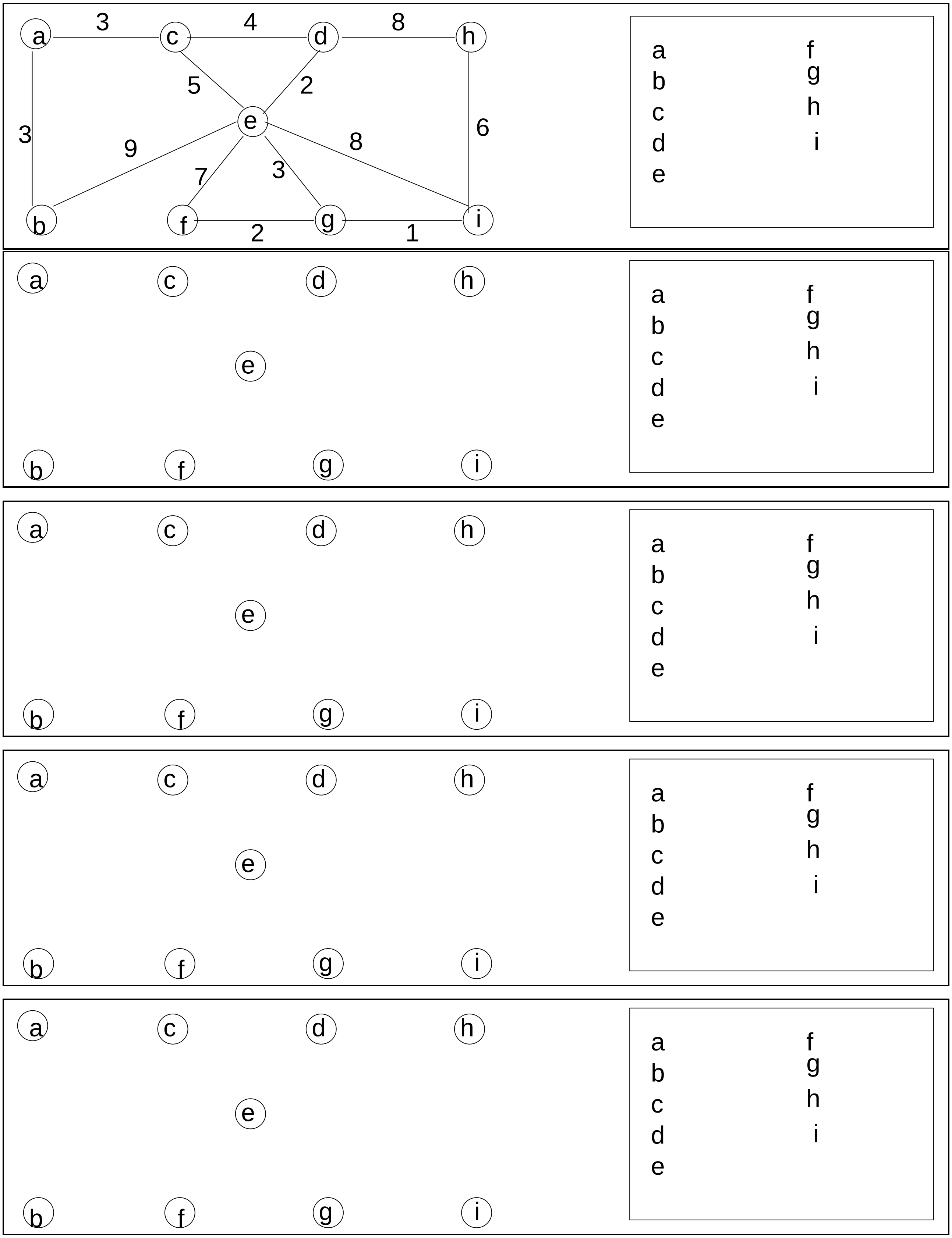
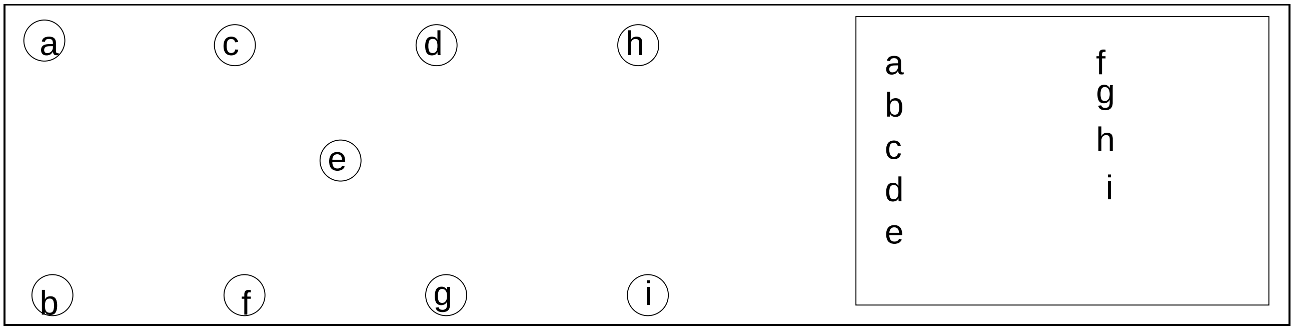
Graph 3. Prim's Algorithm. Root node = *c*.

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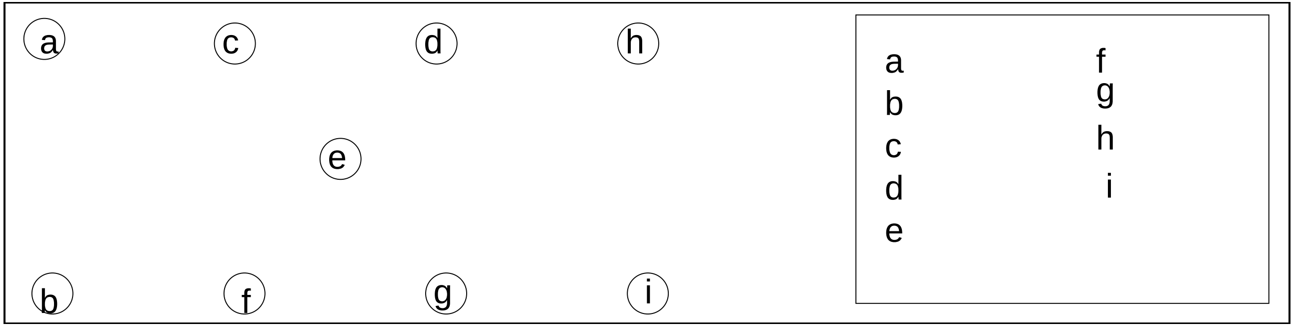
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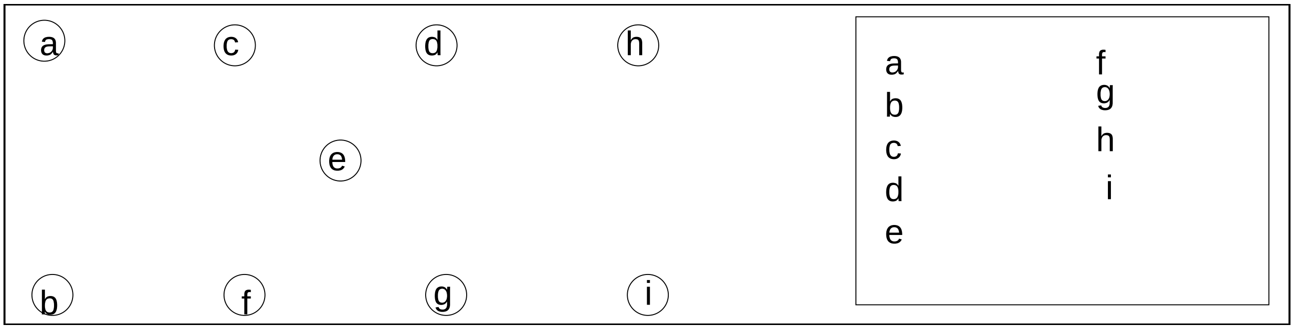
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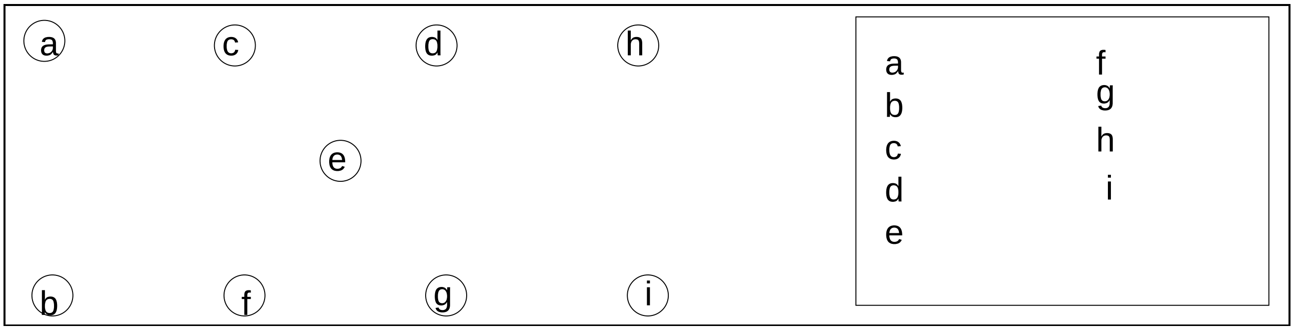
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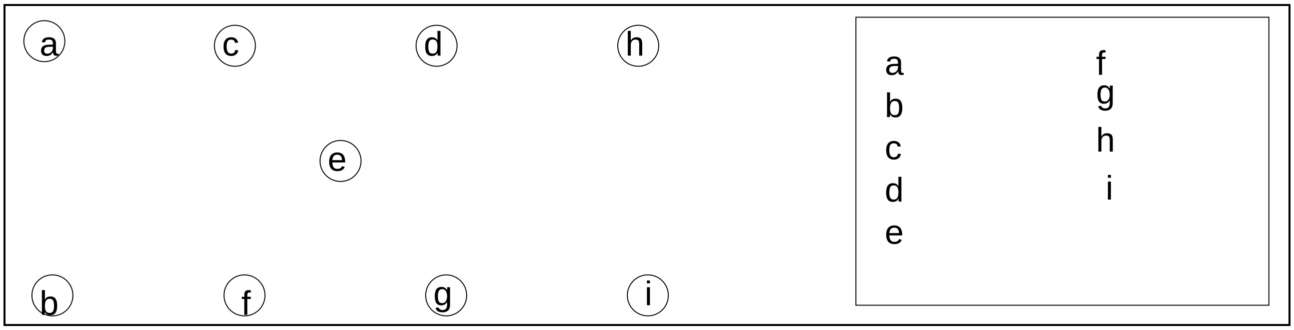
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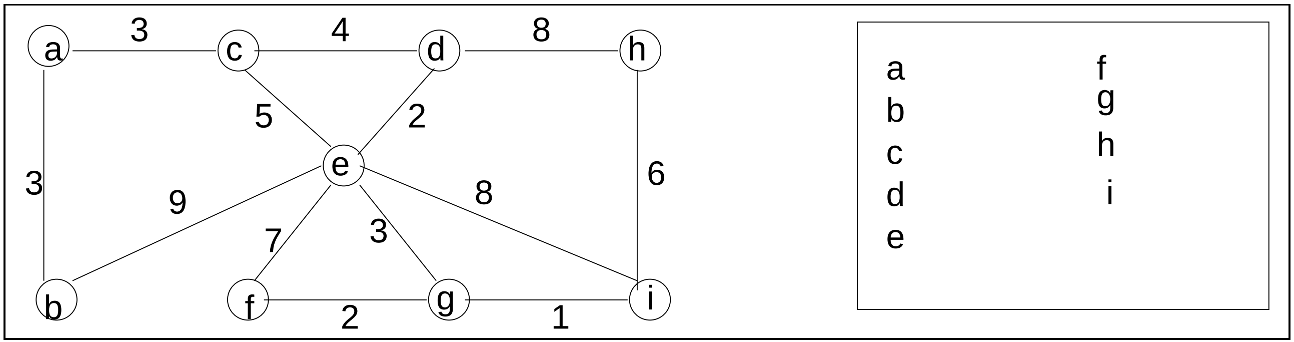
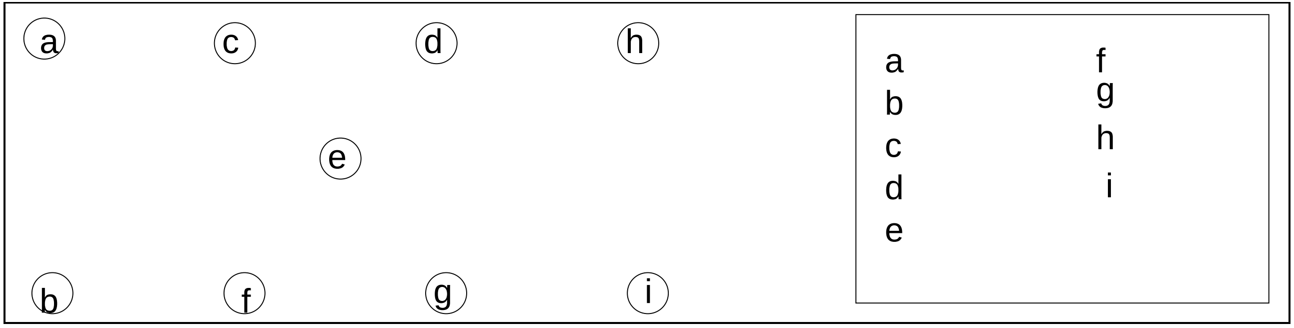
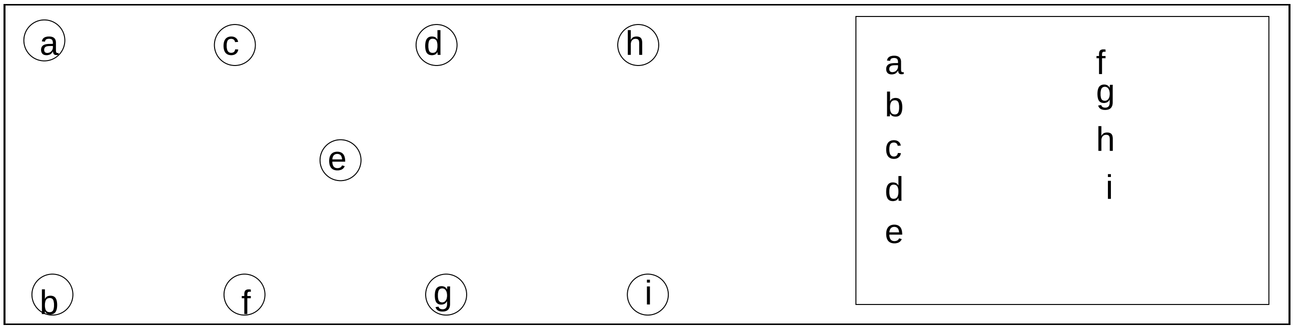
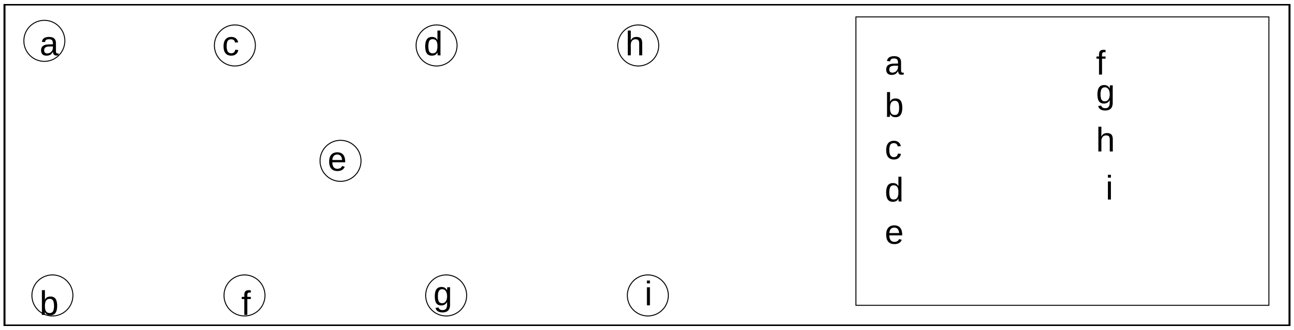
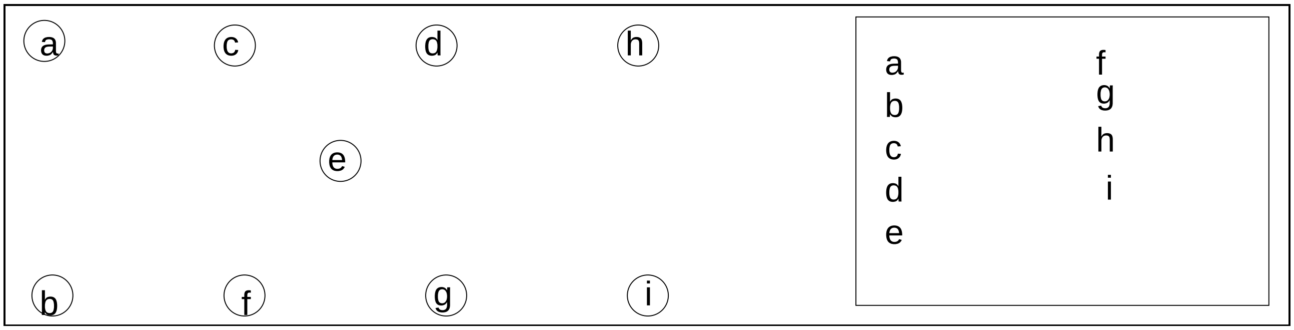
Graph 3. Kruskal's Algorithm.

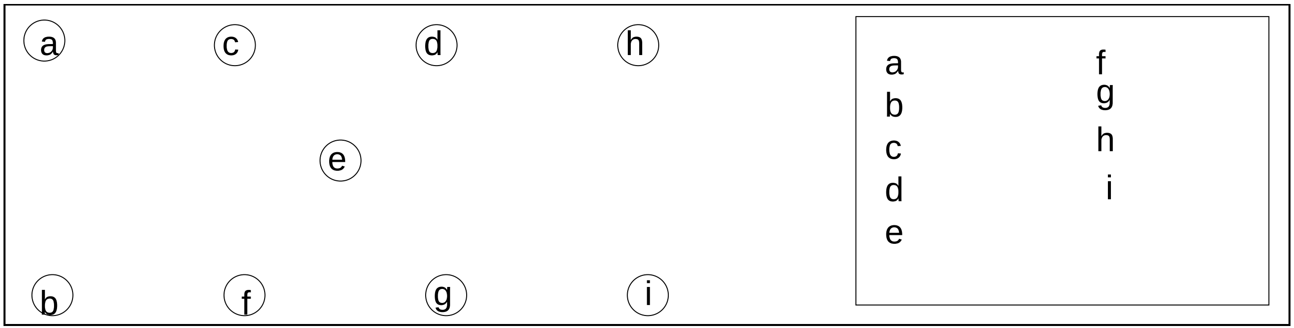








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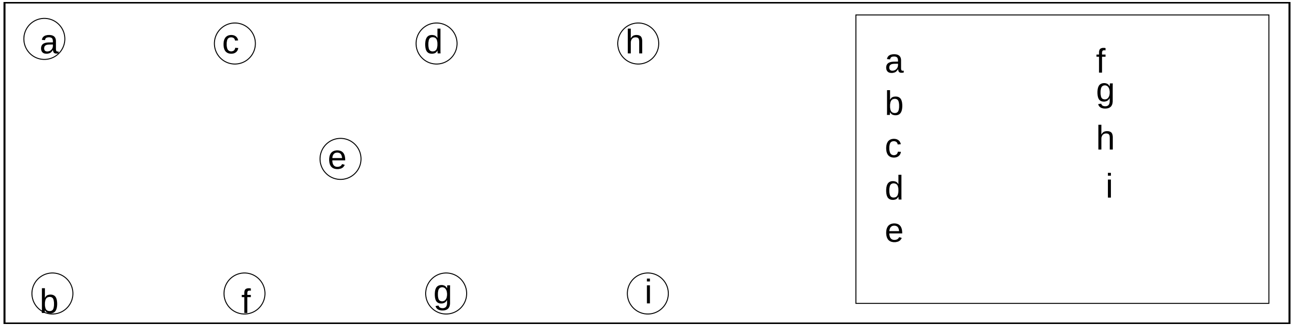
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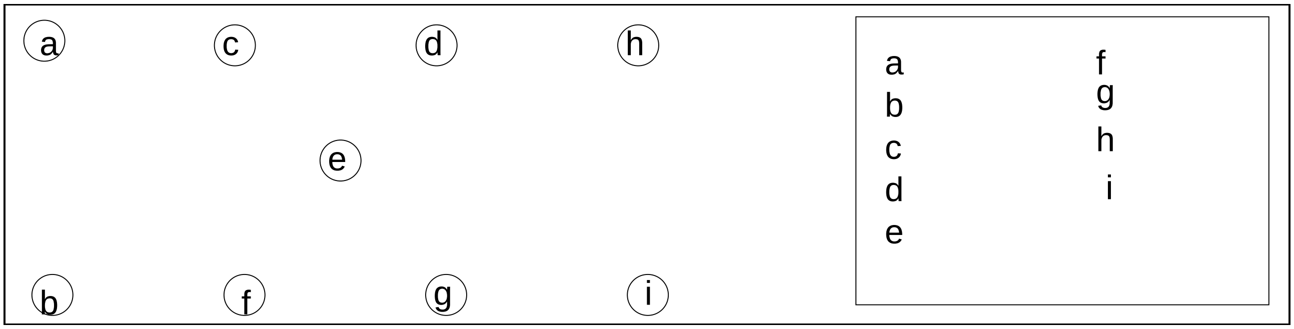
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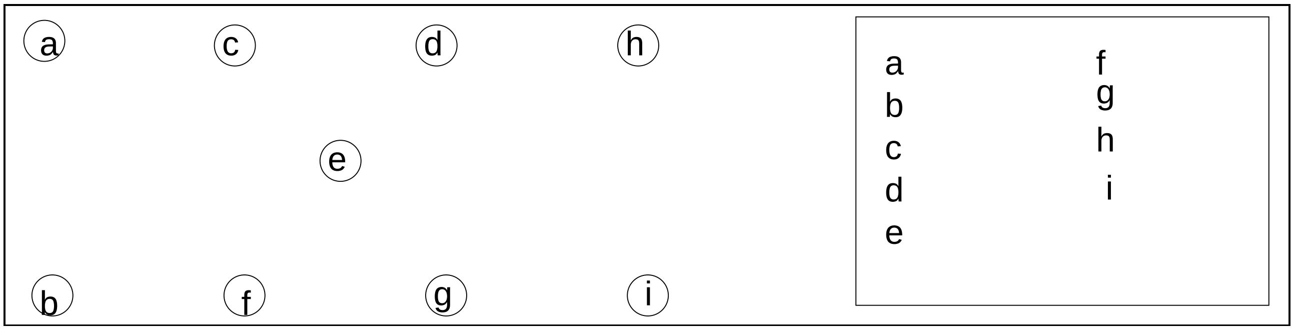
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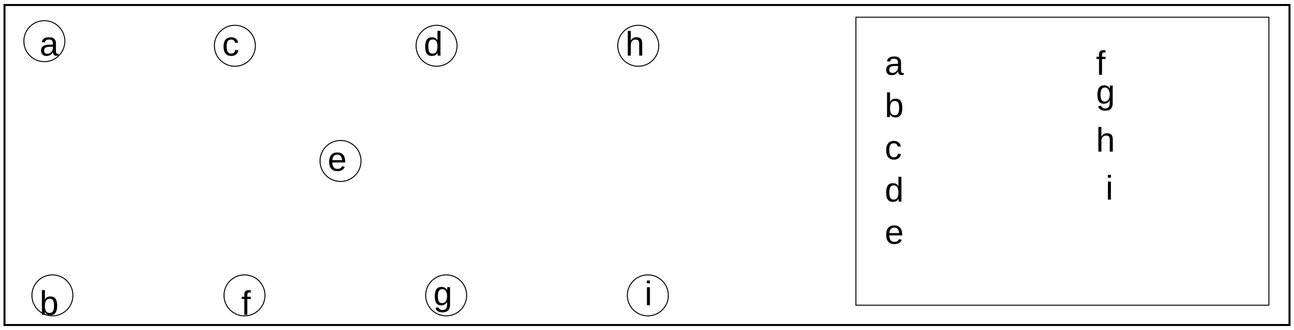
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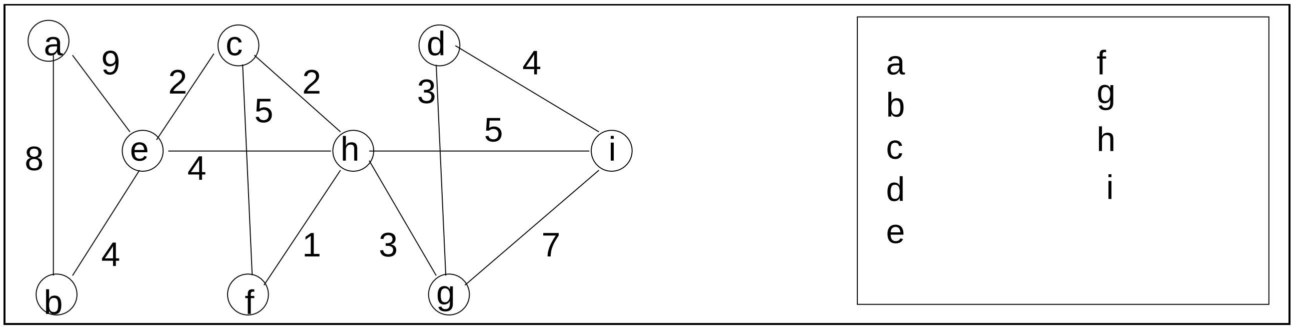
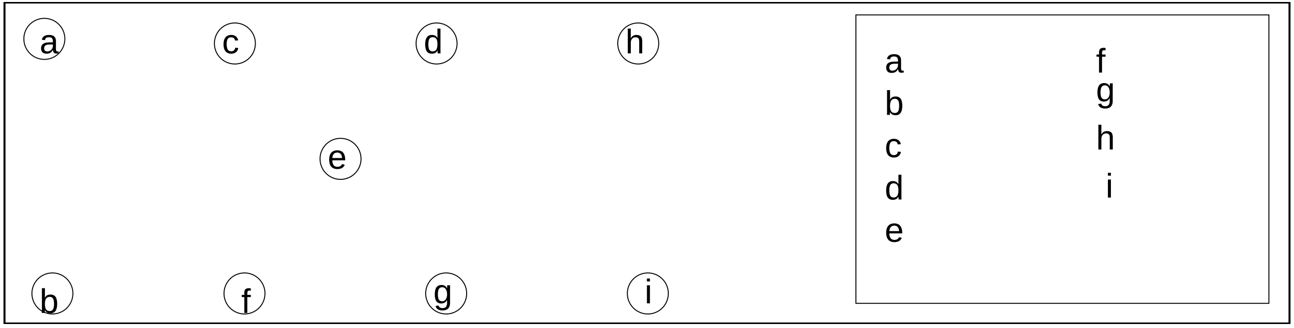
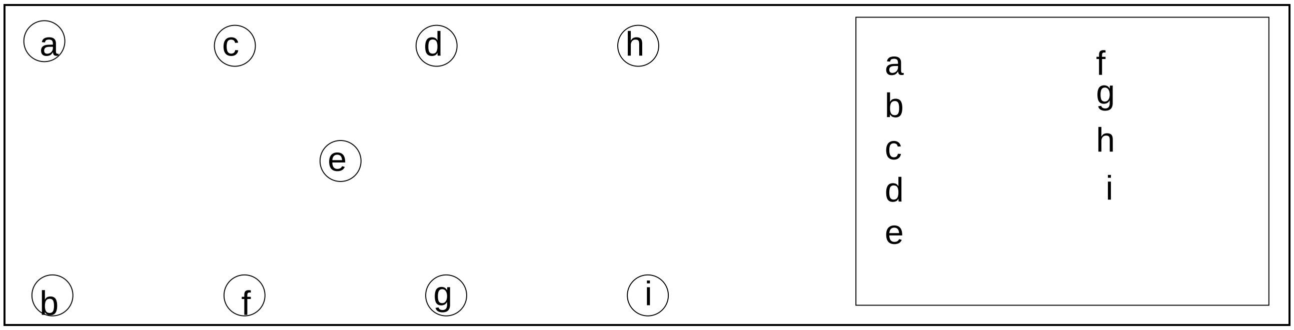
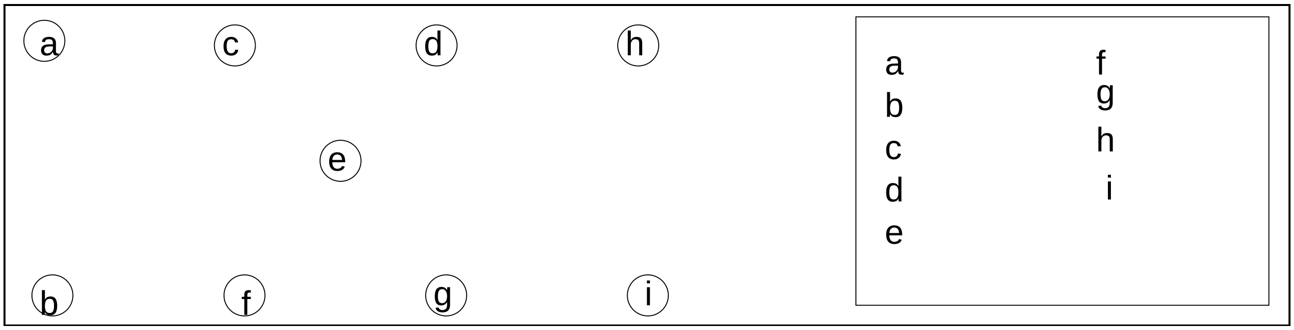
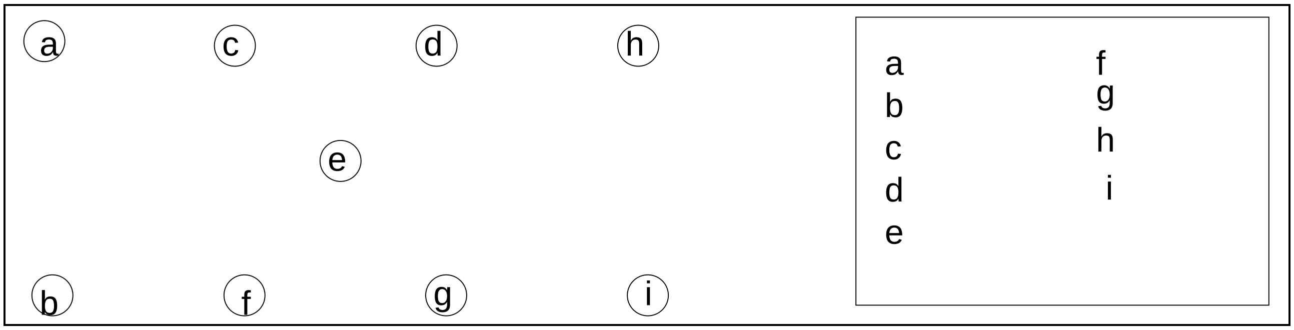
Graph 4. Prim's Algorithm. Root node = h.

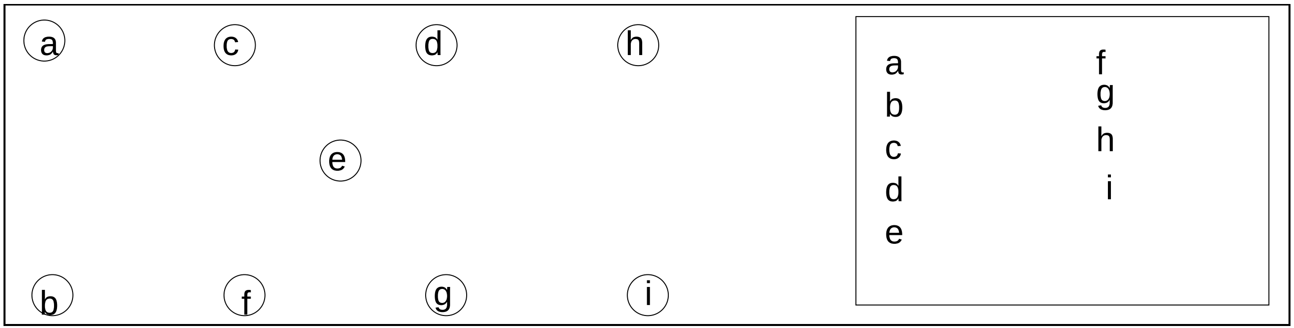








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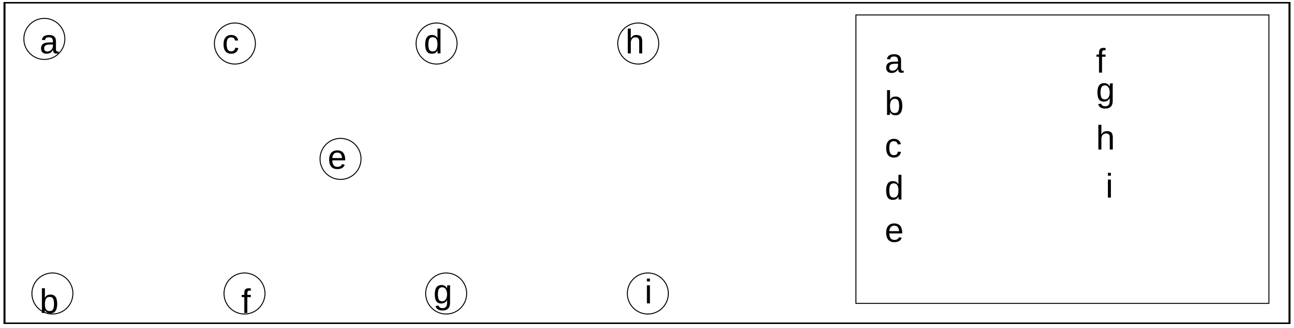
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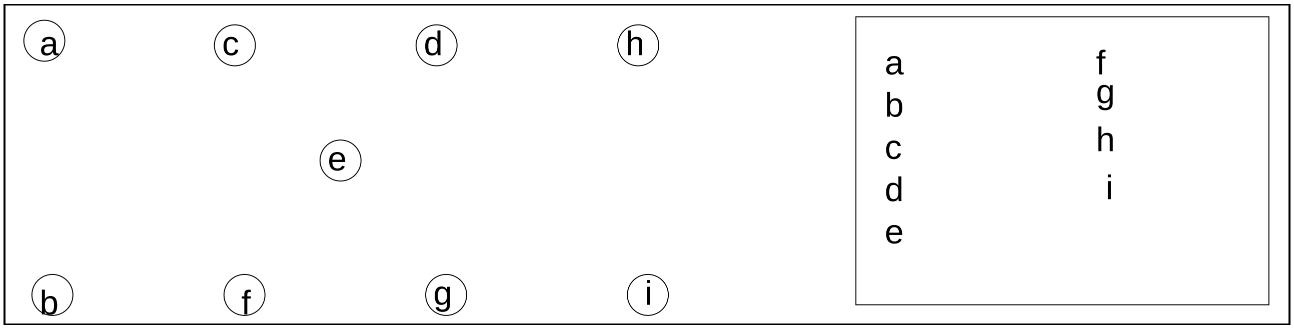
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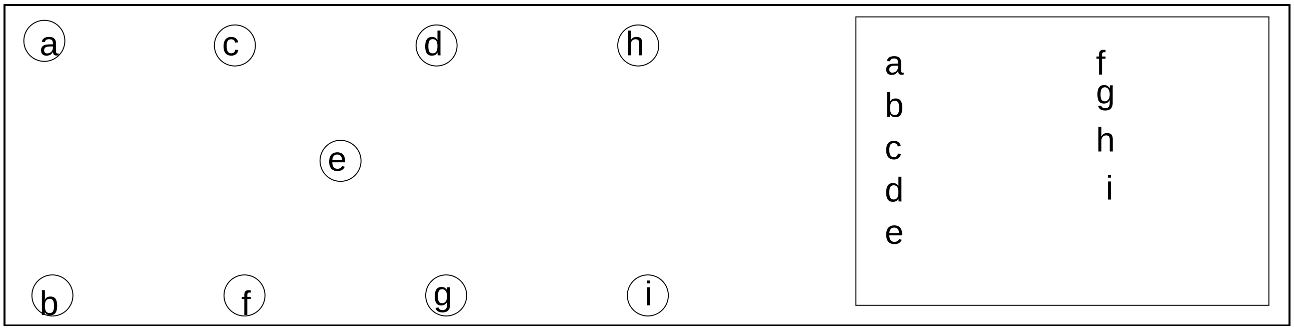
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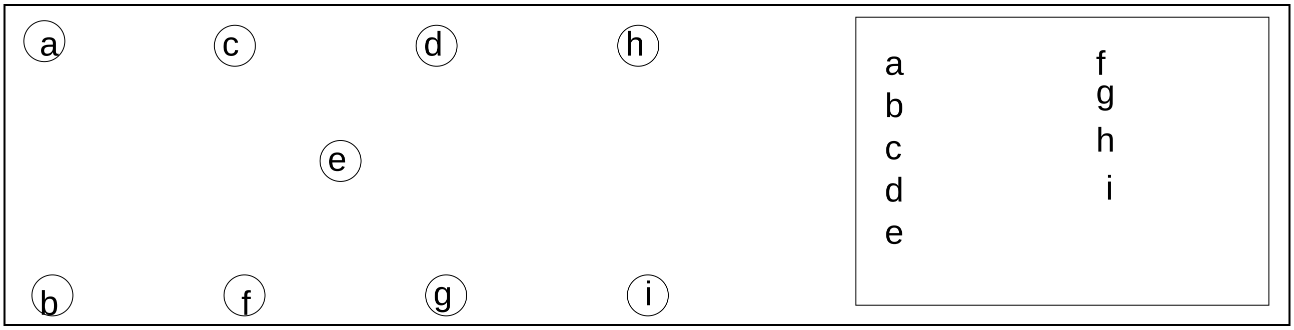
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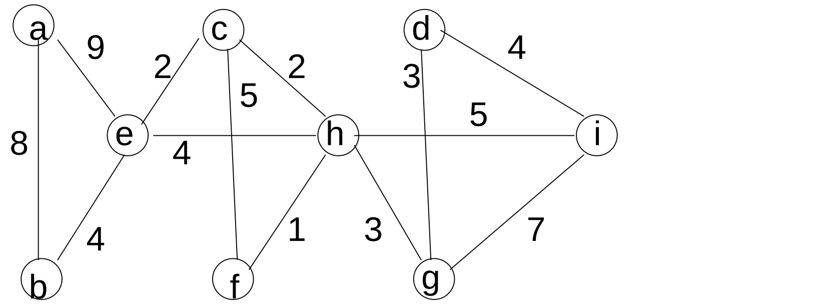
Graph 4. Kruskal's Algorithm.



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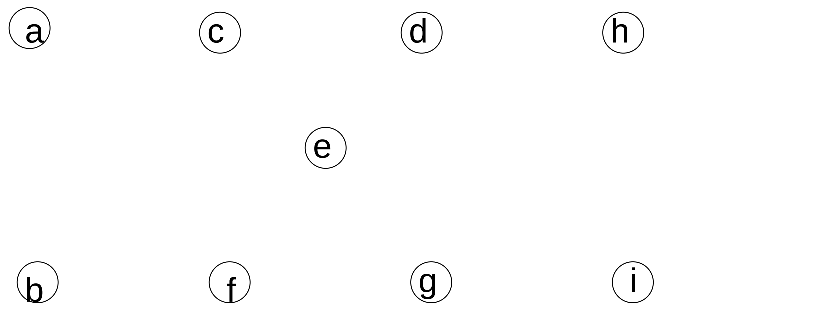

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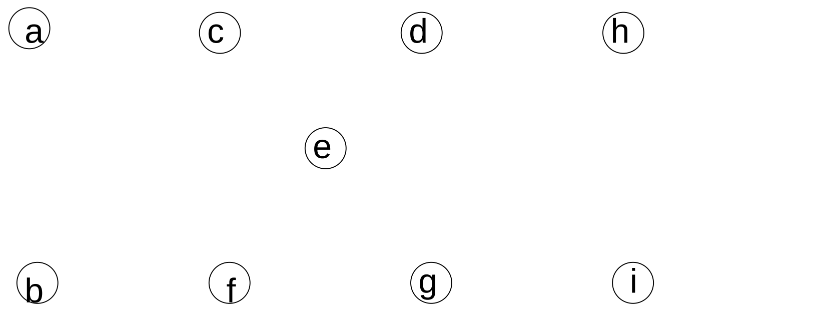

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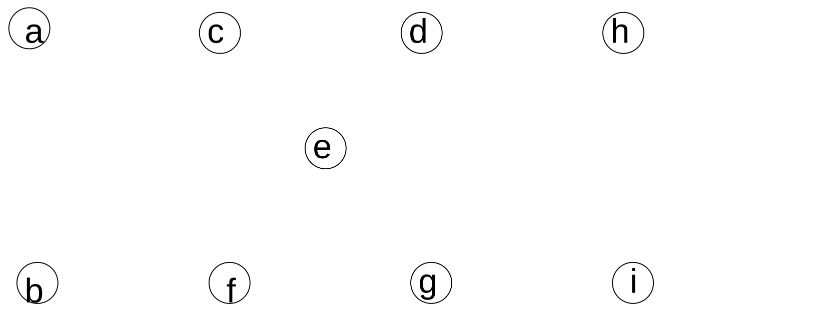

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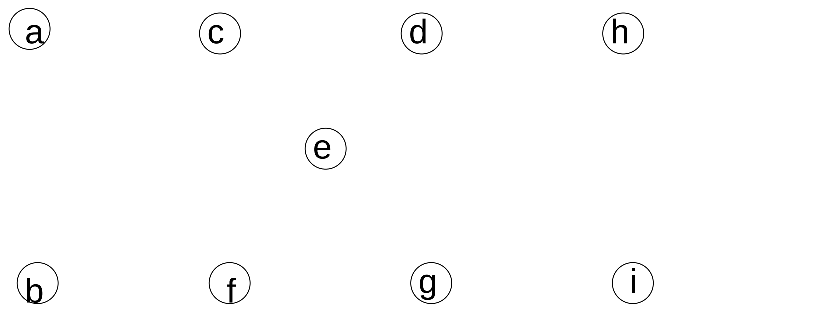

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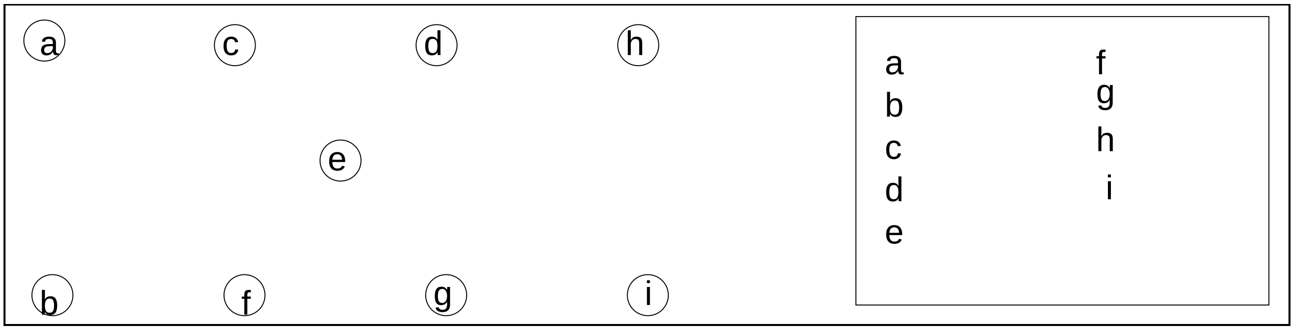
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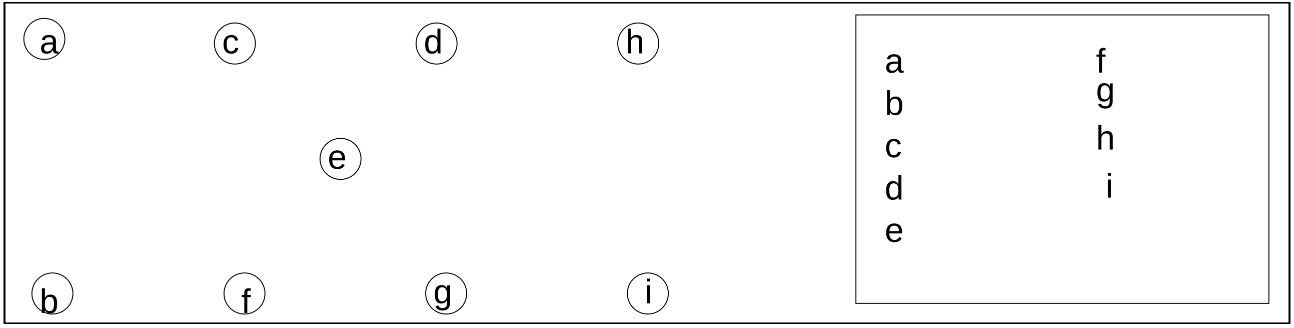
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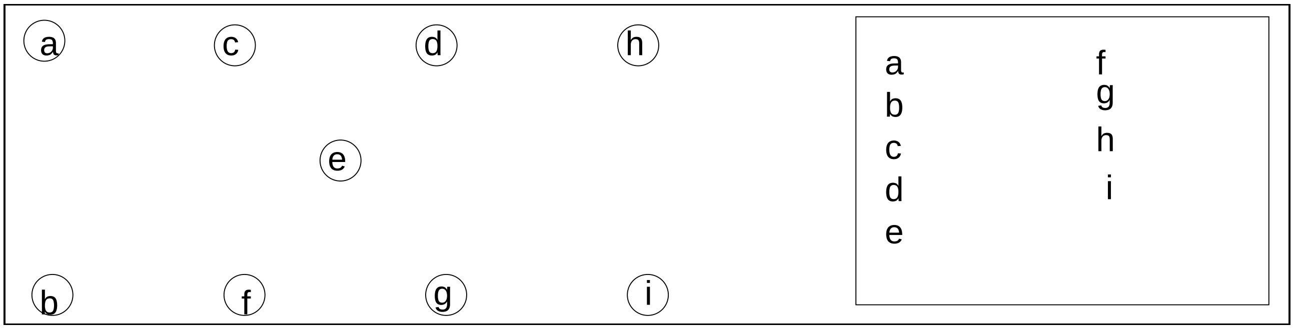
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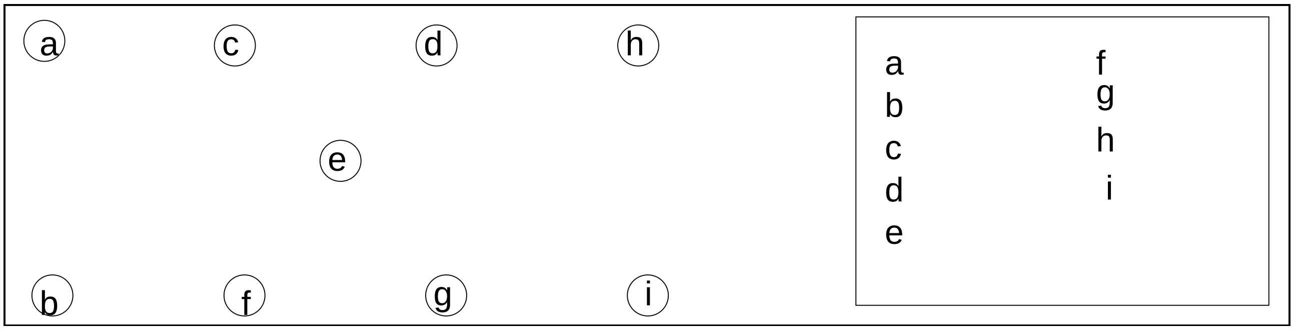
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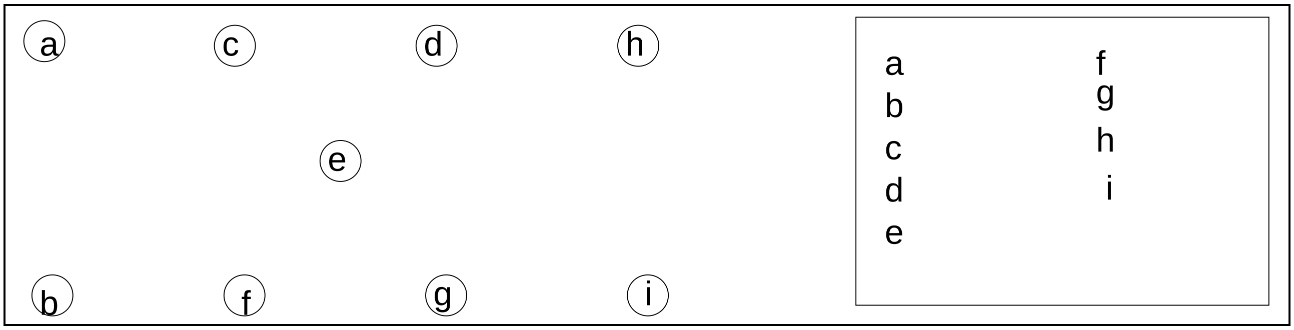
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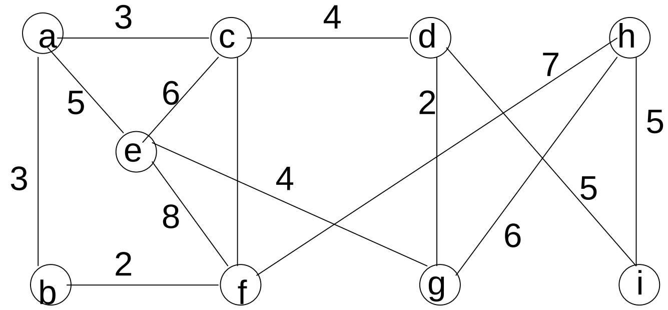
Graph 5. Prim's Algorithm. Root node = g.



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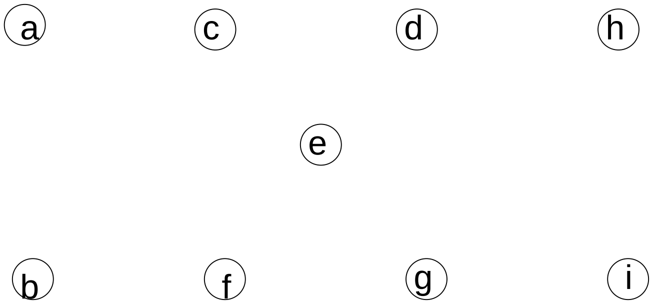

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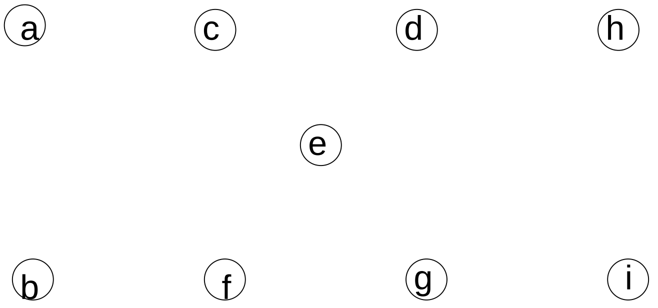

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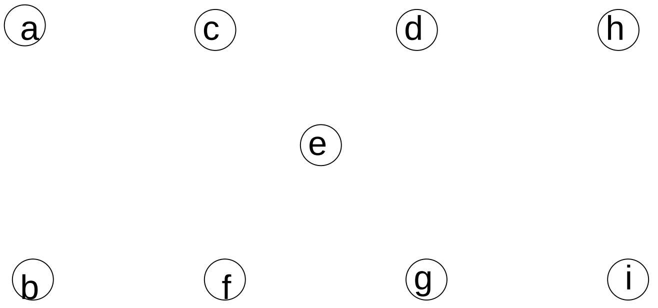

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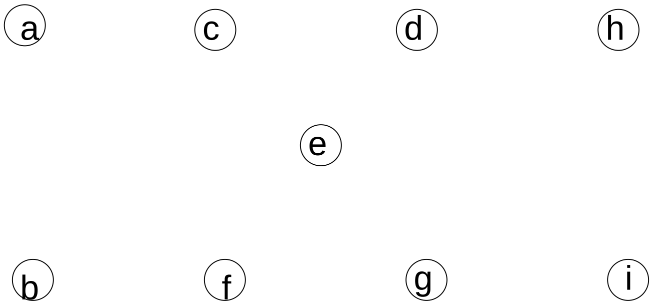

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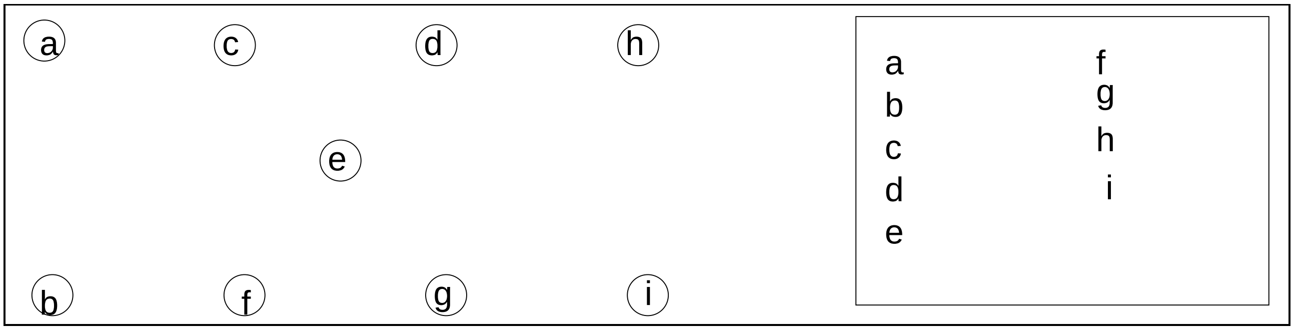
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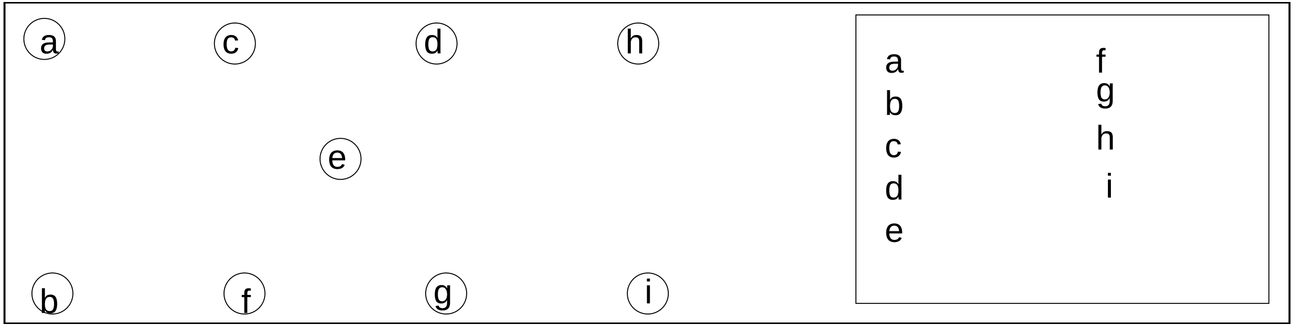
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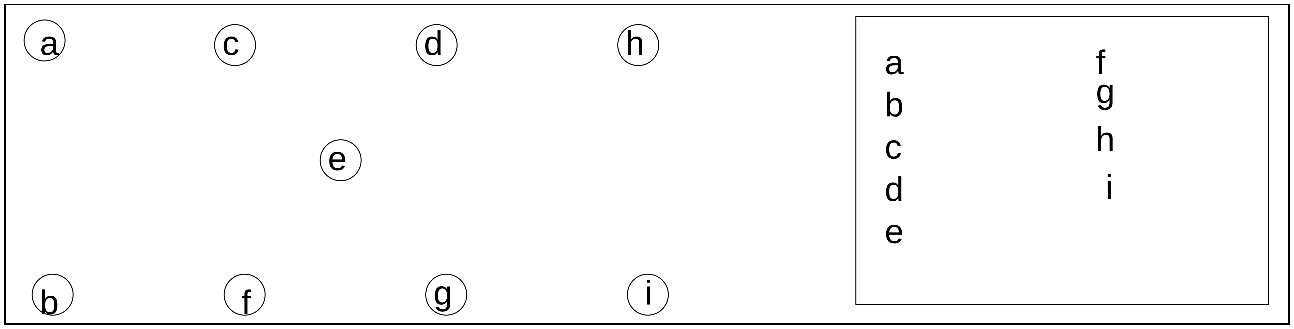
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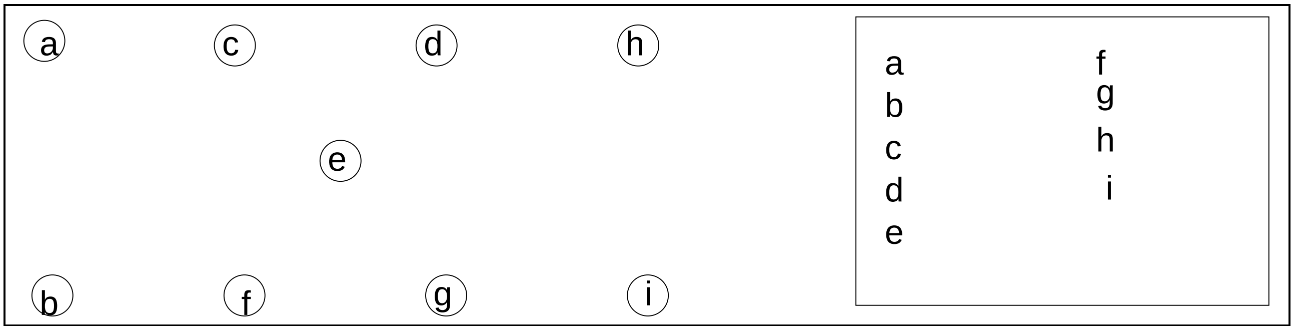
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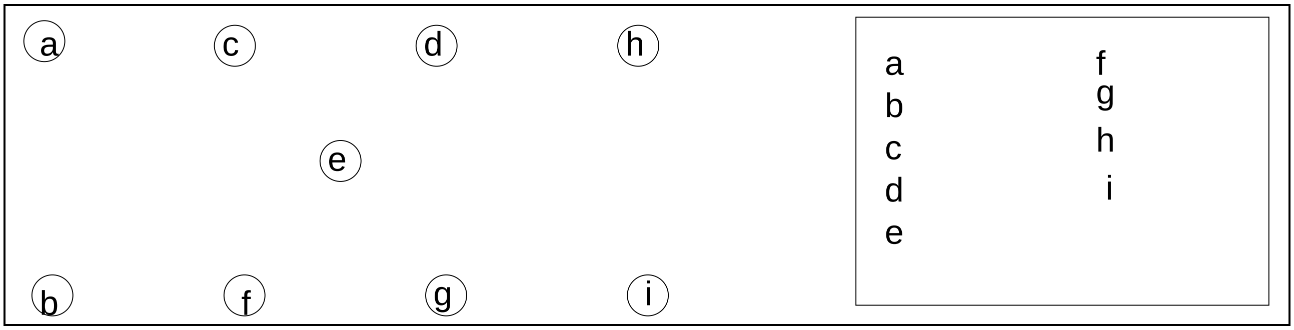
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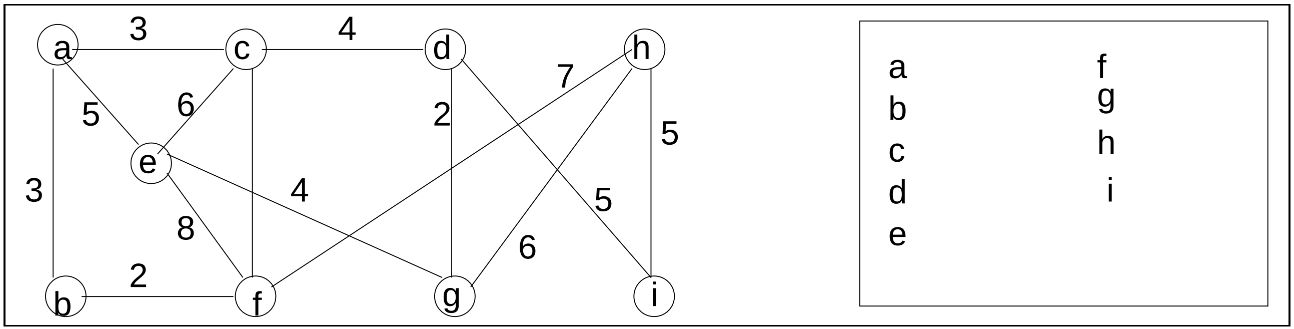
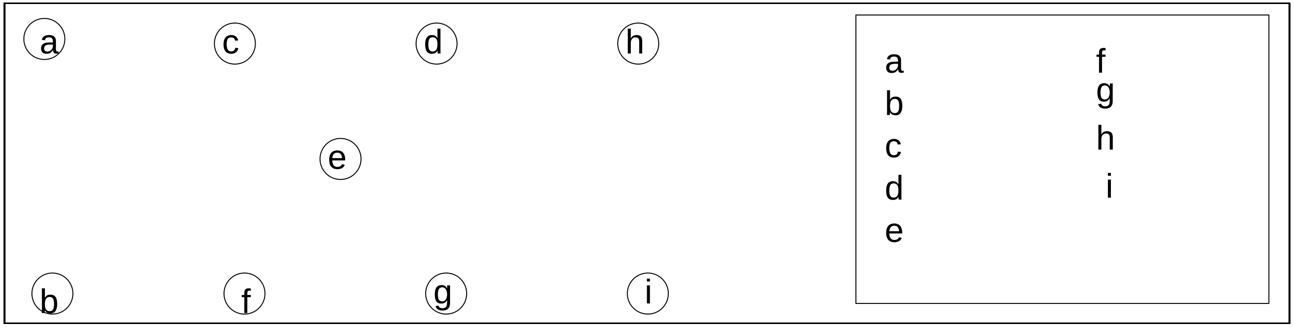
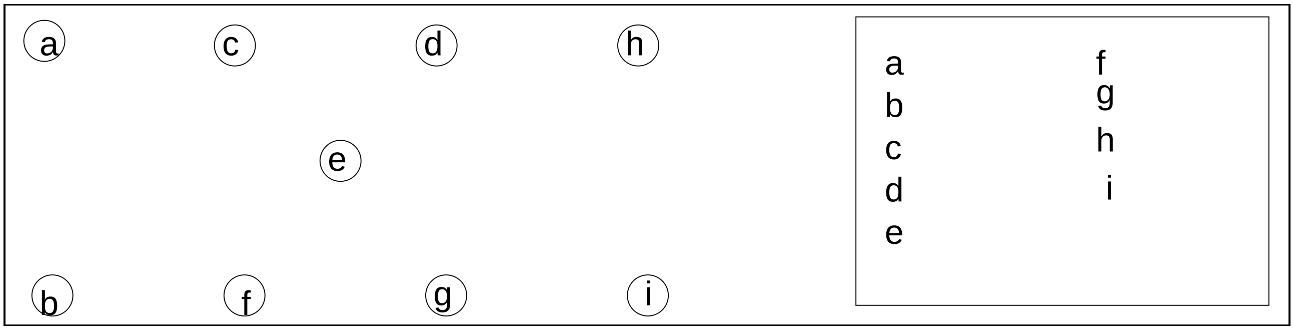
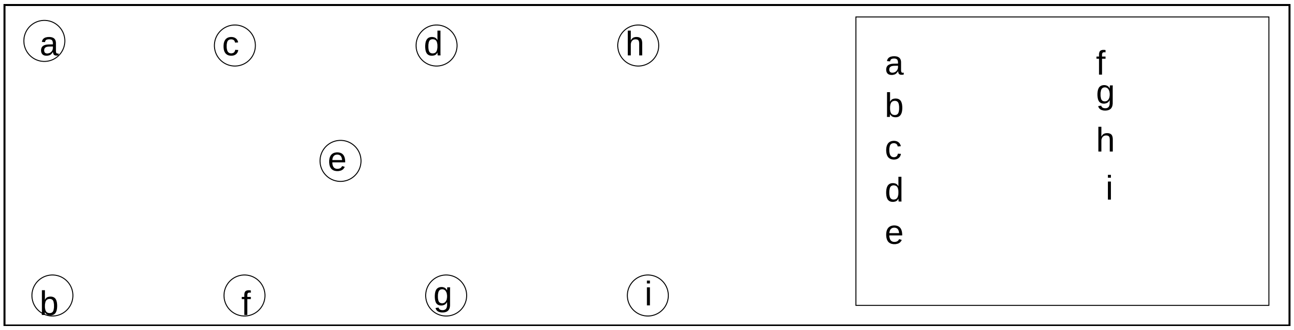
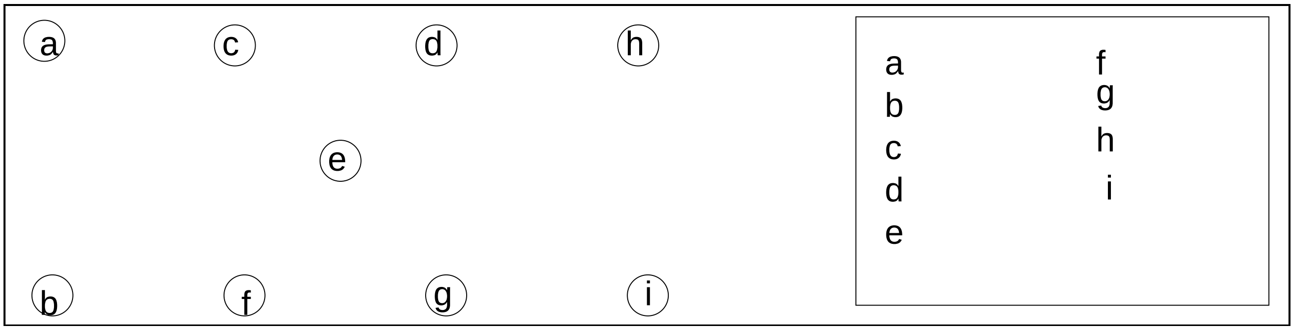
Graph 5. Kruskal's Algorithm.

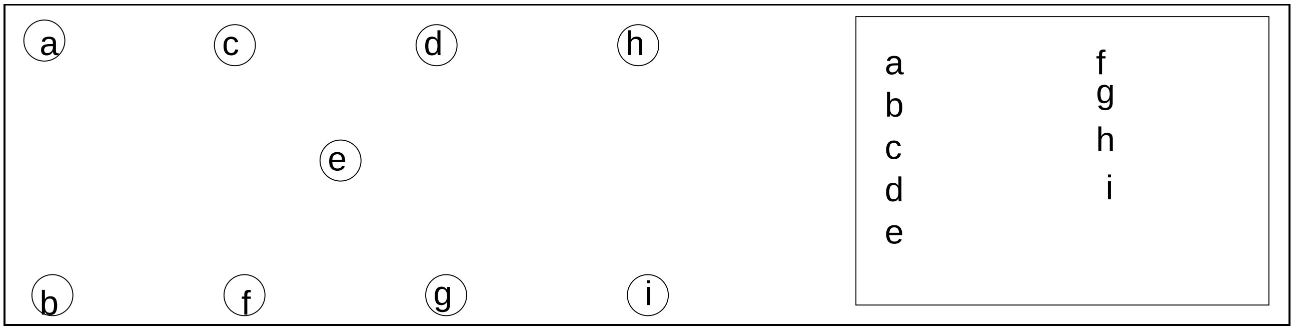








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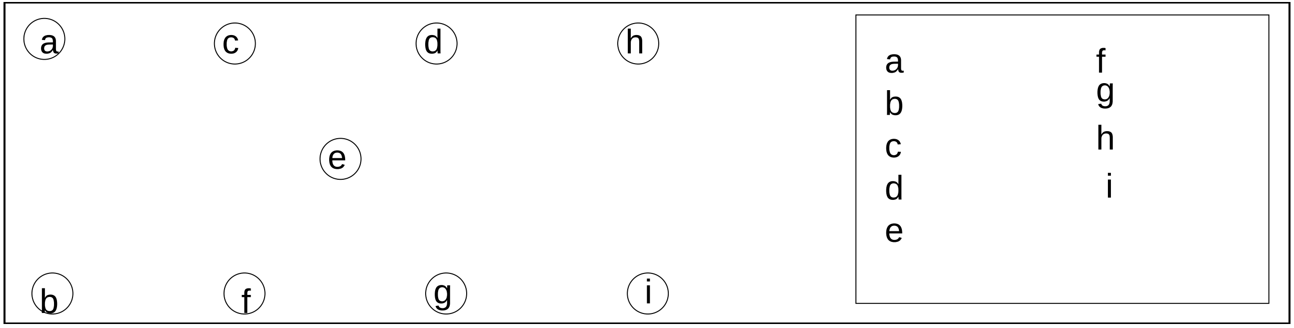
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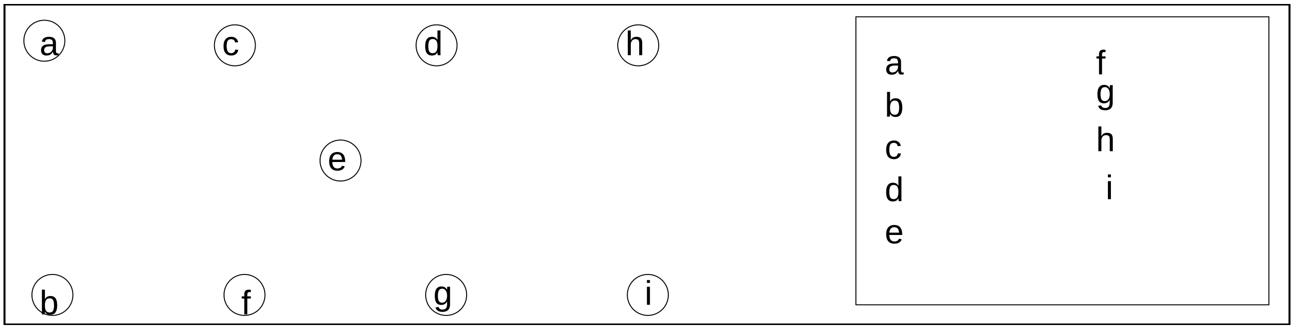
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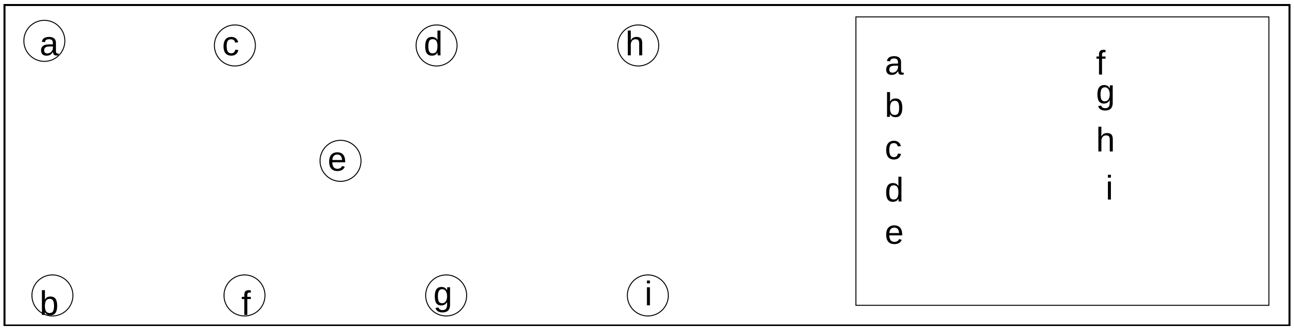
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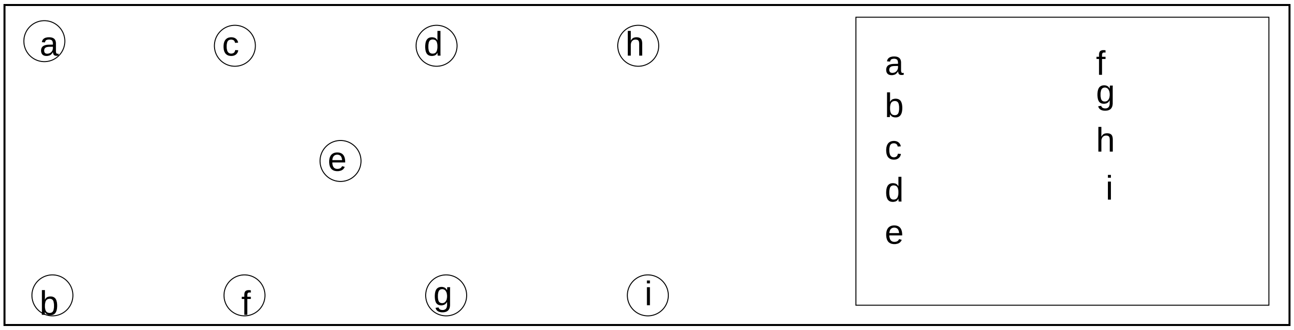
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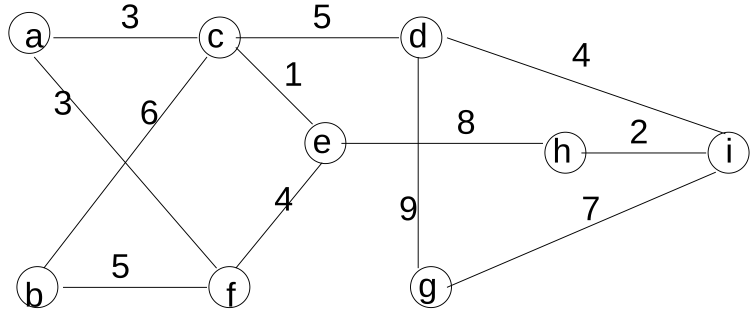
Extra Worksheets. Graph 1.



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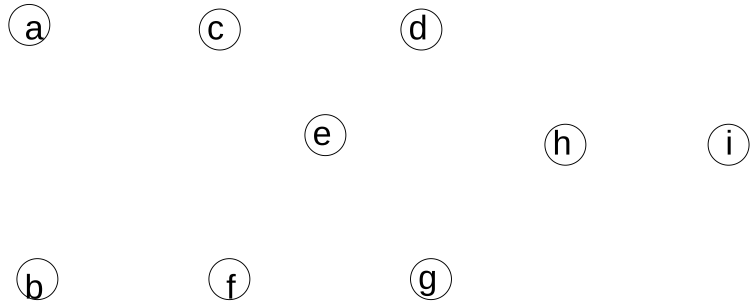

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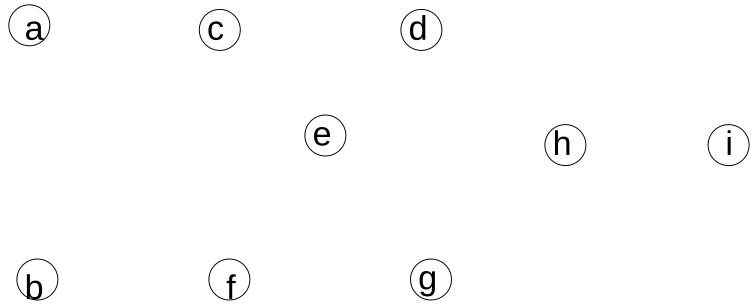

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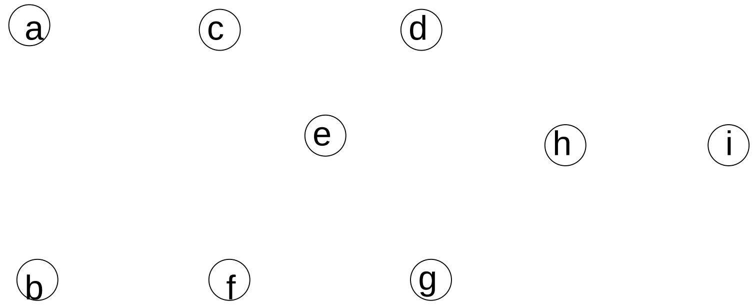

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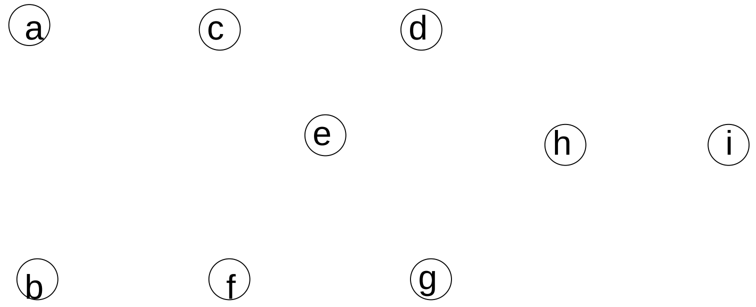

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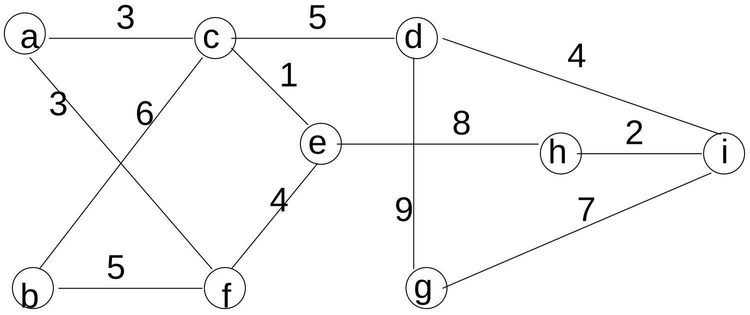
Extra Worksheets. Graph 1.



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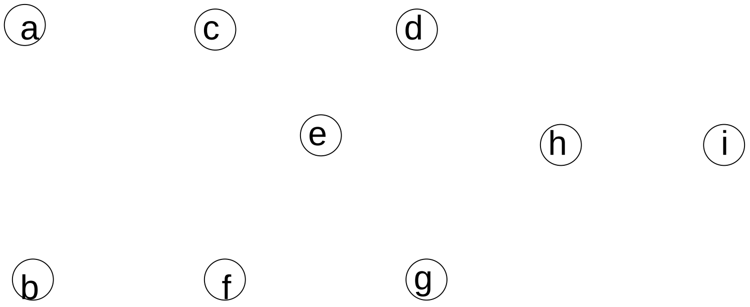

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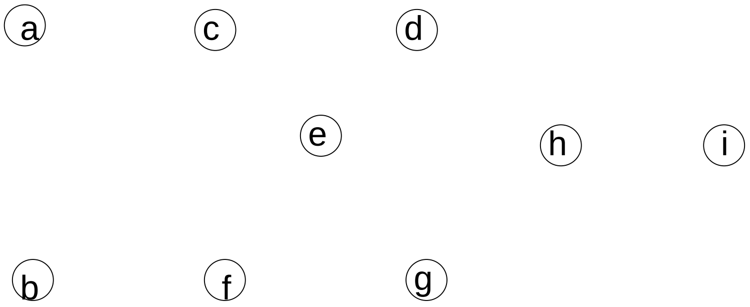

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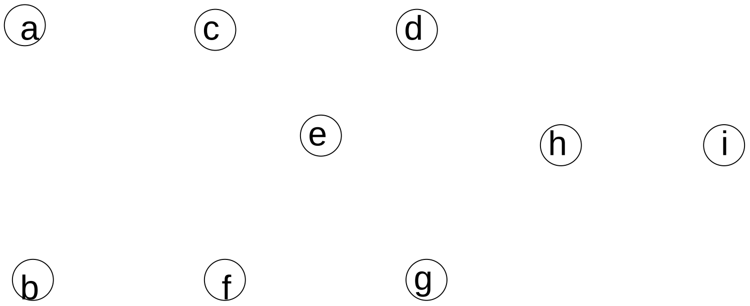

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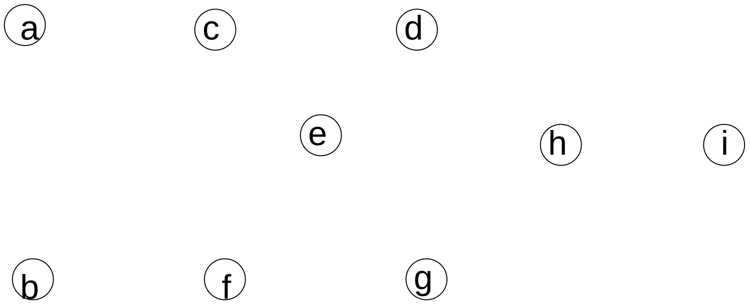

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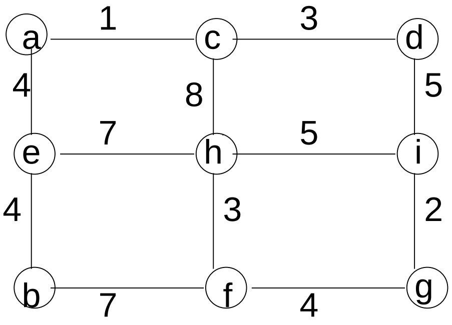
Extra Worksheets. Graph 2



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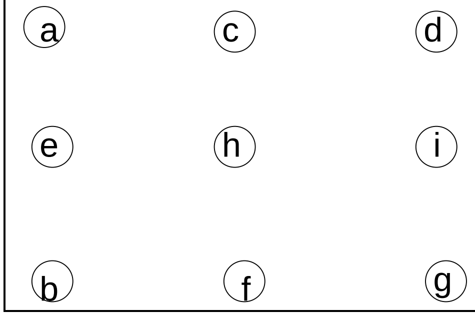

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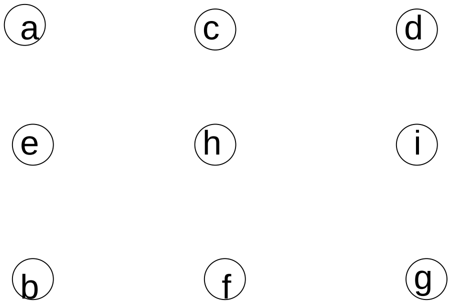

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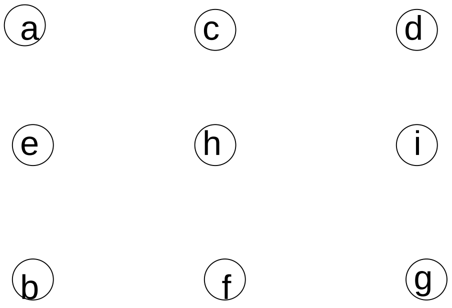

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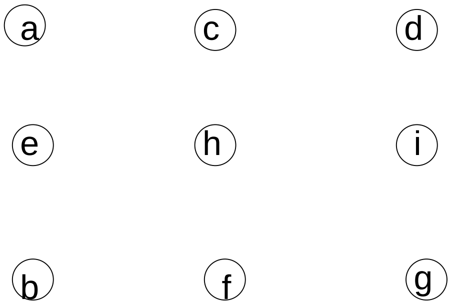

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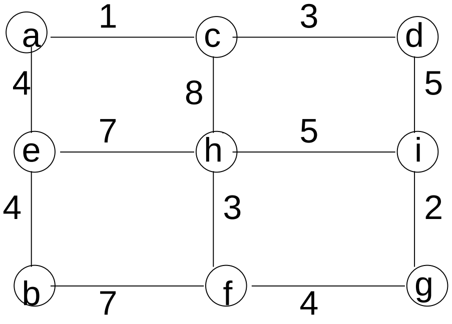
Extra Worksheets. Graph 2



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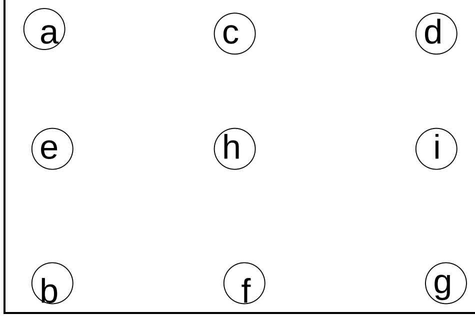

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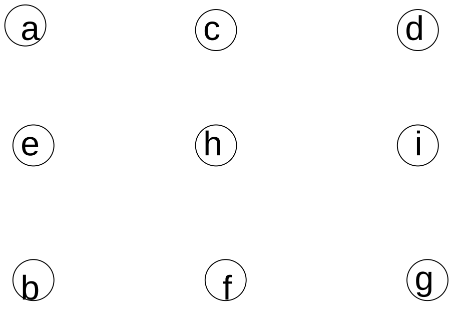

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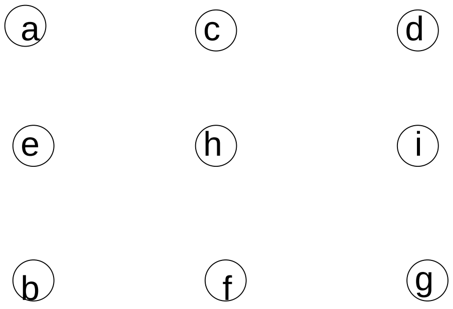

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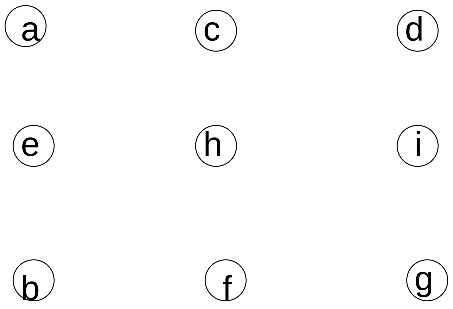

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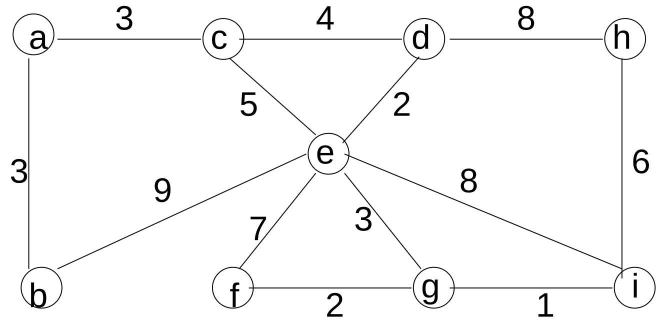
Extra Worksheets. Graph 3.



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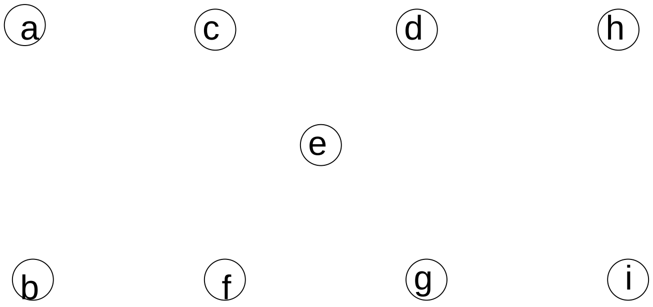

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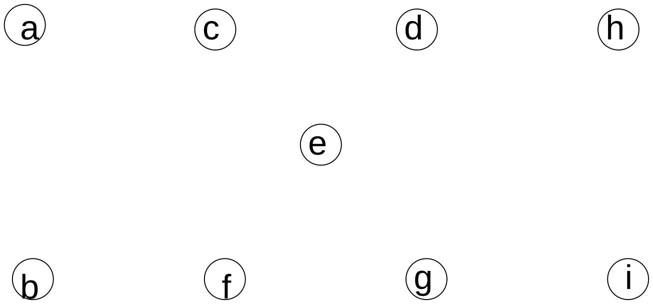

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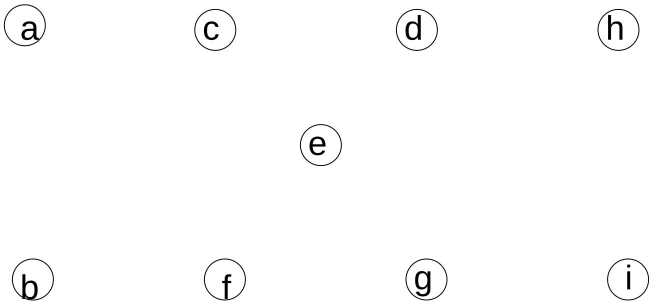

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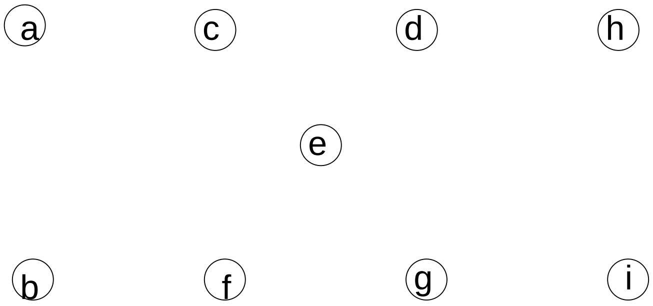

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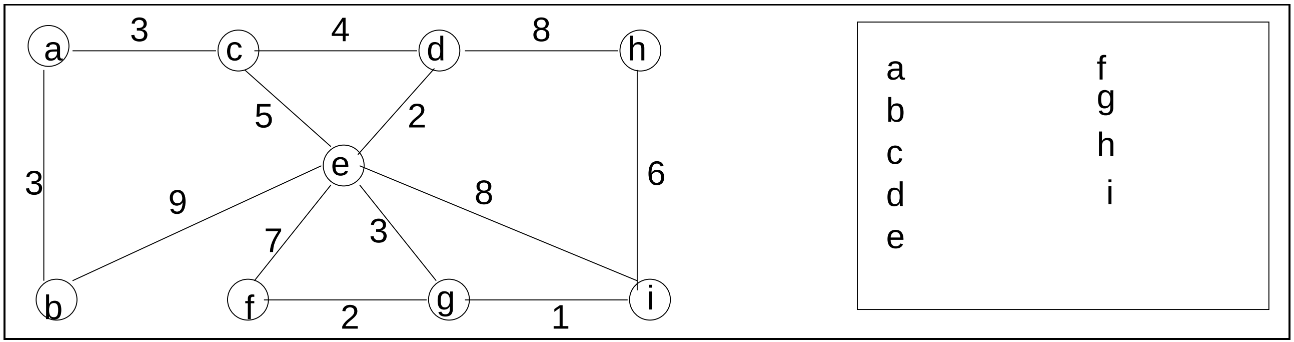
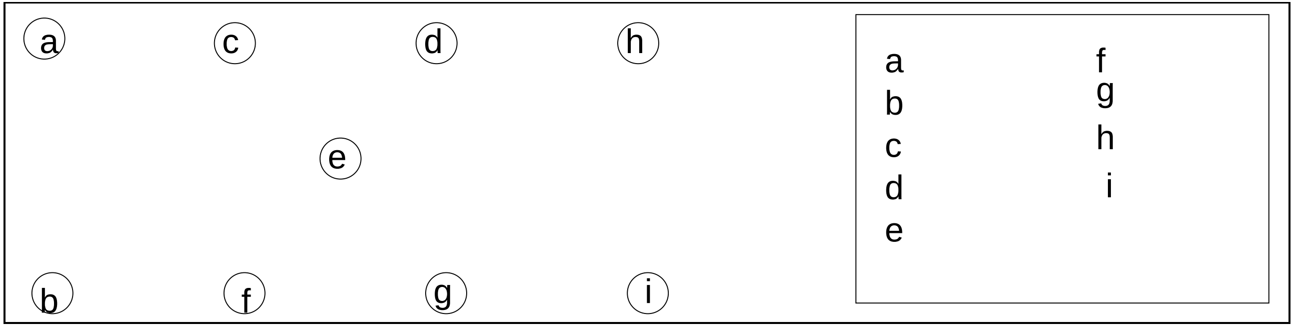
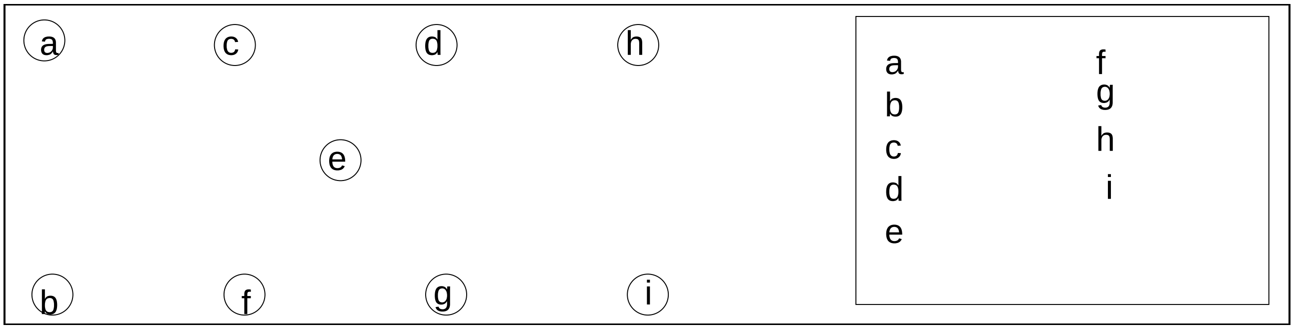
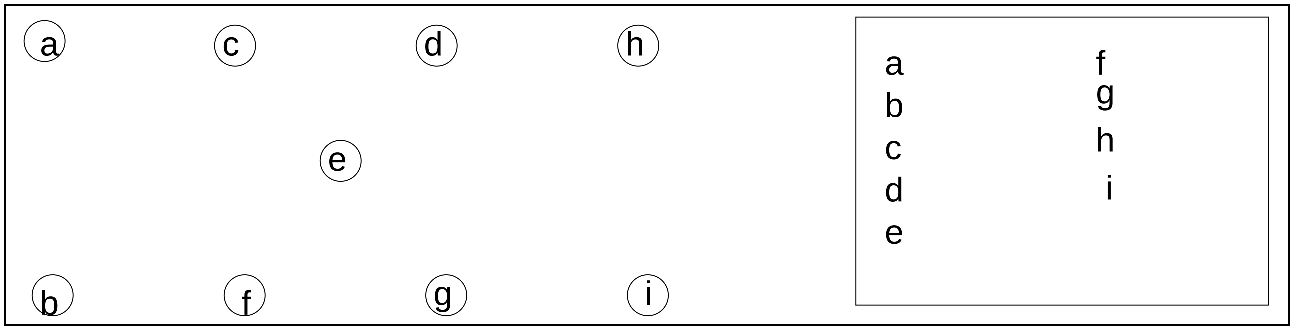
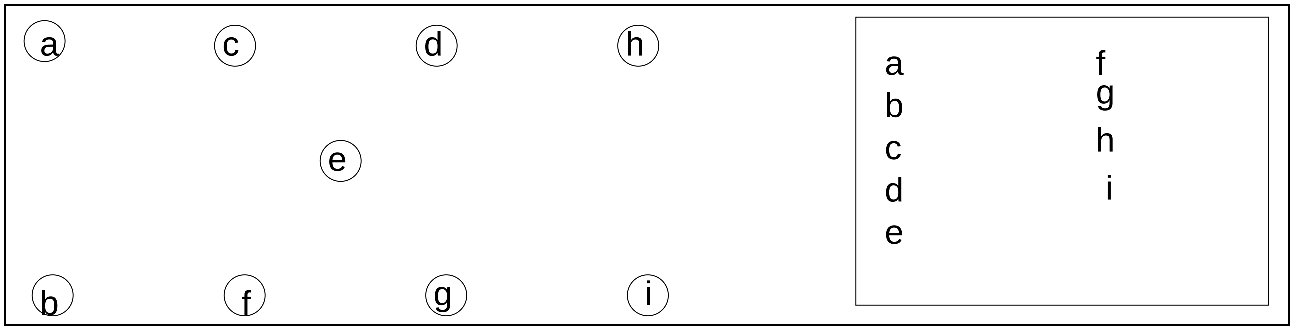
Extra Worksheets. Graph 3.



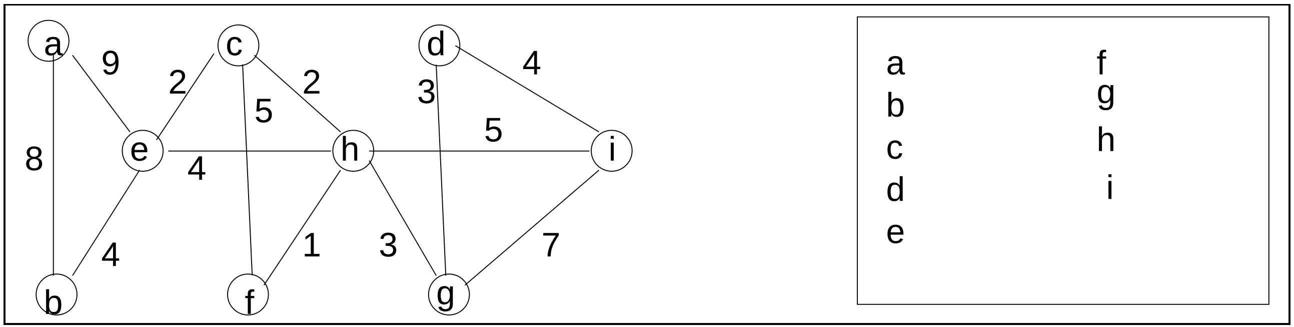


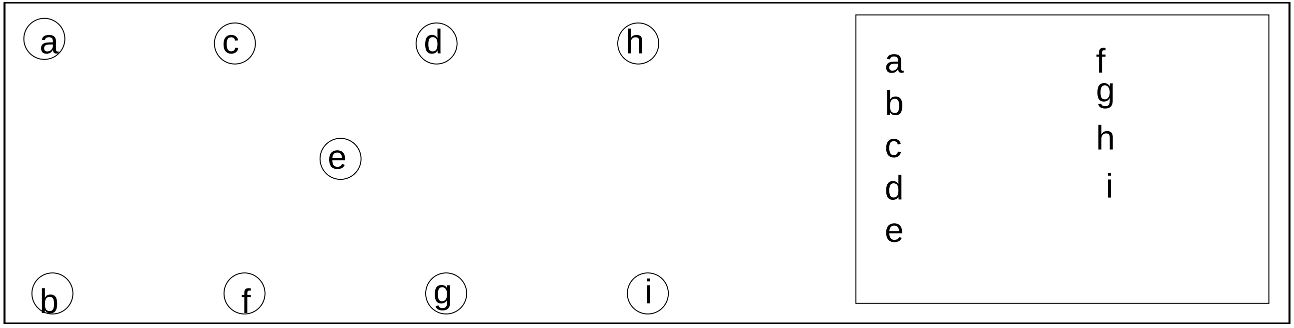


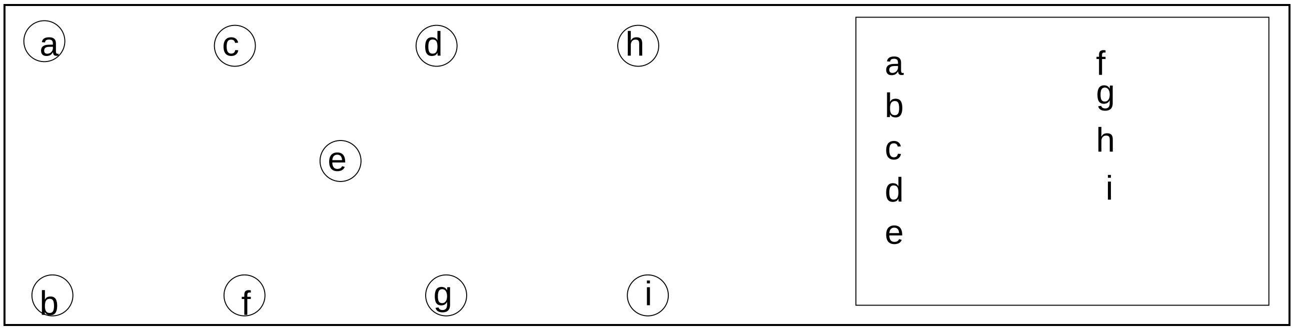


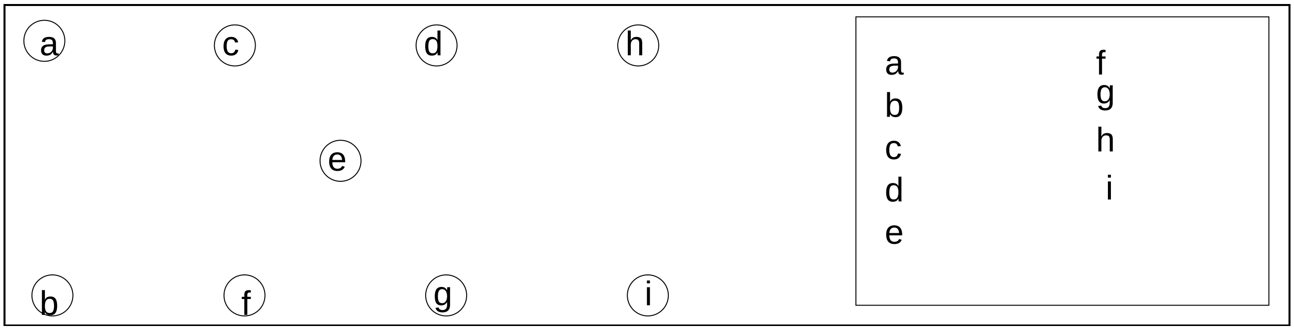


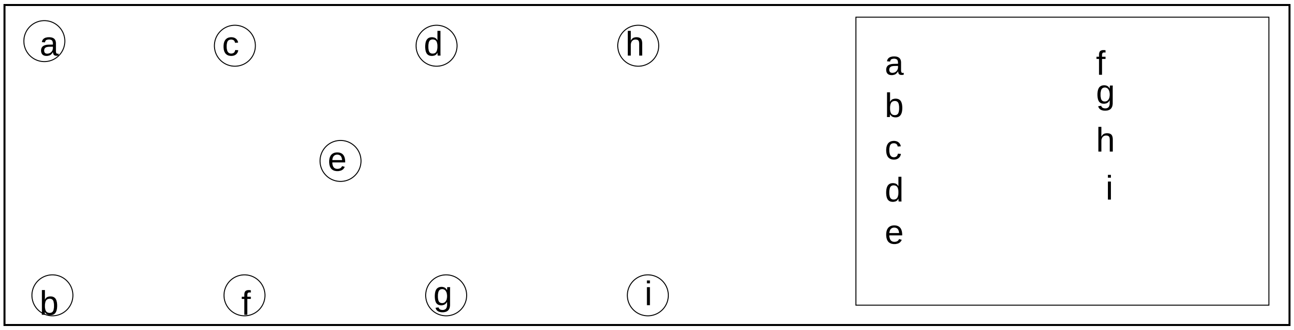
Extra Worksheets. Graph 4.



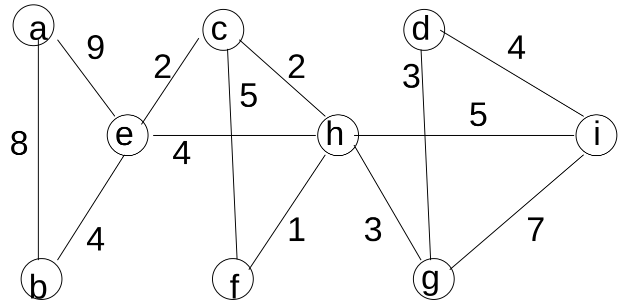








Extra Worksheets. Graph 4.



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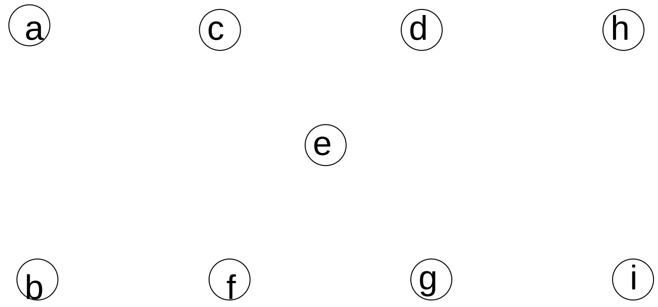

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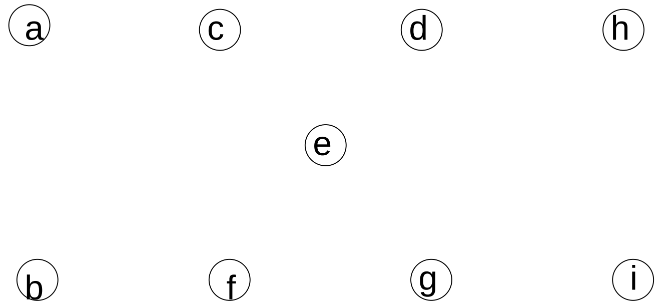

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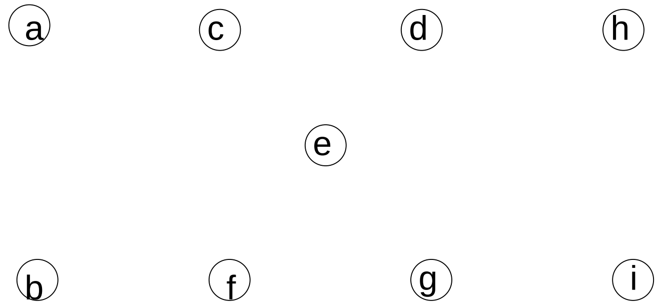

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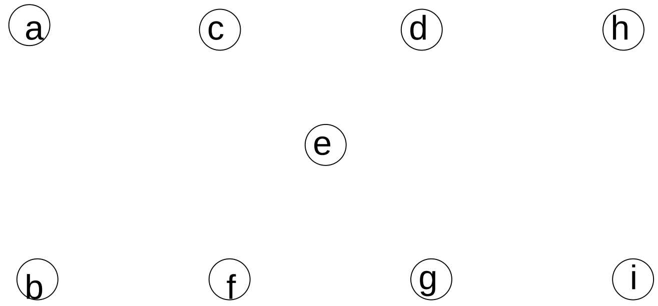

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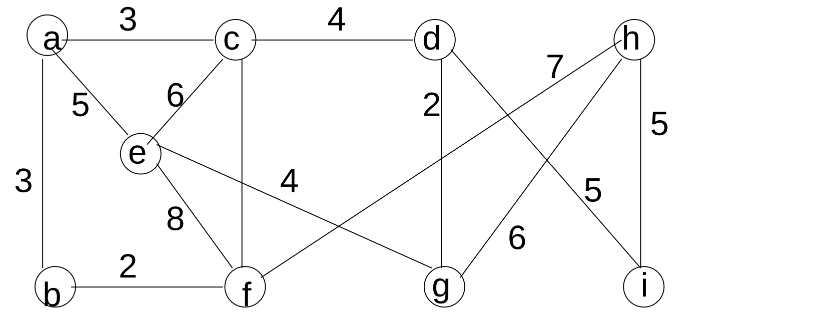
Extra Worksheets. Graph 5.



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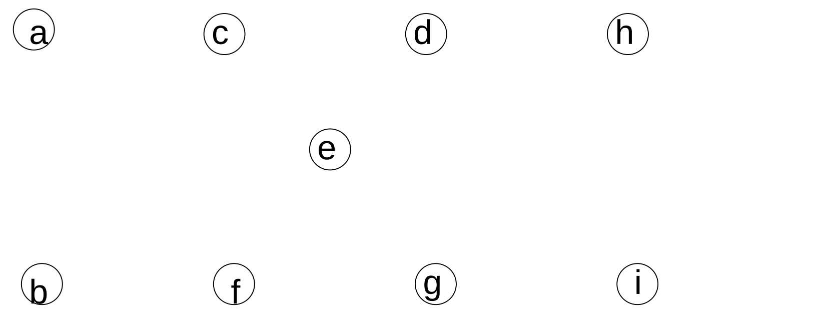

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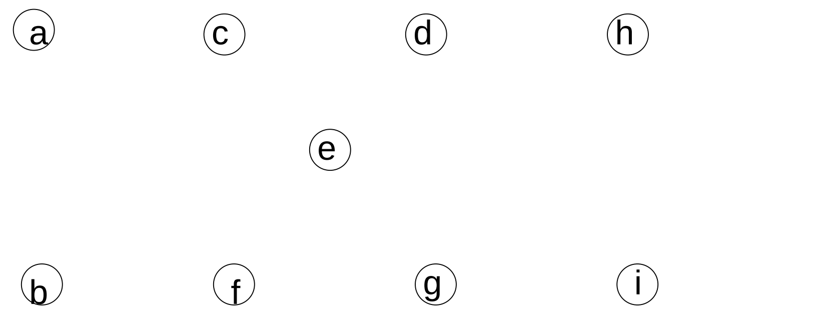

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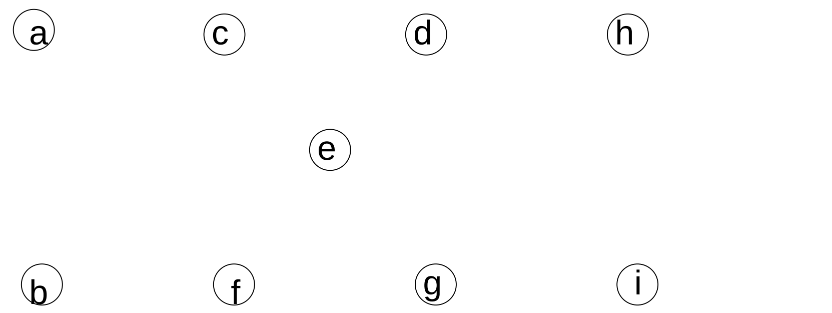

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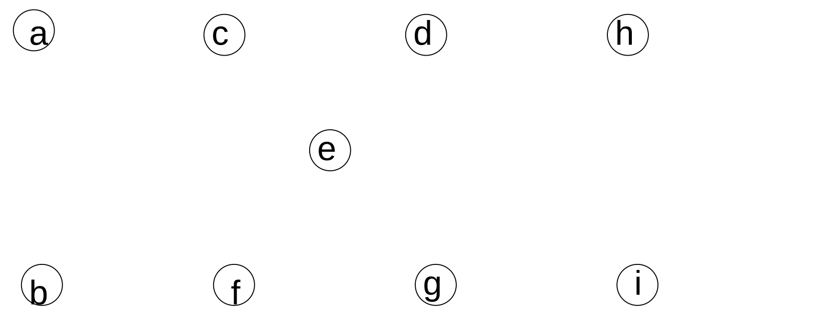

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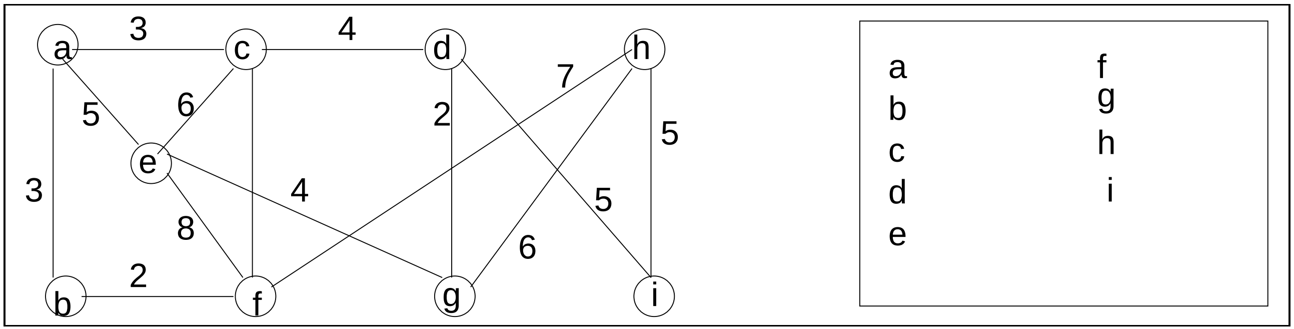
Extra Worksheets. Graph 5.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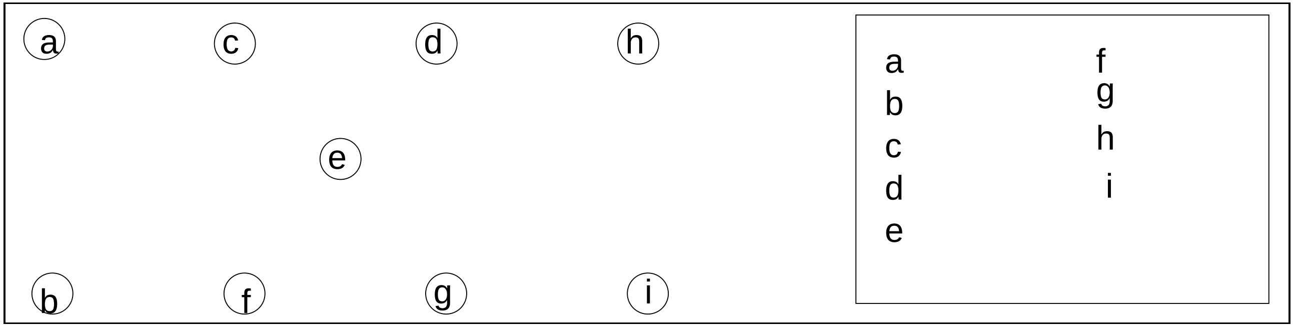
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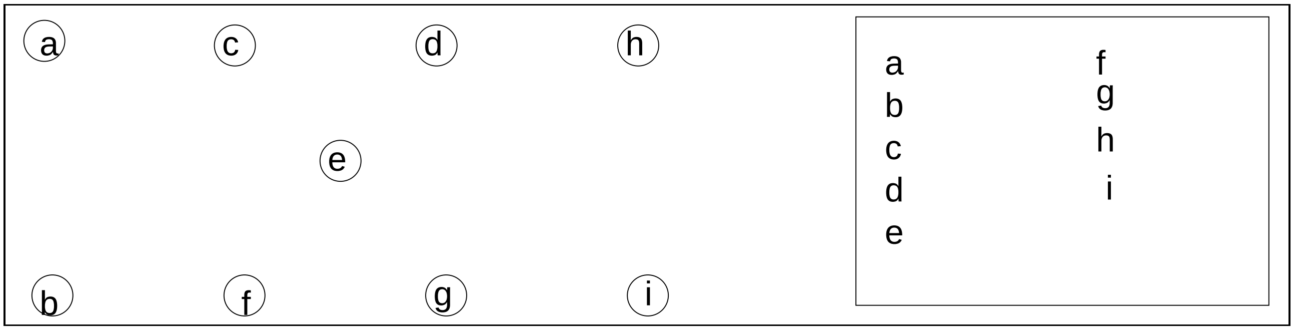
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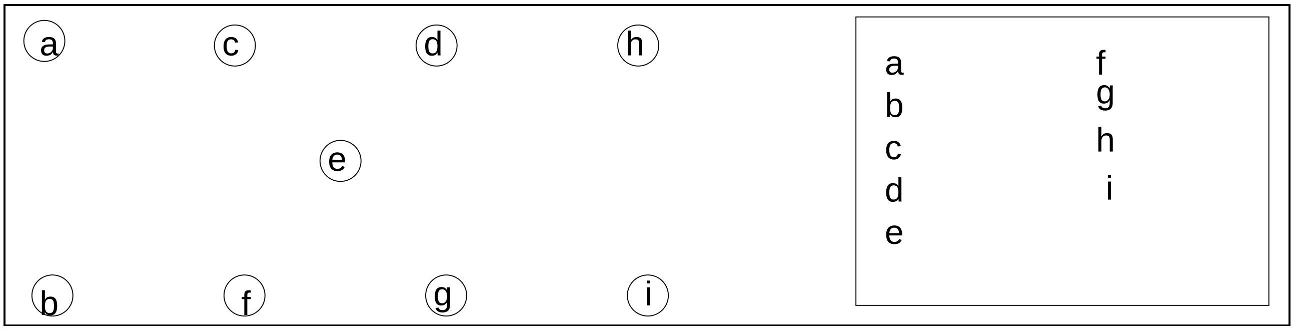
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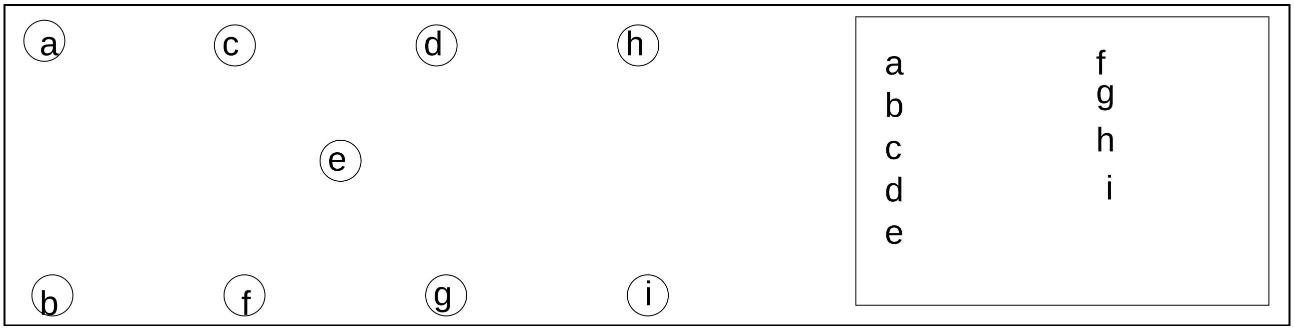
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