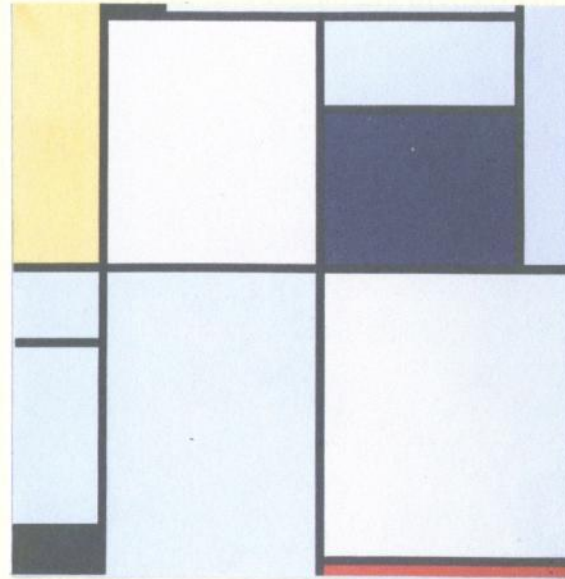


# Orientation-Constrained Rectangular Layouts

David Eppstein

Elena Mumford

# RECTANGULAR LAYOUTS



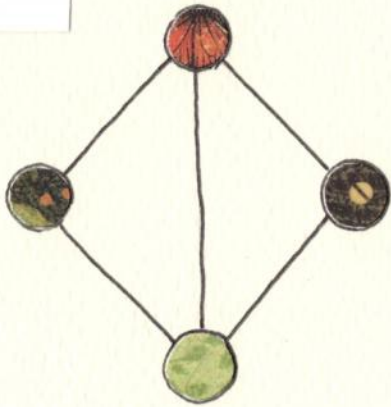
[Mondrian' 21]

## Rectangular layout

partition of a rectangle into finitely many interior-disjoint rectangles, such that no four rectangles meet in one point.

# RECTANGULAR DUALS

TRIANGULATED  
GRAPH  $G$



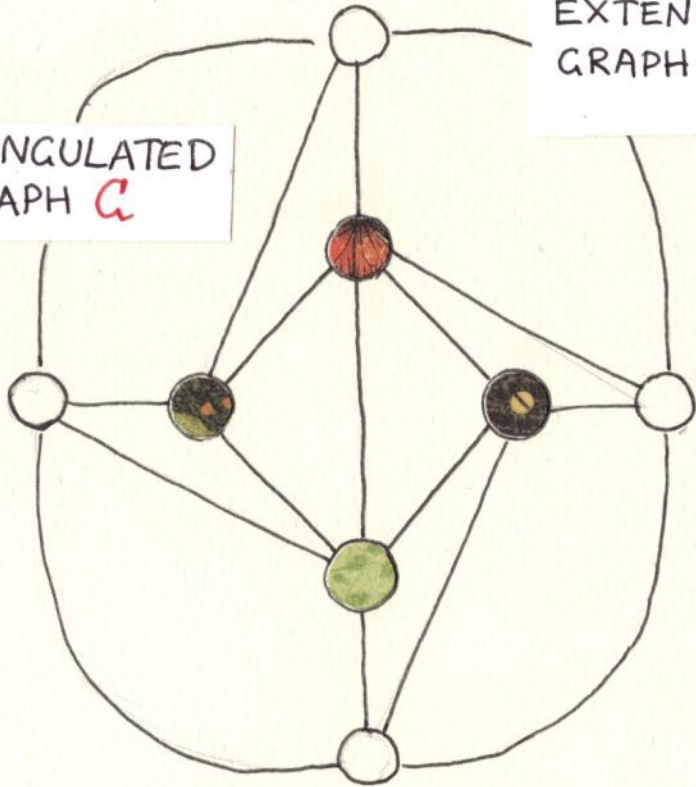
RECTANGULAR  
DUALS FOR  $G$





# RECTANGULAR DUALS

TRIANGULATED  
GRAPH  $G$



EXTENDED  
GRAPH  $E(G)$



RECTANGULAR  
DUALS FOR  $E(G)$



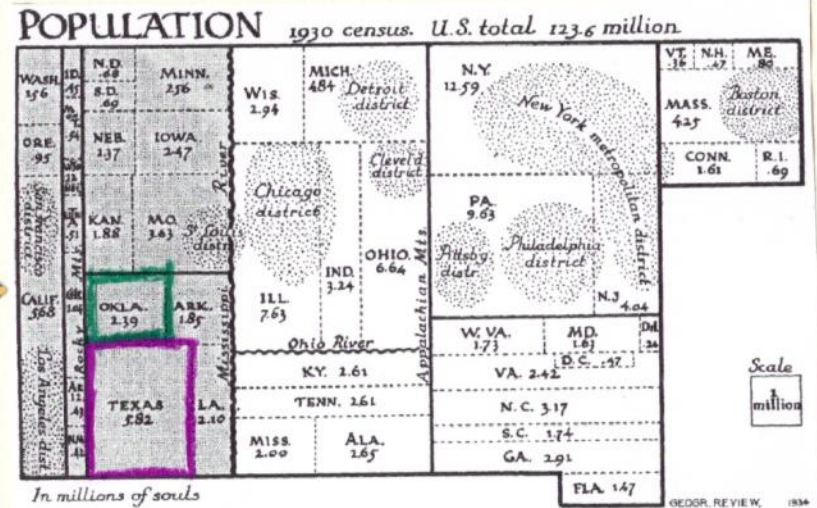
NOT A RECTANGULAR  
DUAL FOR  $E(G)$







# ORIENTATION CONSTRAINTS

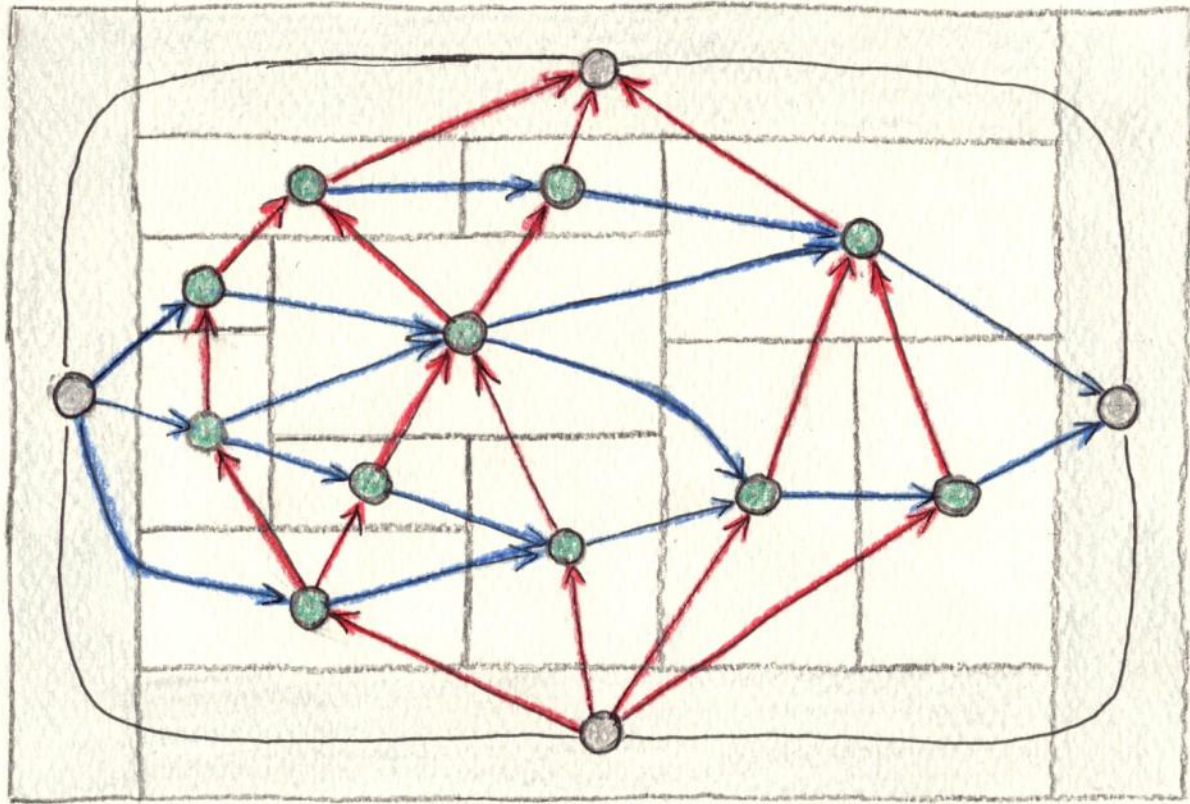


PRESERVE RELATIVE POSITIONS  
OF THE REGIONS



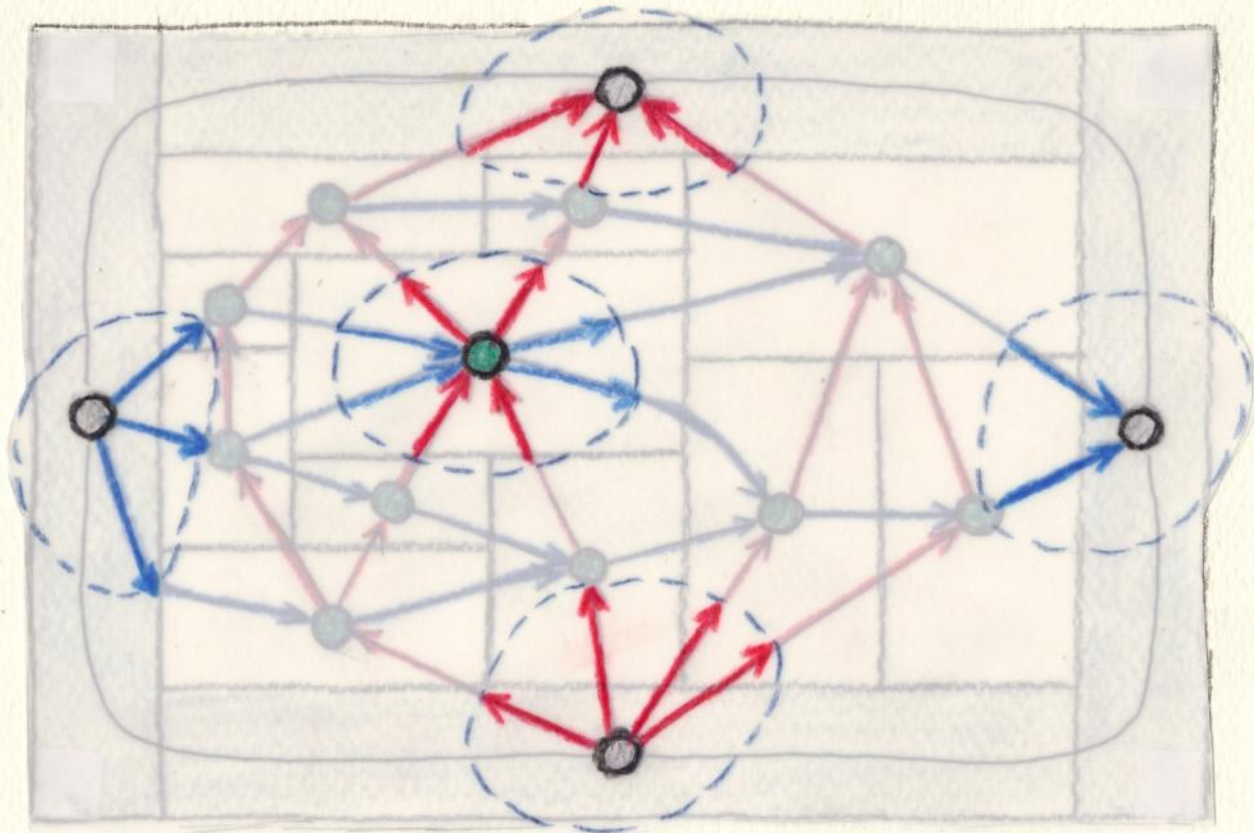
CONSTRAINTS ON THE  
ORIENTATIONS OF THE ADJACENCIES

# REGULAR EDGE LABELING (REL)



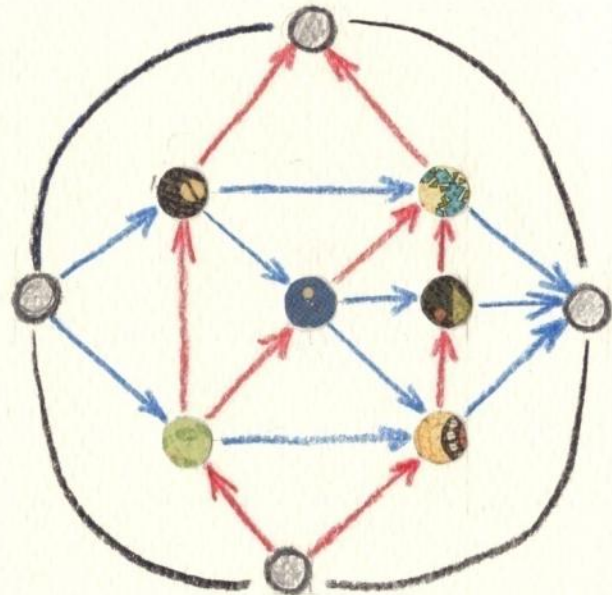
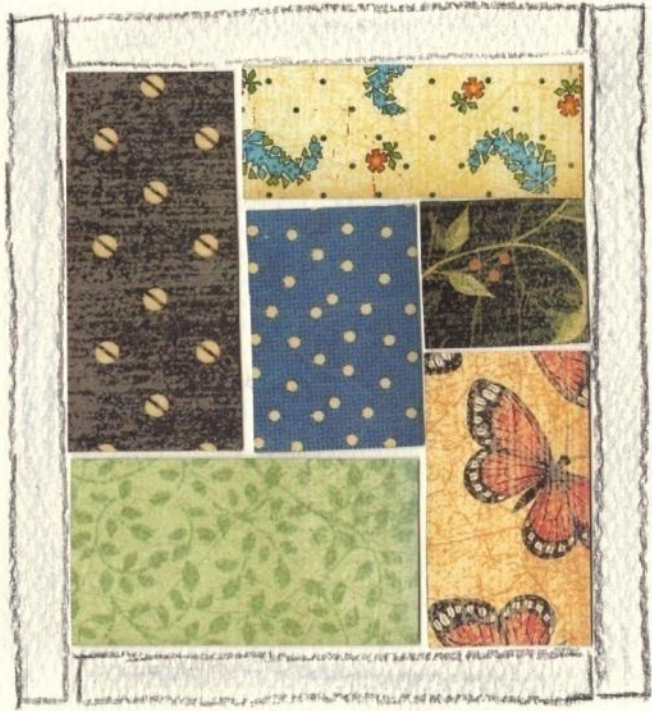


# REGULAR EDGE LABELING (REL)





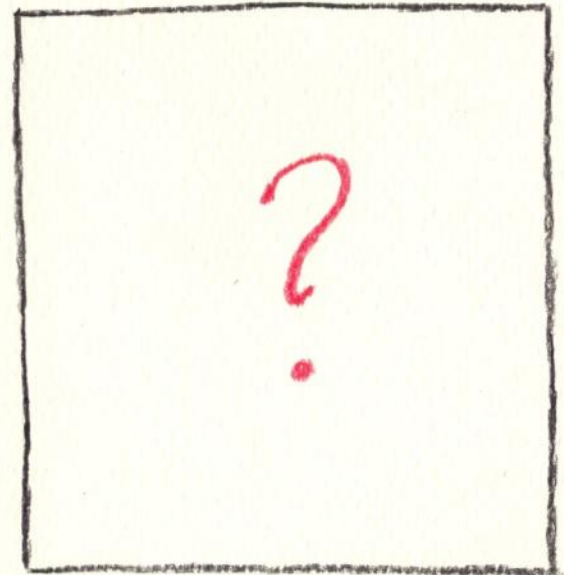
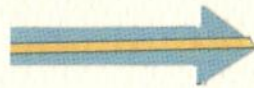
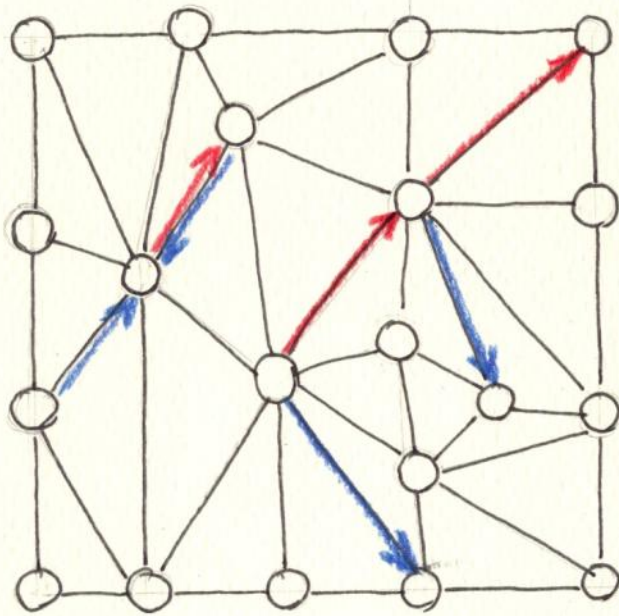
# REL = RECTANGULAR DUAL



[Kant and He'97]

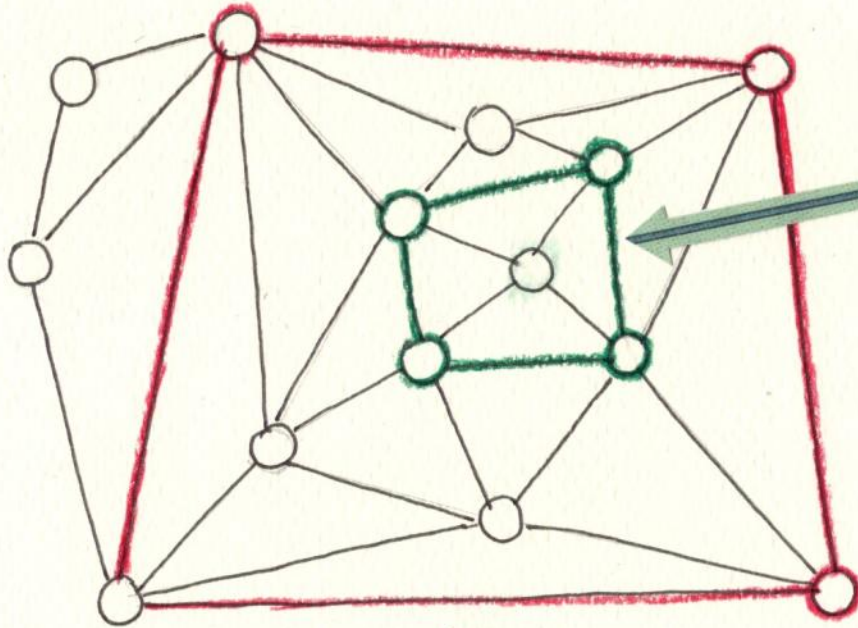
Every rectangular dual for  $E(G)$  corresponds to a regular edge labeling of  $E(G)$  and vice versa.

# ORIENTATION-CONSTRAINED DUALS





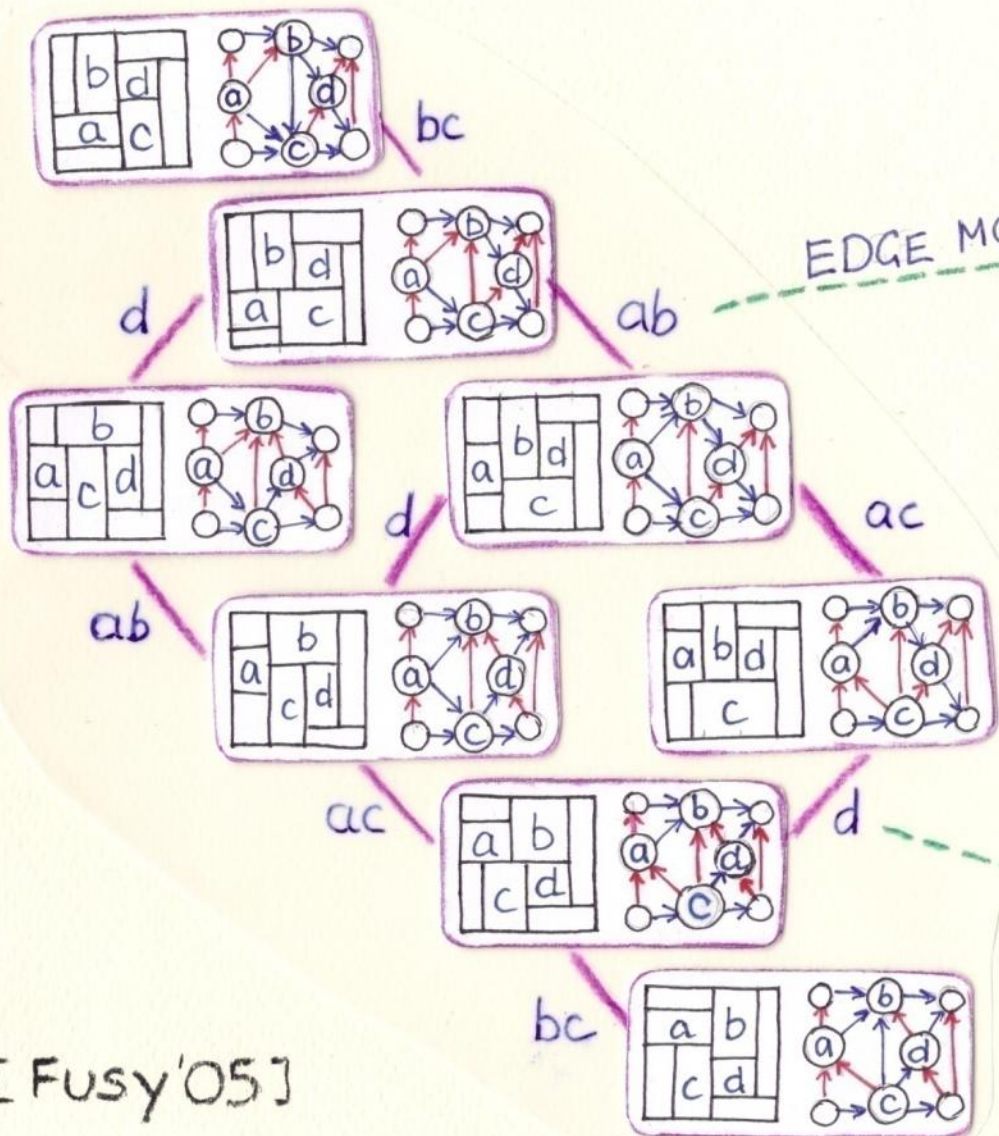
# SEPARATING 4-CYCLES



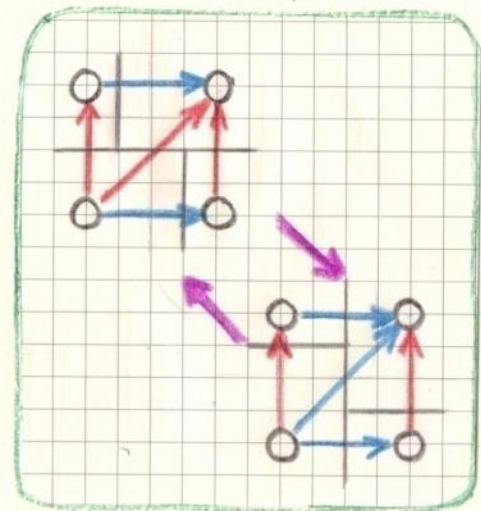
TRIVIAL  
SEPARATING  
4-CYCLE

NON-TRIVIAL  
SEPARATING  
4-CYCLE

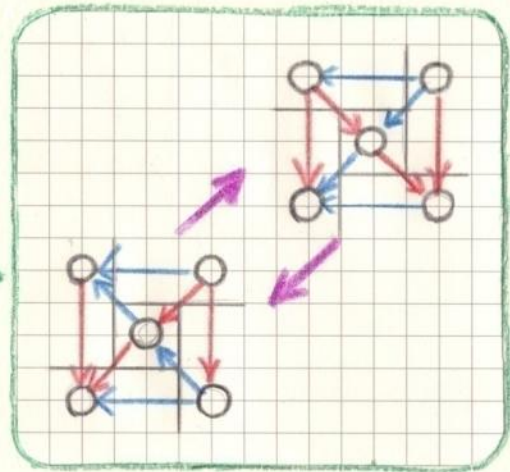
# DISTRIBUTUTIVE LATTICE OF RELS



EDGE MOVE



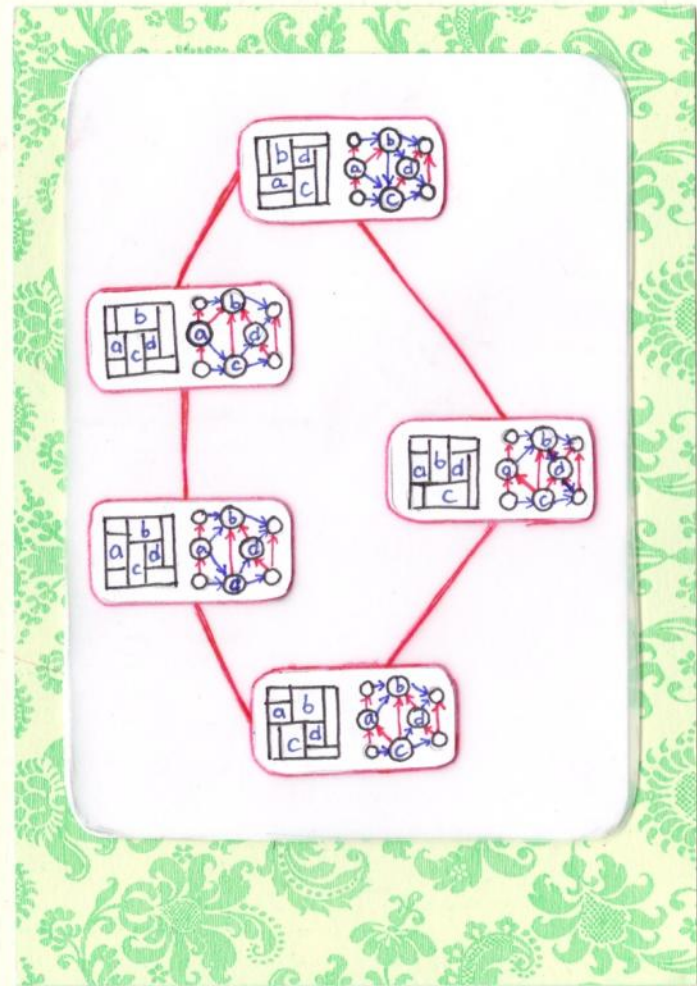
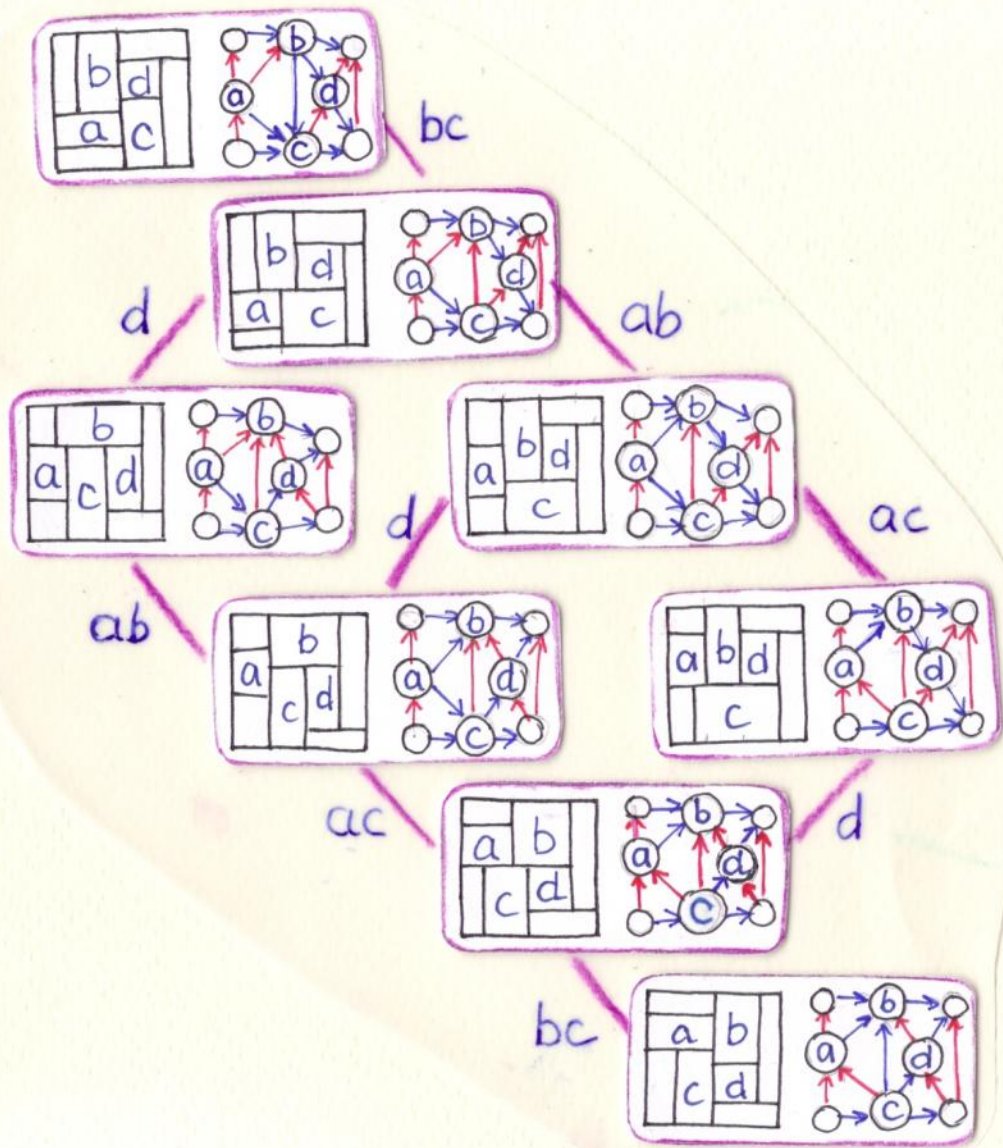
VERTEX MOVE



[Fusy'05]

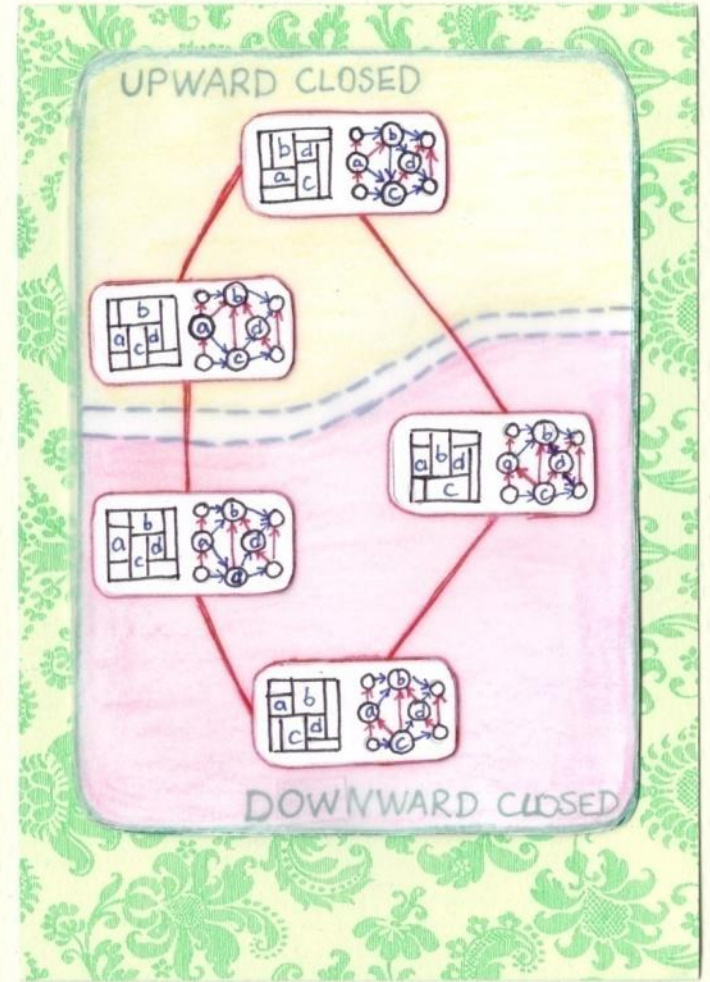
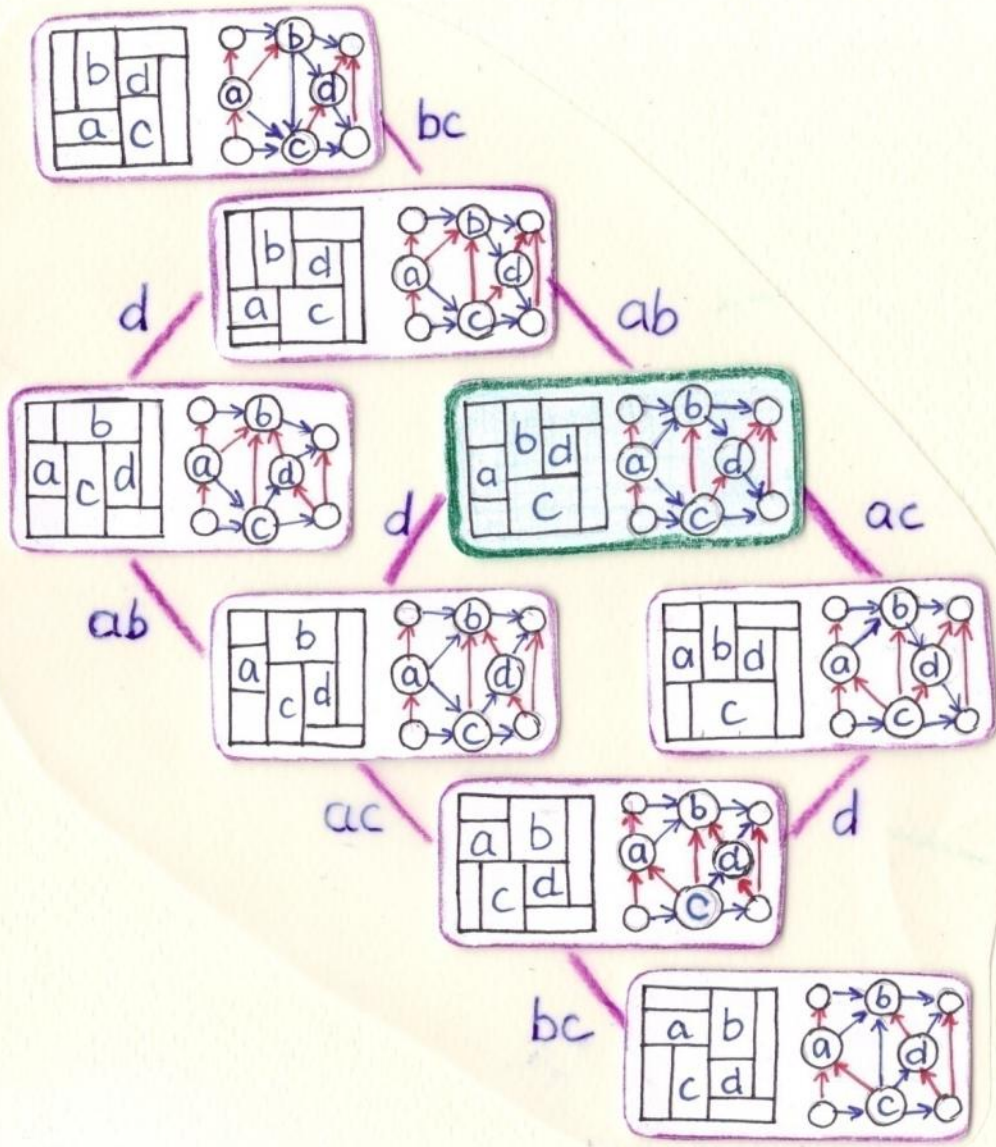


# BIRKHOFF'S REPRESENTATION THEOREM



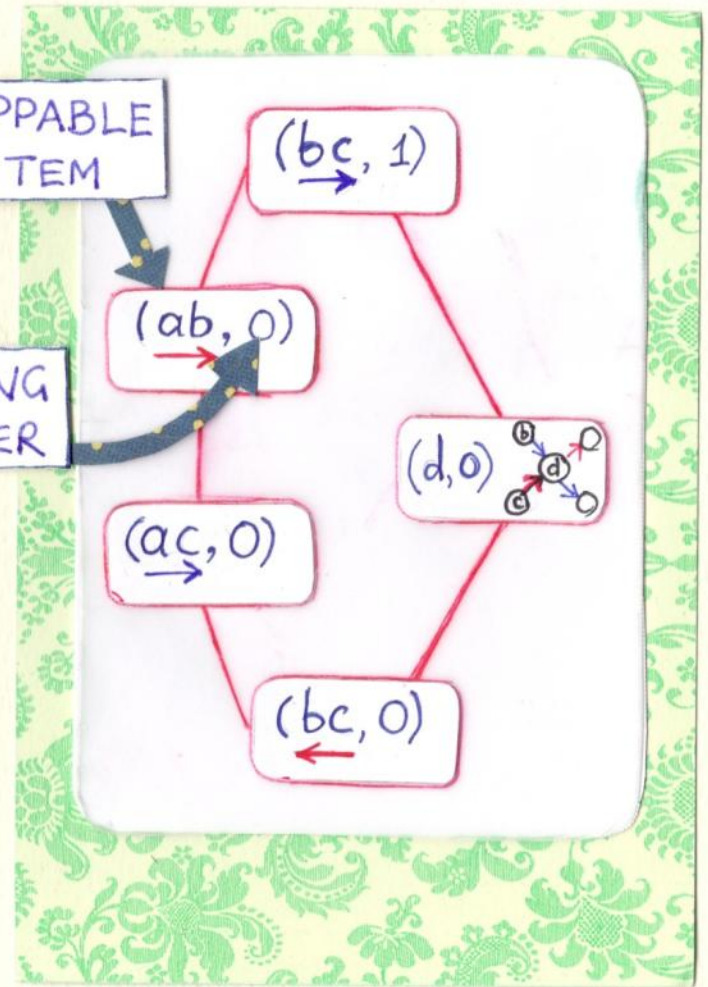
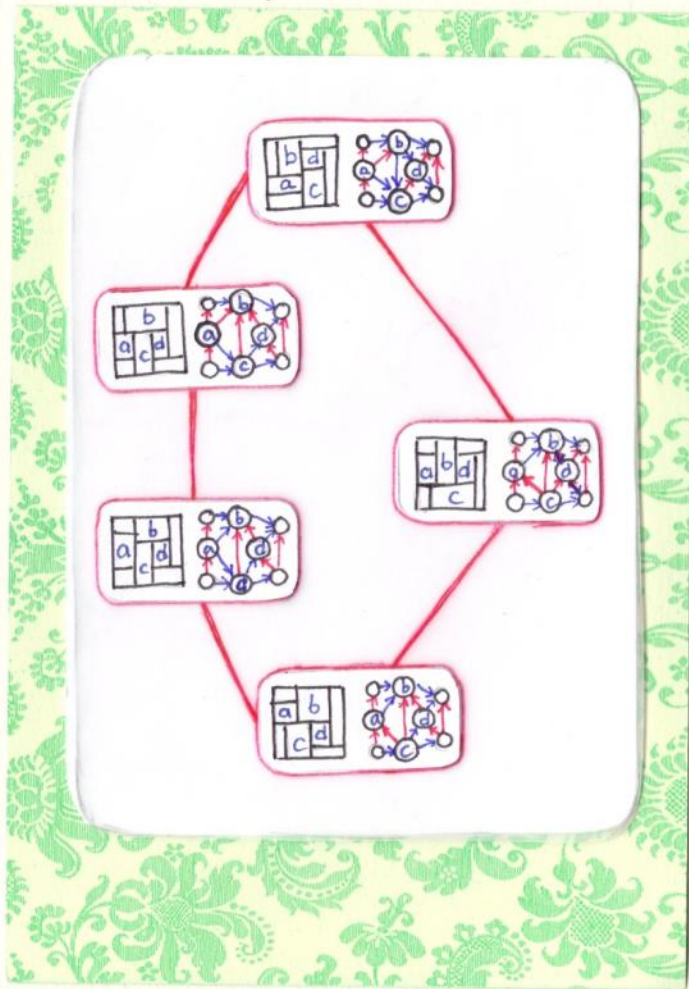


# BIRKHOFF'S REPRESENTATION THEOREM



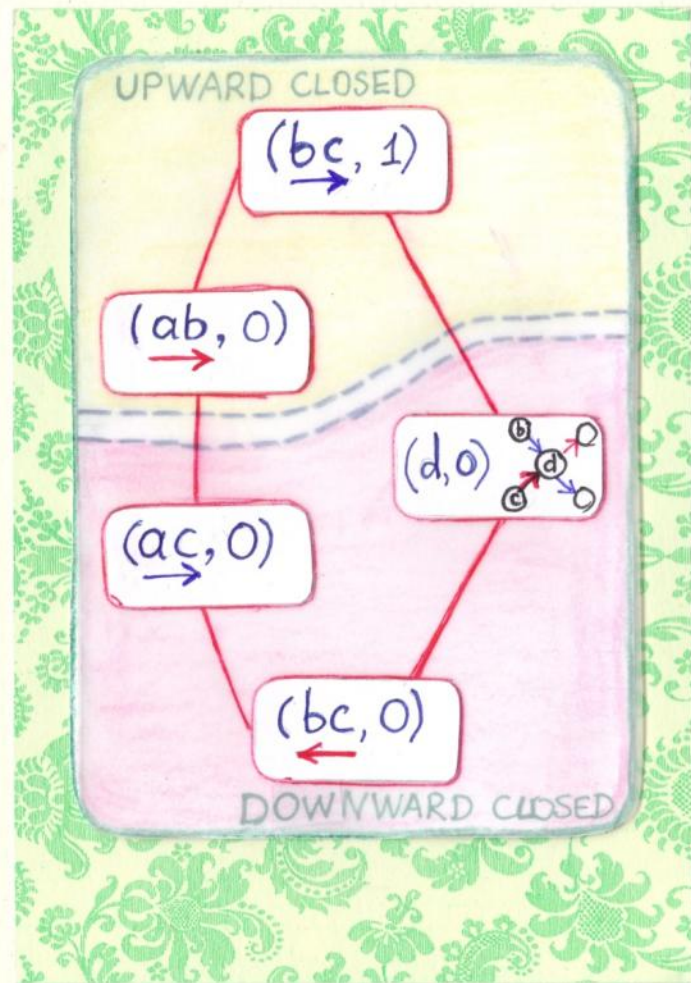
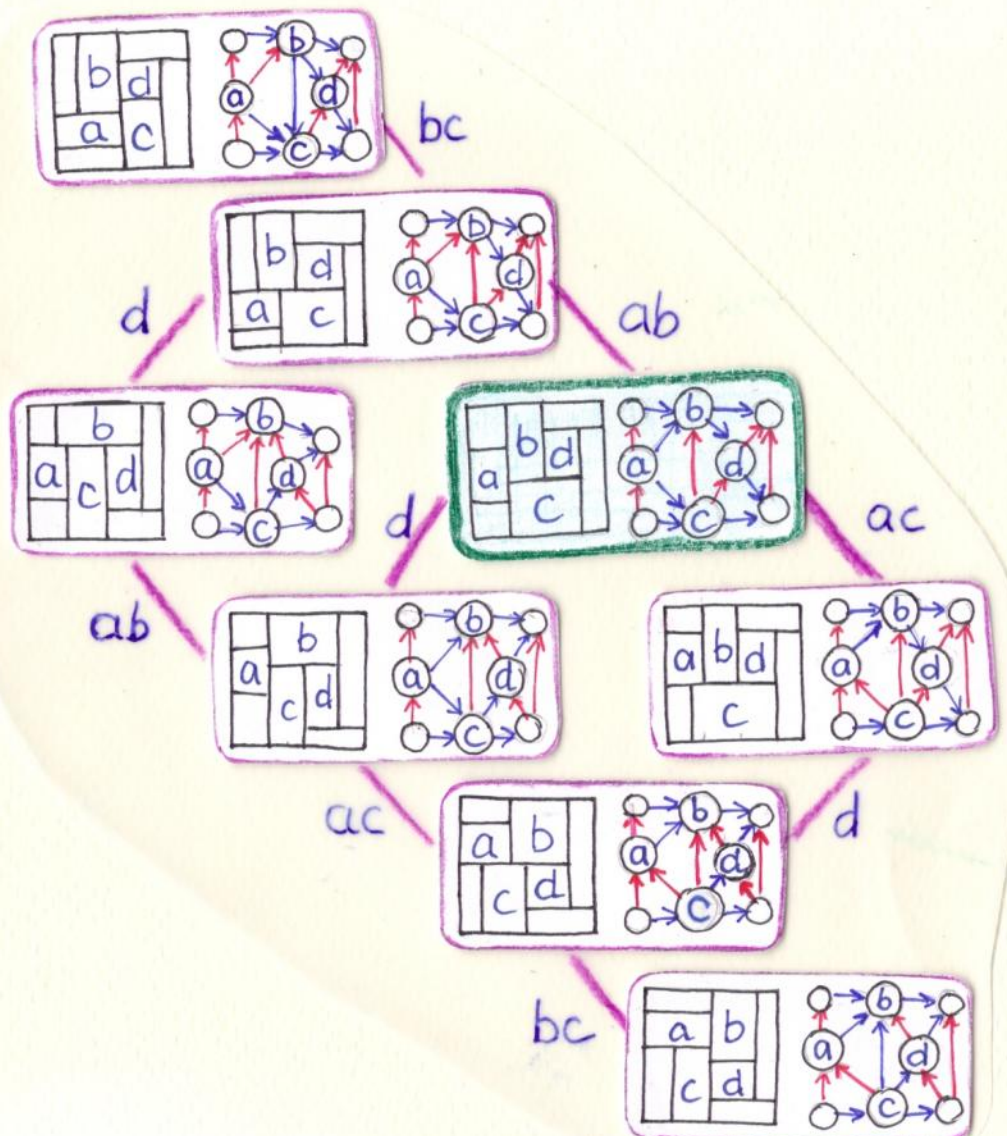


# PARTIAL ORDER OF FLIPPABLE ITEMS



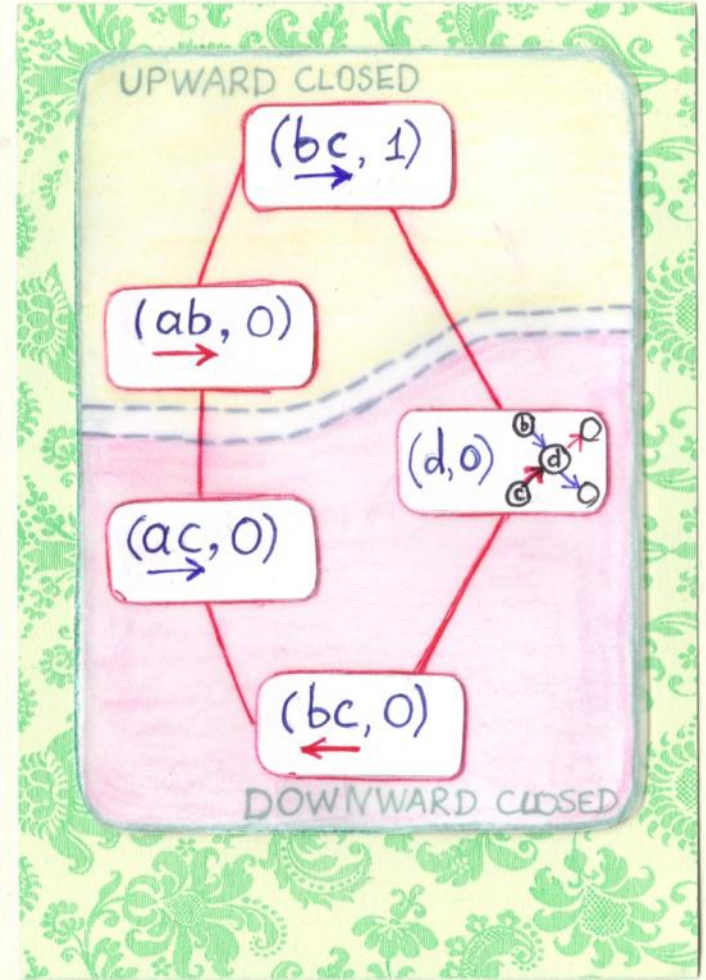
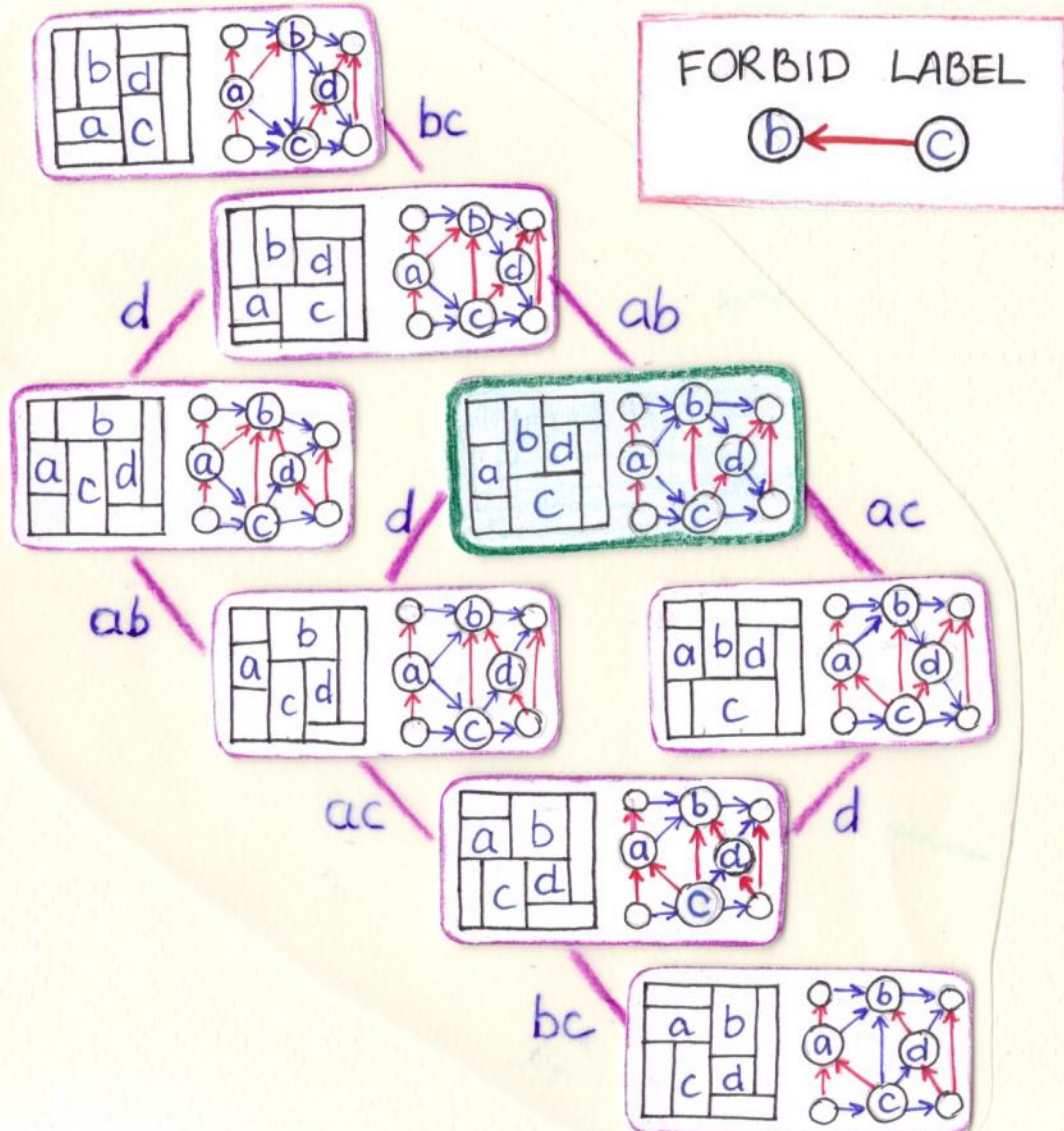
[ Eppstein, Mumford, Speckmann, Verbeek '09 ]

# BIRKHOFF'S REPRESENTATION THEOREM



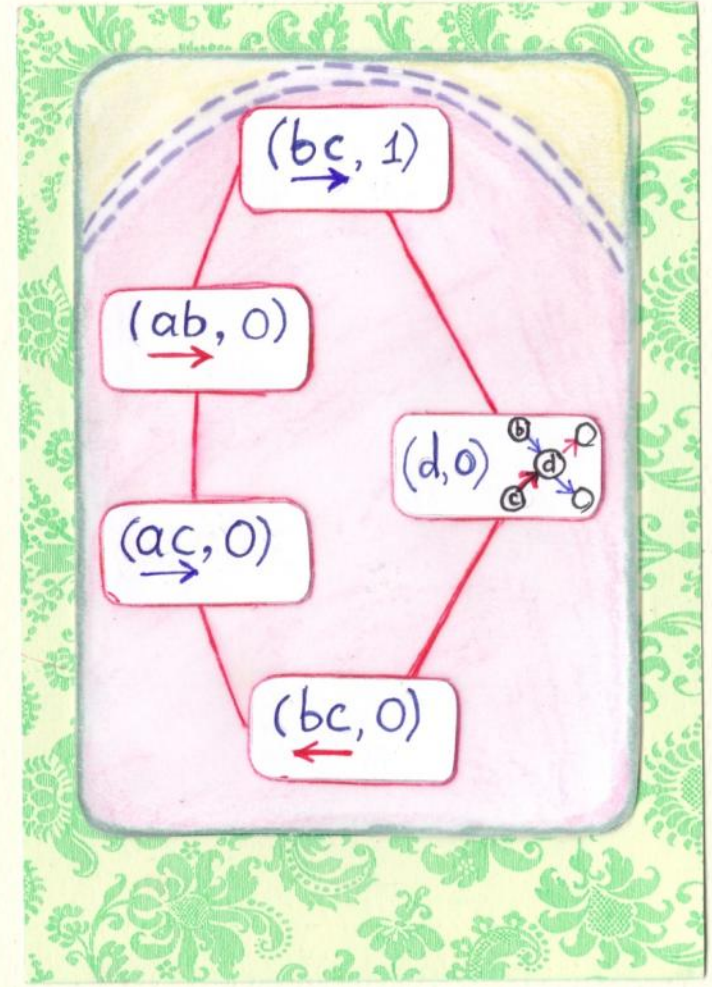
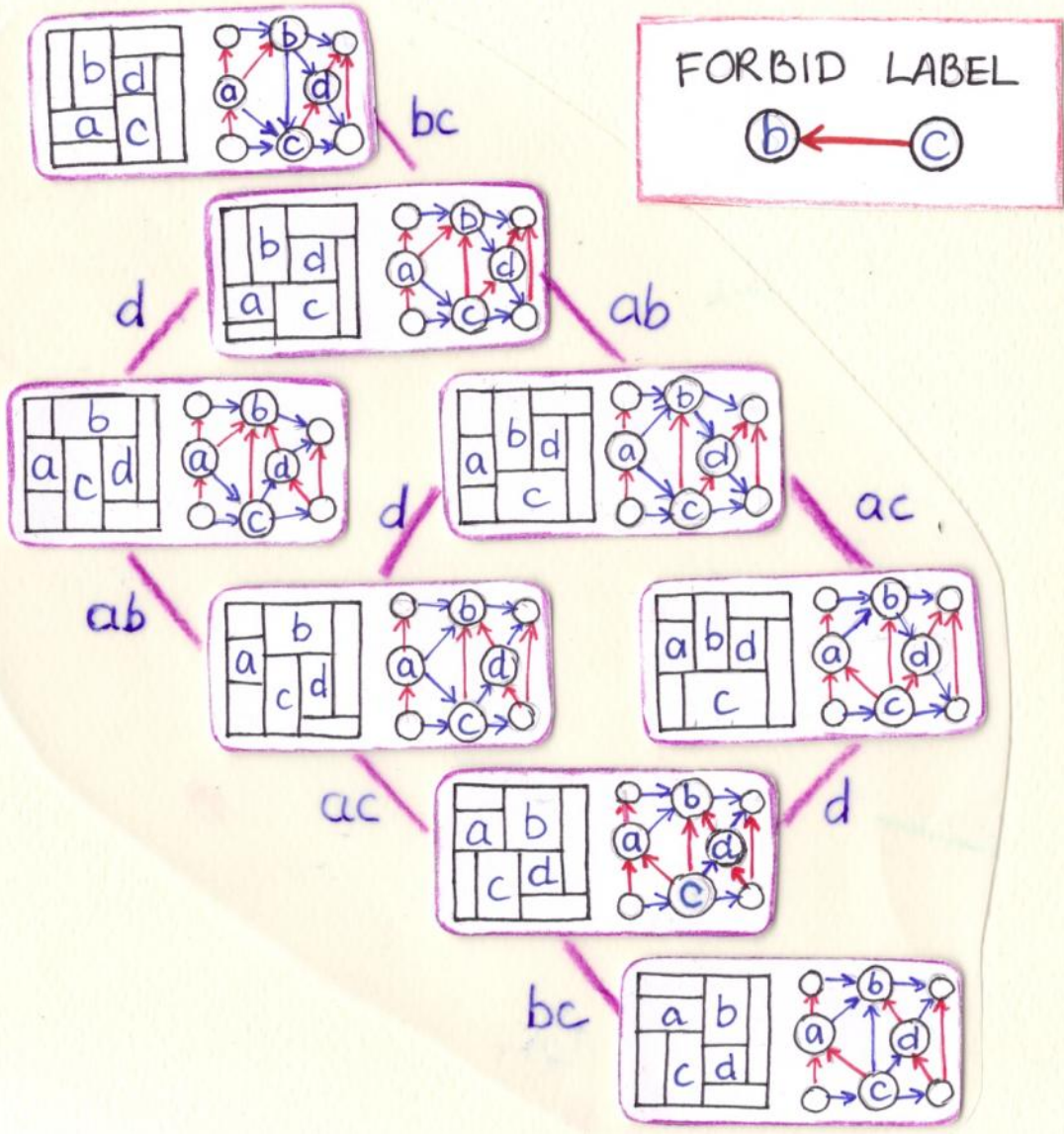


# ORIENTATION CONSTRAINTS



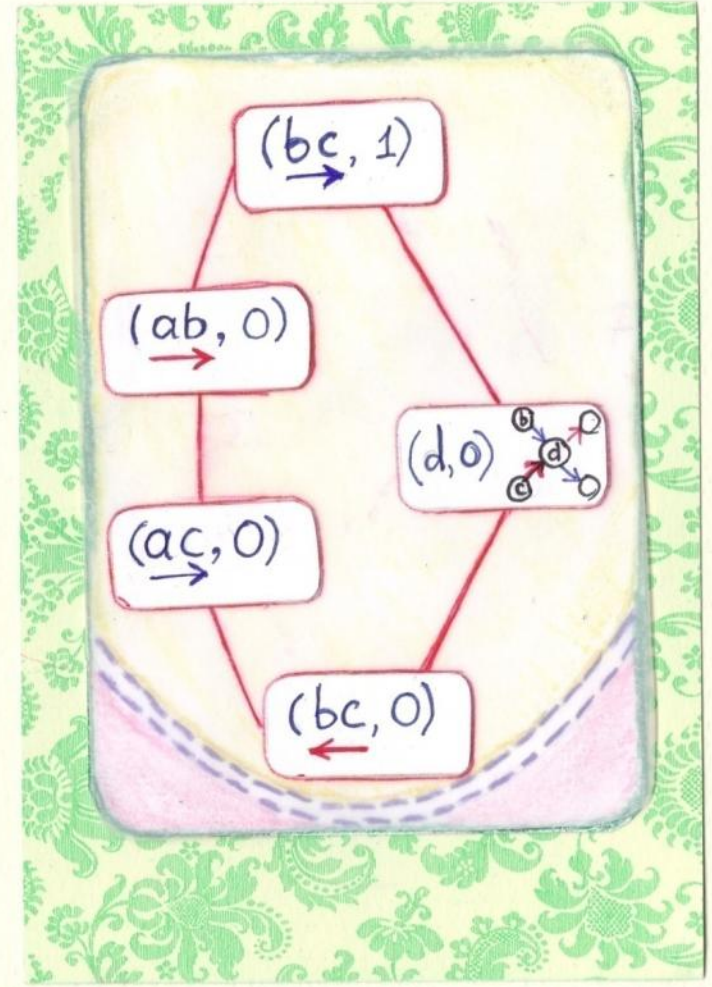
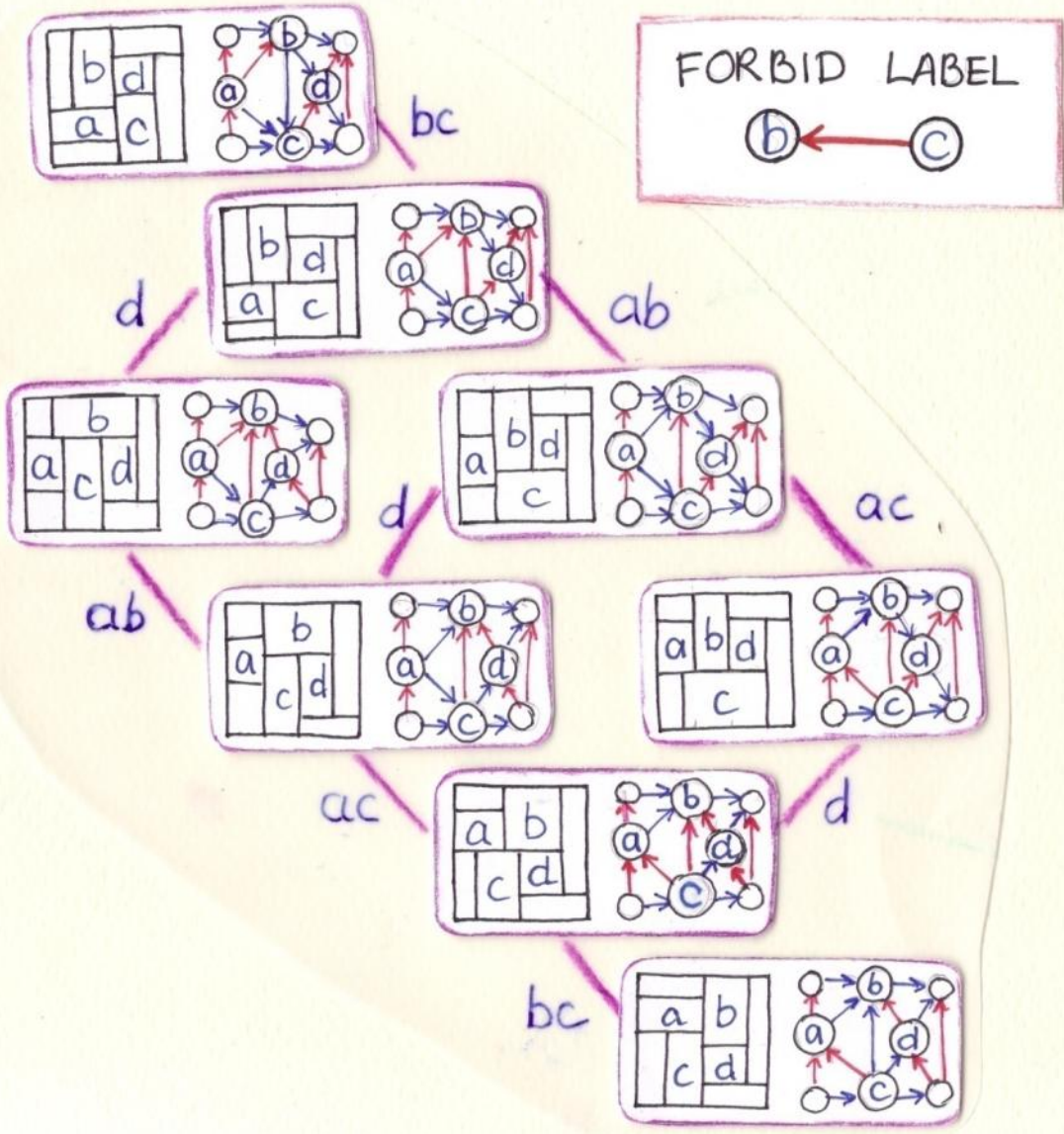


# ORIENTATION CONSTRAINTS



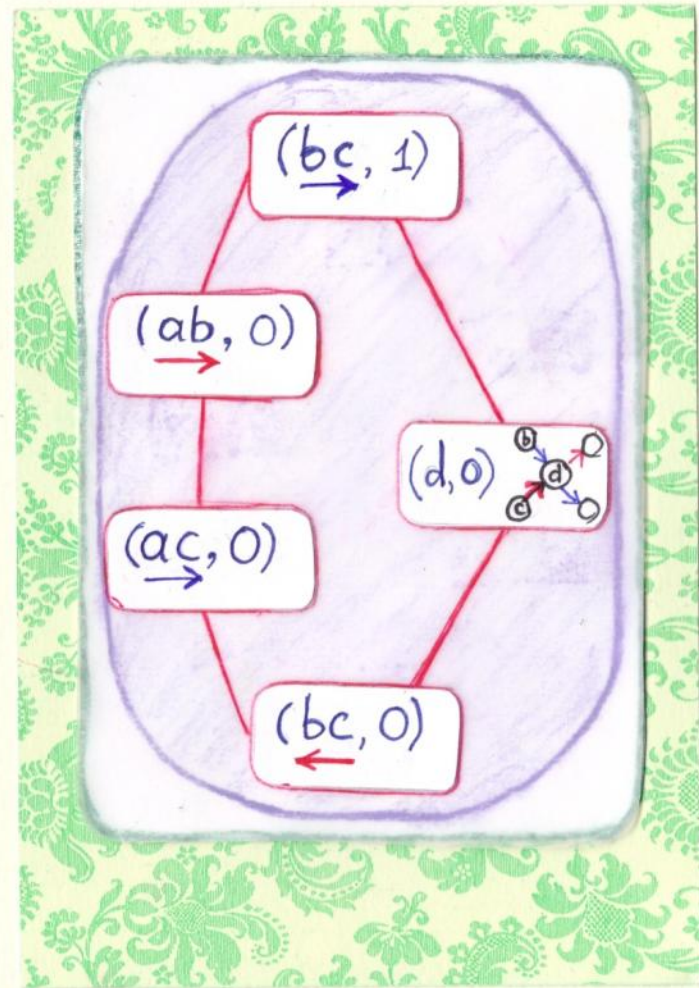
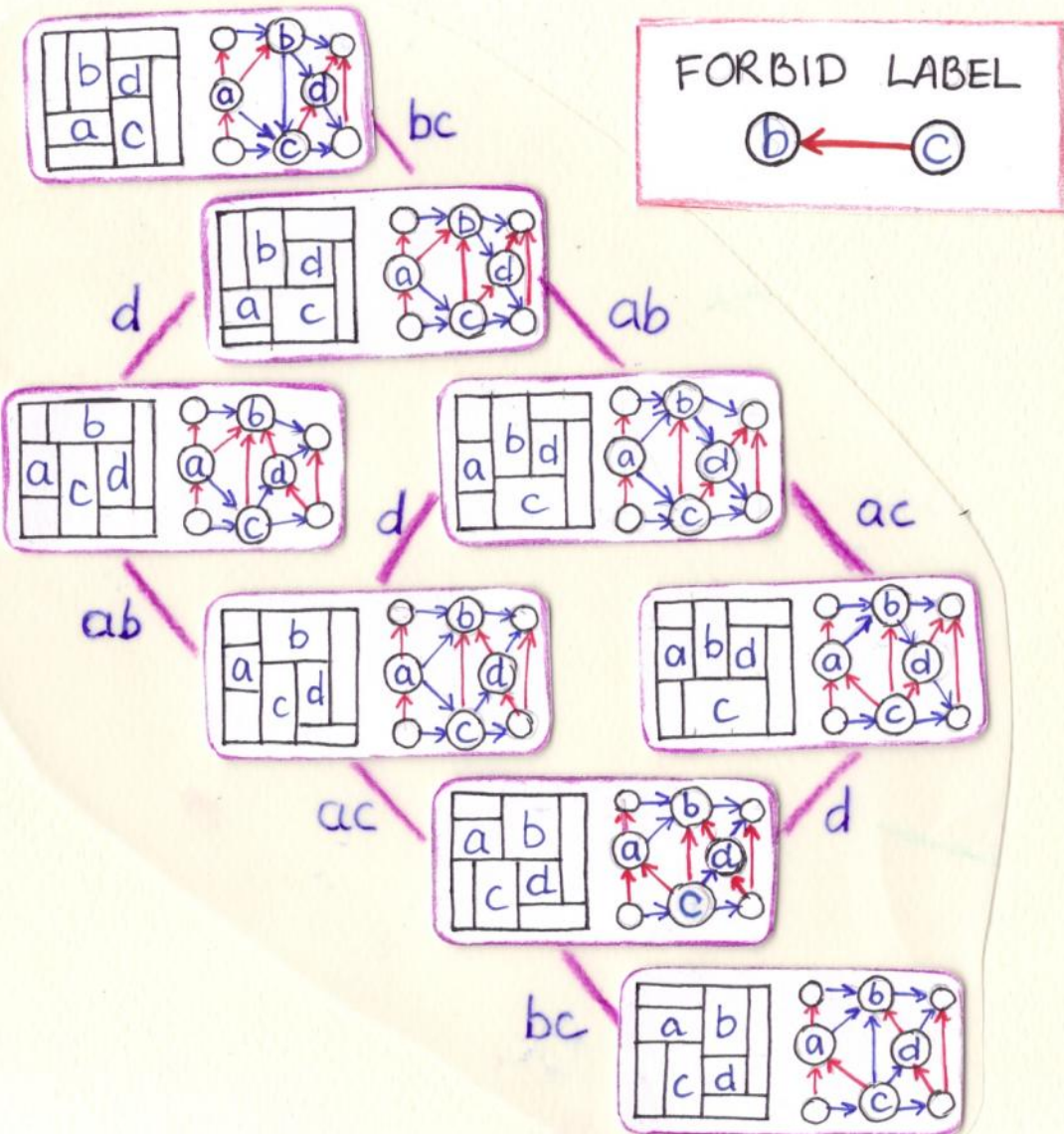


# ORIENTATION CONSTRAINTS



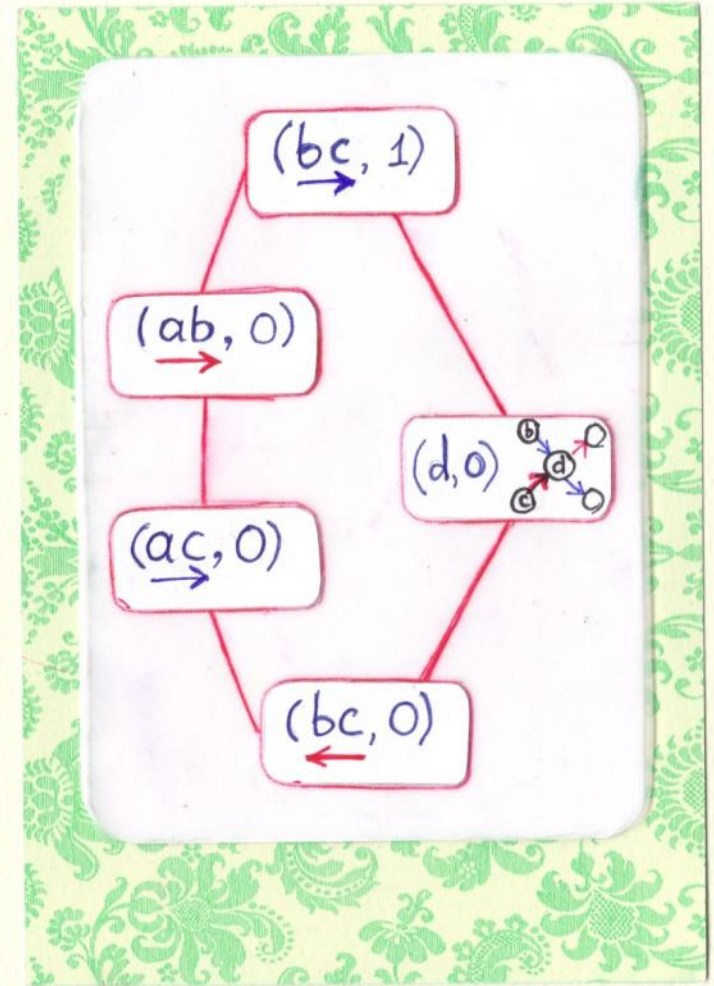
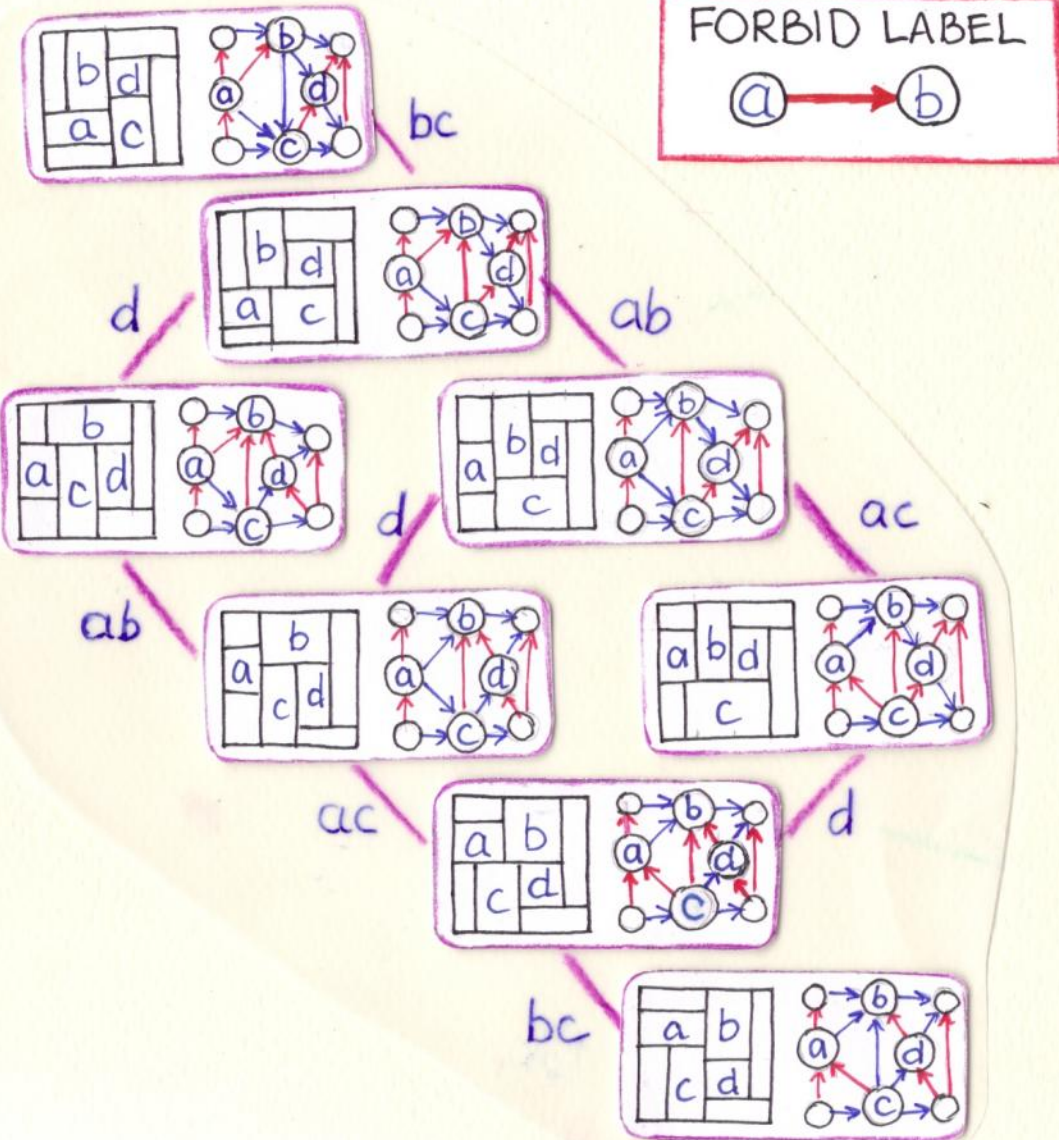


# ORIENTATION CONSTRAINTS

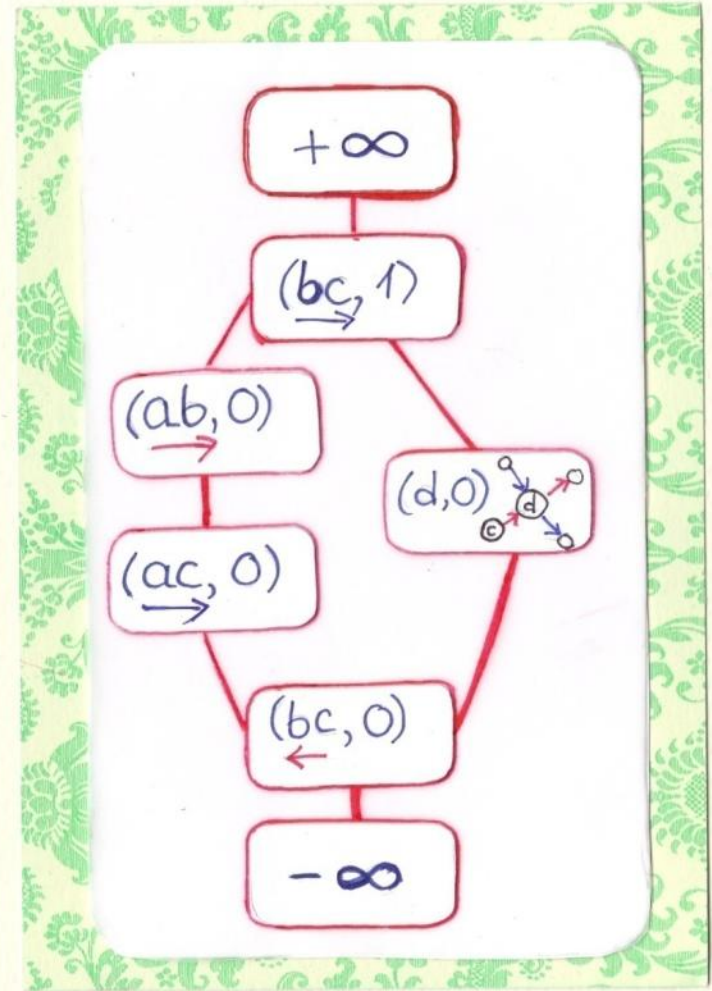
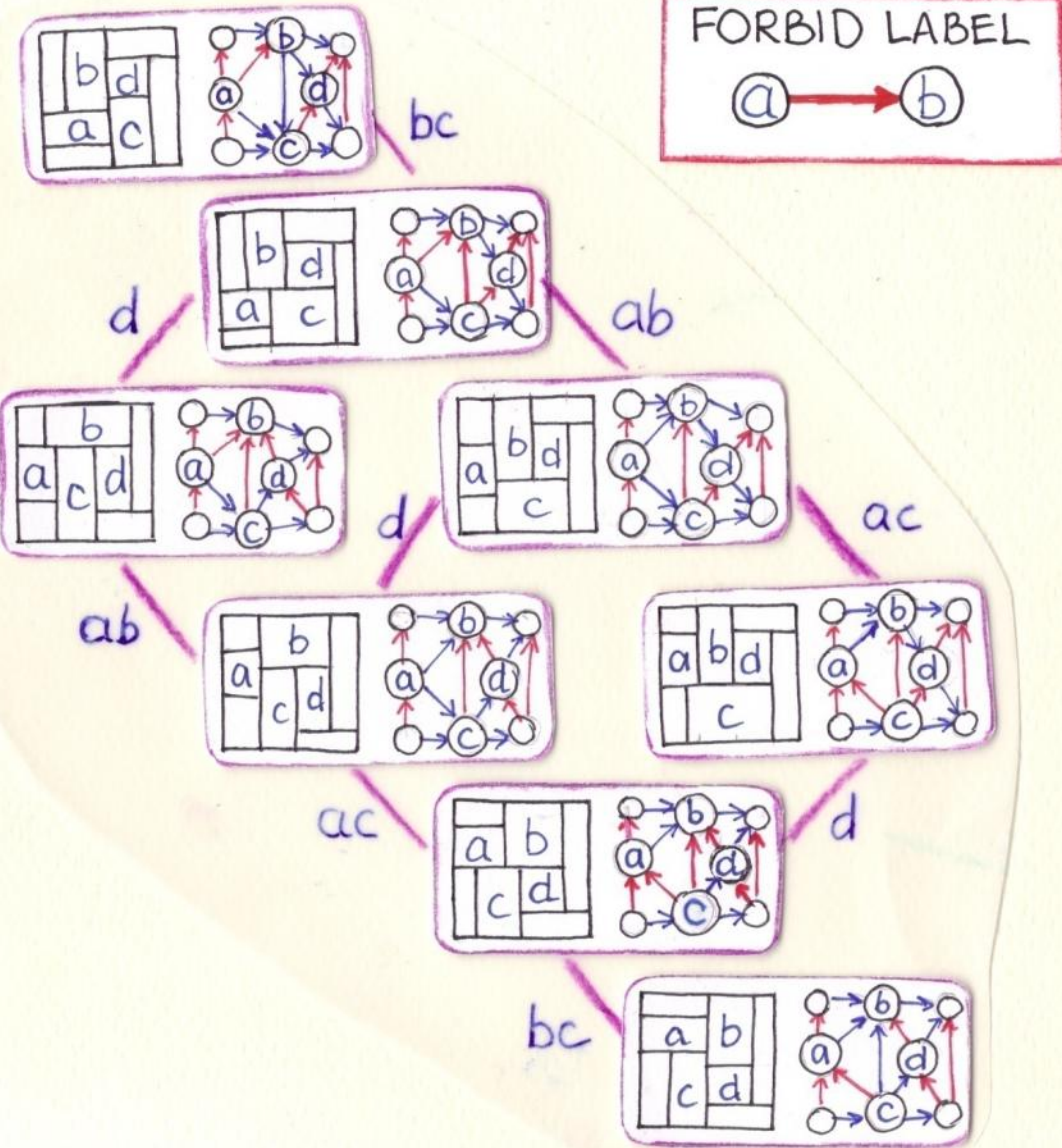




# ORIENTATION CONSTRAINTS

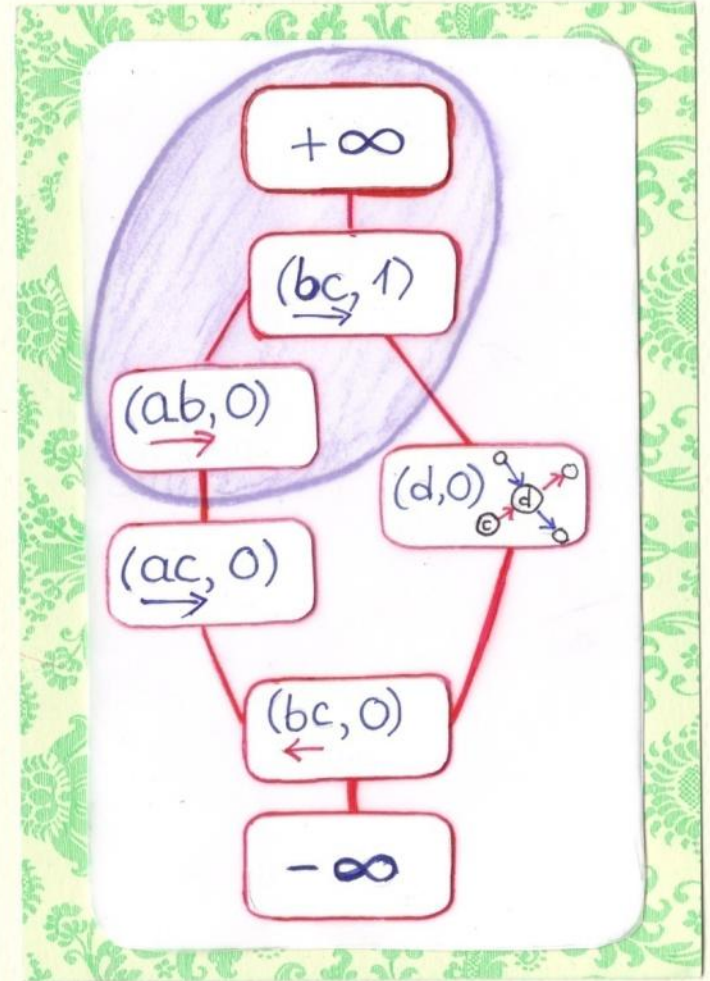
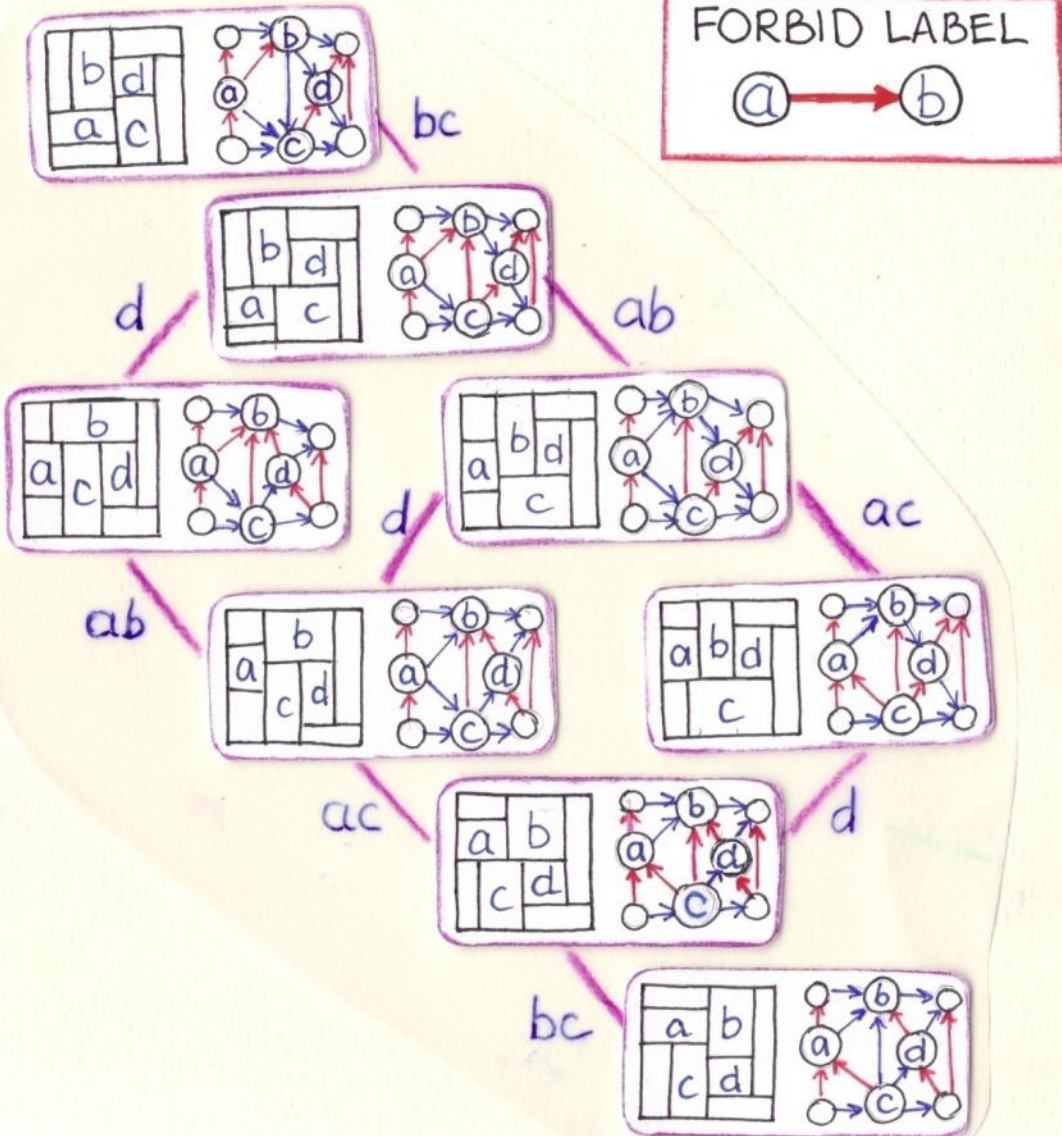


# ORIENTATION CONSTRAINTS

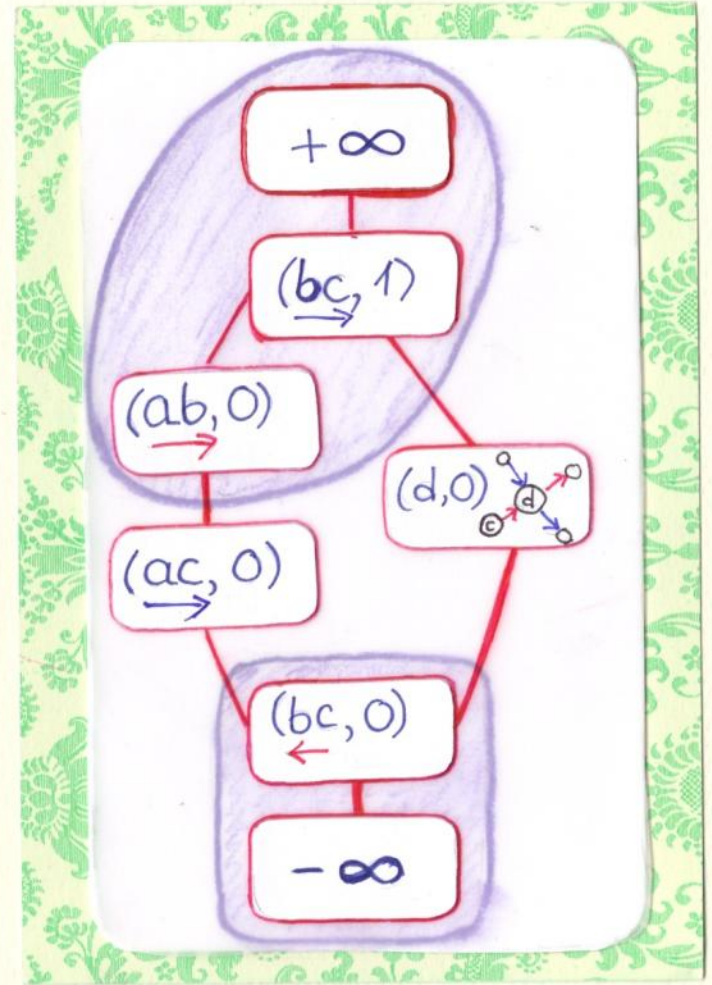
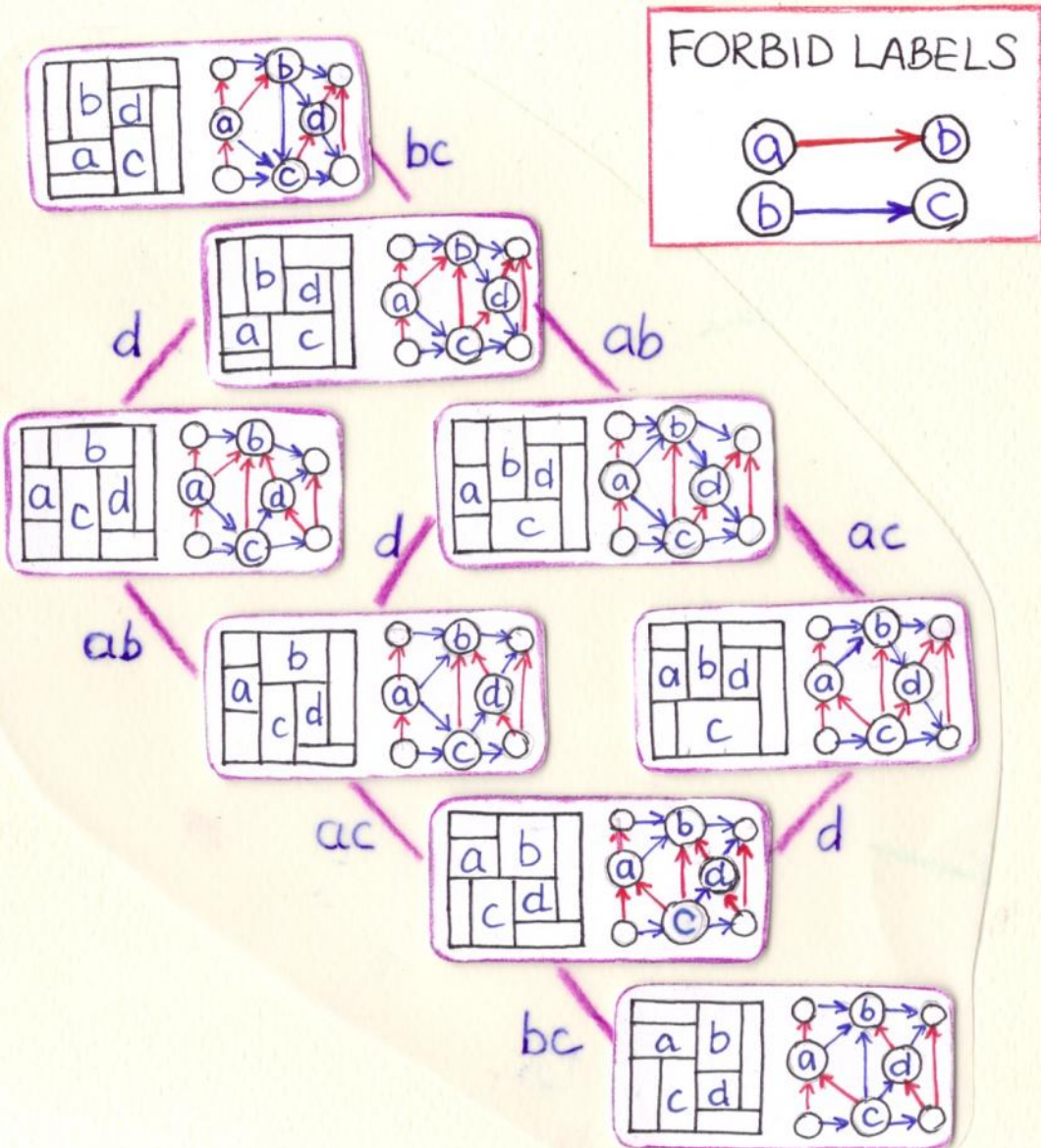




# ORIENTATION CONSTRAINTS



# ORIENTATION CONSTRAINTS





# RESULTS

- Find a layout for given constraints in polynomial time
- List all layouts satisfying the constraints in polynomial time per layout
- Find area-universal layouts satisfying the constraints