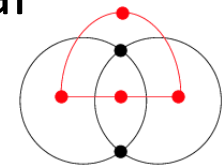


2. A Method for embedding an Euler diagram

Steps we will take to convert an abstract description into an Euler diagram:

1. Generate the superdual graph for the abstract description
2. Find a planar subgraph using edge removal
3. If the graph is not wellconnected, add concurrent edges whilst maintaining planarity
4. Find a plane layout for the graph and add edges to remove tangential intersections
5. Construct the Euler diagram from the dual

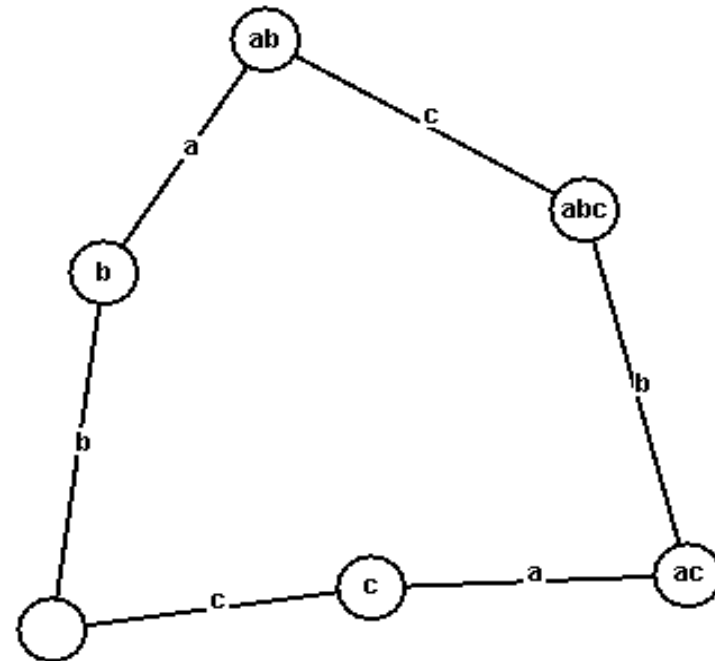


2.1. Generate the superdual graph for the abstract description

Create one vertex for each zone description (including {})

Join vertices where node labels have exactly one letter in their symmetric difference.

{ } b c ab ac abc



Problems: Finding the superdual

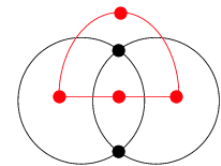
Find the superduals of these abstractions:

{ a b ab abc

{ a b c d

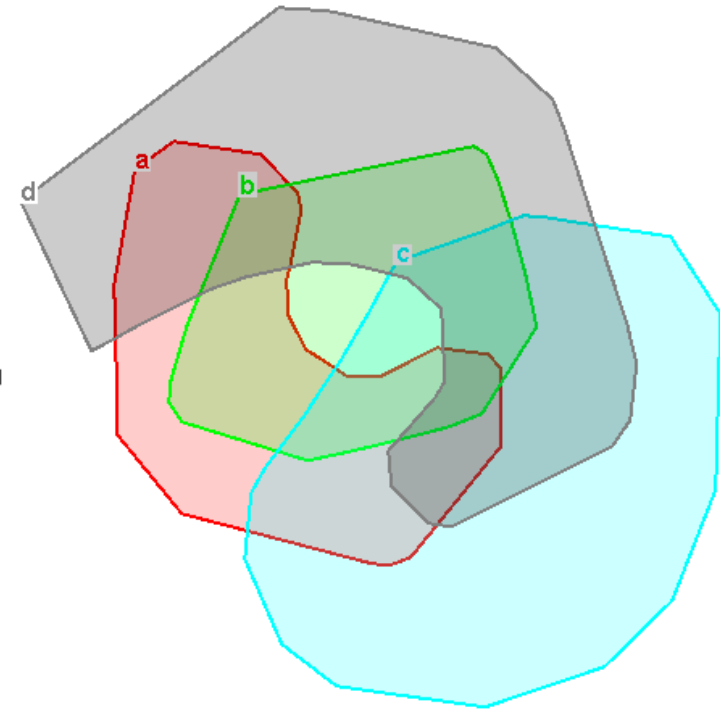
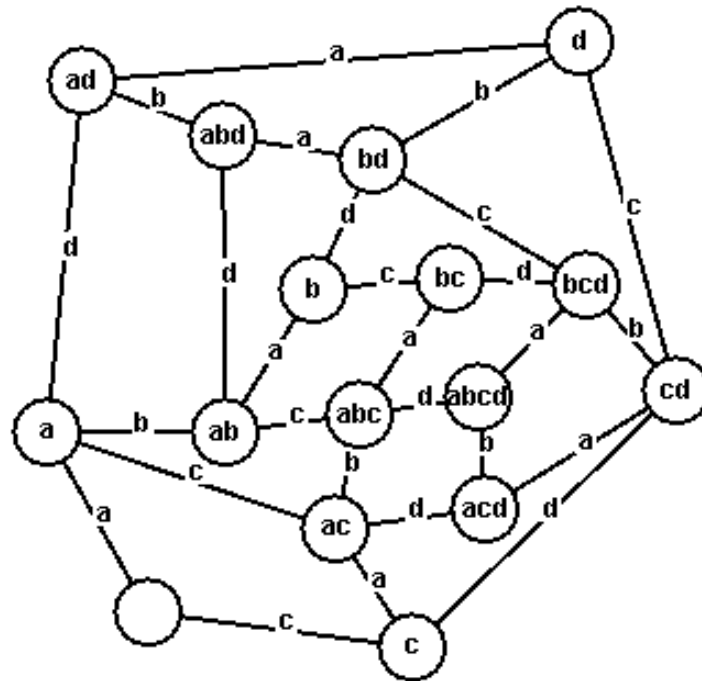
{ ab ac ad

{ a b c ab ac bc abc



2.2. Find a planar subgraph using edge removal

If the superdual is non planar (cannot be drawn without incurring edge crossings) remove edges until a planar graph is formed. **This example is Venn 4.**



2.3. If the graph is not wellconnected, add concurrent edges whilst maintaining planarity

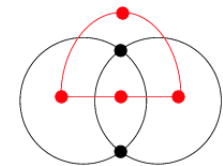
Wellconnected means that:

a) the graph is connected

and for each contour label in the abstraction:

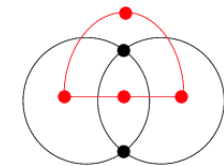
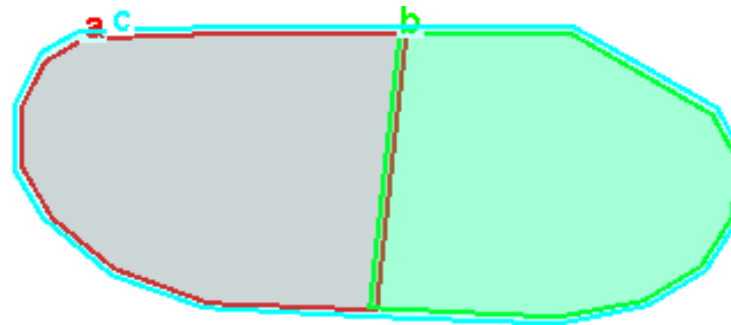
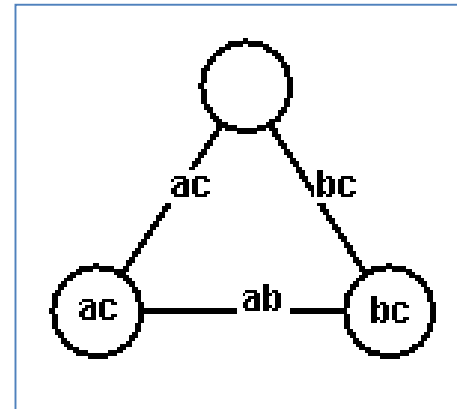
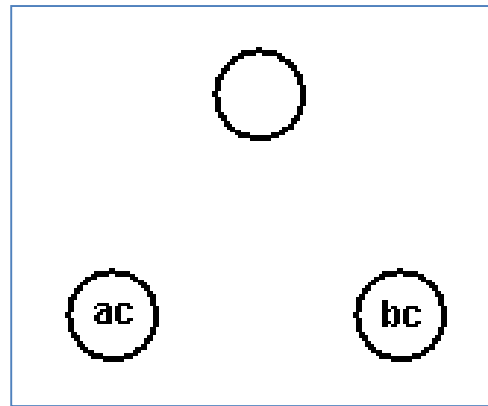
b) if the nodes **without** that contour label present are removed then the graph remains connected **and,**

c) if the nodes **with** that contour label present are removed then the graph must remain connected.



Example: adding concurrent edges

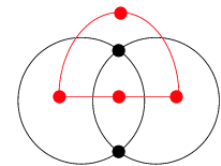
$\{ ab \ ac \}$



Problems: Wellconnected dual

Form the superdual of this abstraction and form a wellconnected dual from it:

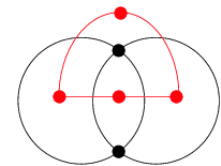
{ a b bc abc



2.4. Find a plane layout for the graph and add edges to remove tangential intersections

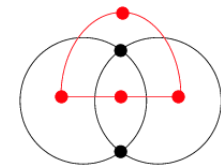
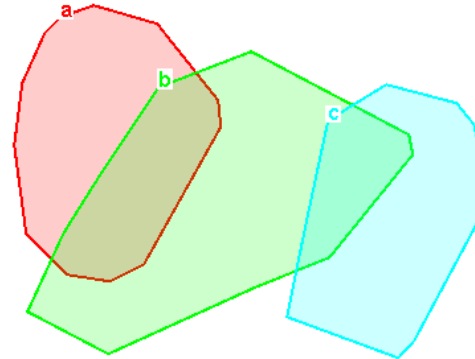
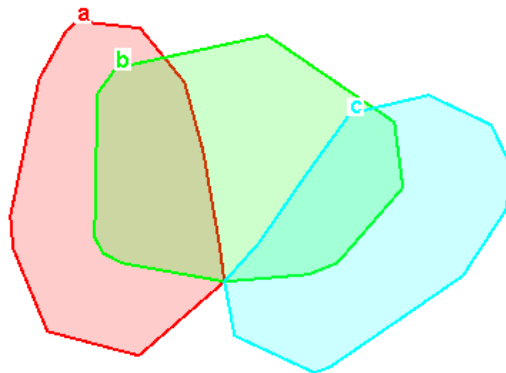
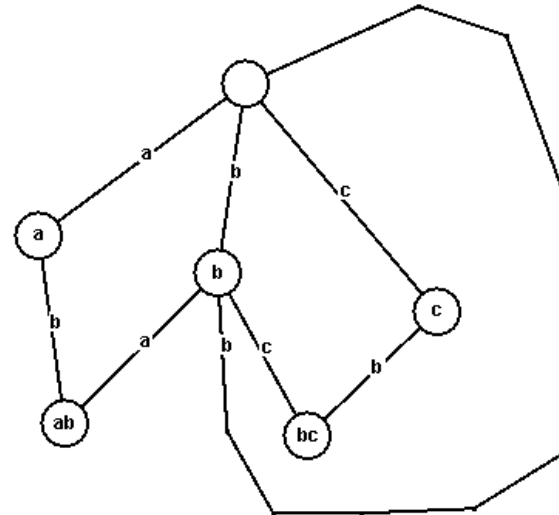
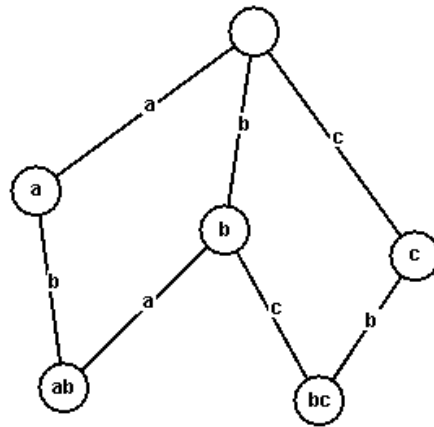
Once laid out, we look for faces where it is possible to add an edge between two non adjacent nodes that have only one contour label difference.

The new edge removes a tangential intersection.



Example: adding tangential edges

$\{ a \ b \ c \ ab \ bc \}$

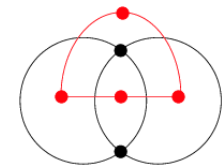


2.5. Construct the Euler diagram from the dual

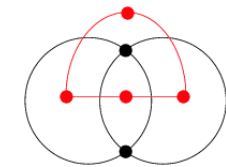
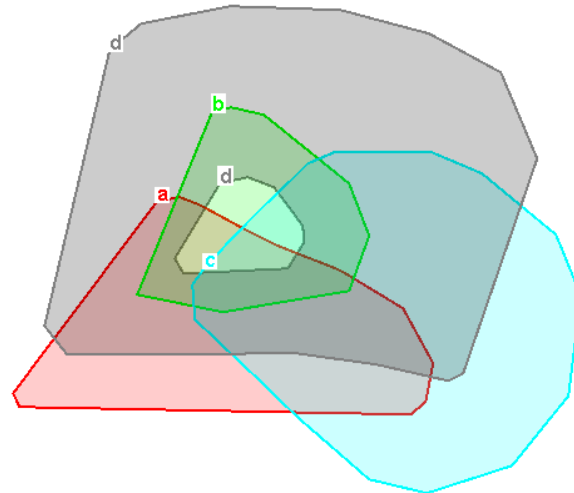
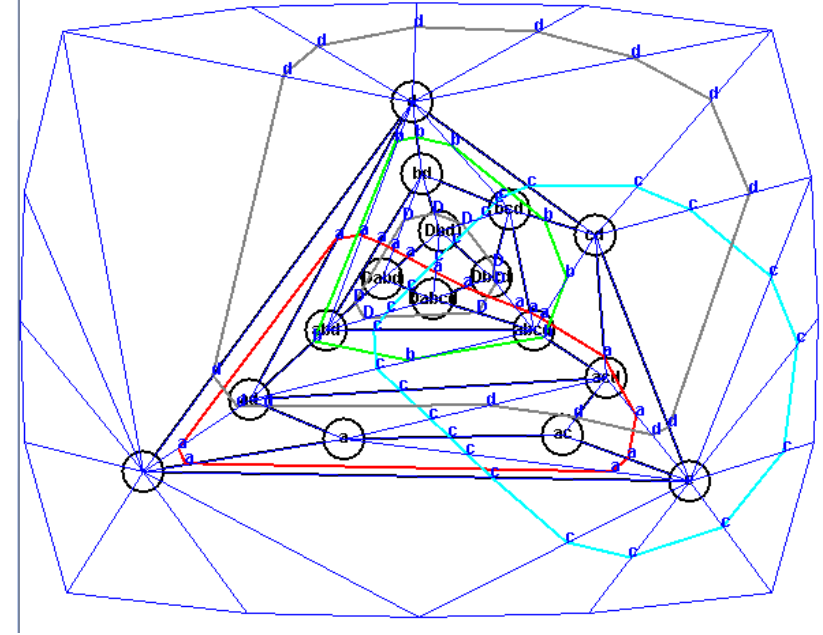
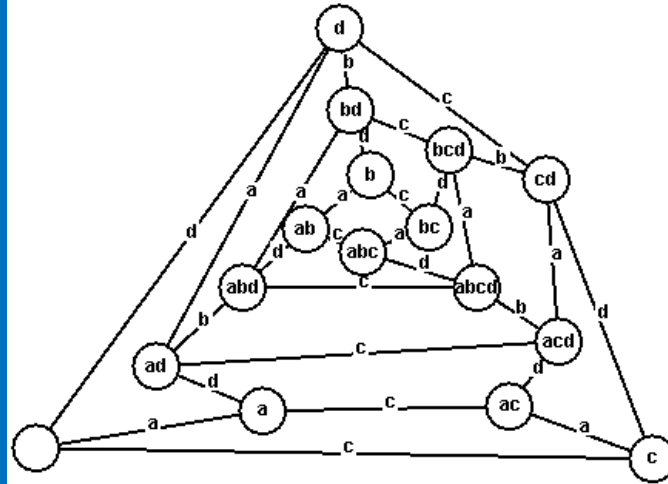
The graph is now the dual of the Euler diagram.

To find the diagram from it:

1. Label the edges of the dual with the symmetric difference of the nodes at either end. Edges with more than one label mean that a concurrent edge will cross it
2. Route the curves around connected groups of nodes that contain the label.



Example: Another version of Venn4



Problems: Find embeddings for the below

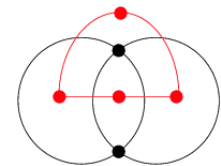
(You found the superdual of these earlier)

{ a b ab abc

{ a b c d

{ ab ac ad

{ a b c ab ac bc abc



Tool demo

The previous steps can be automated. The tool at:
www.eulerdiagrams.com/diagrams2010Tutorial.html
Performs this task.

A paper describing the method was published at
Diagrams 2008:

General Euler Diagram Generation. Peter Rodgers, Leishi Zhang, and Andrew Fish. In *Proceeding Diagrams 2008*, LNCS (LNAI) 5223, pages 13-27. Springer, September 2008.

