Open Problems

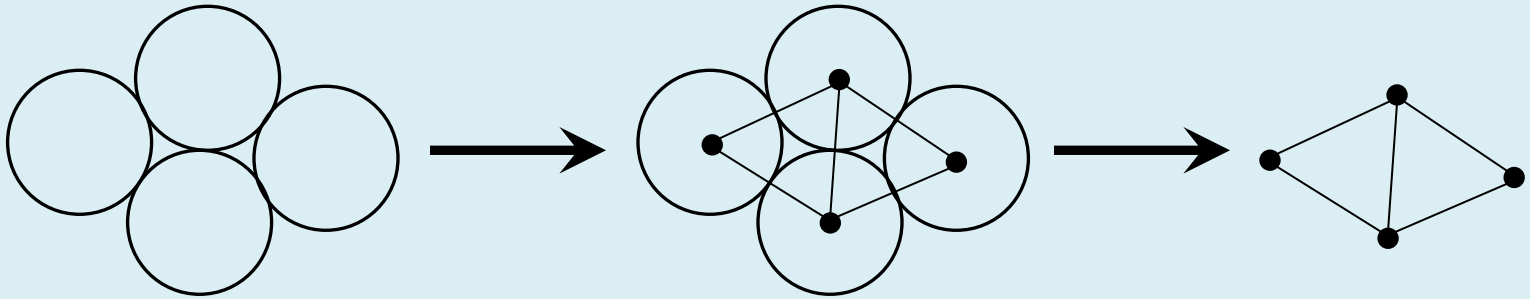
Workshop on Graph Drawing and Graph Algorithms 2013
Department of Computer Science and Engineering
Bangladesh University of Engineering and Technology

Coin-graph Recognition

Q. What are the graphs that come up by touching coins?

Q. Can we recognize coin graphs in polynomial time?

Q. Is there any nontrivial sufficient condition on a planar graph to be a coin graph?

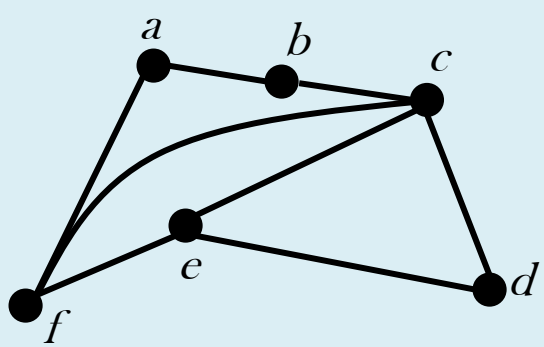


A graph of n vertices is a *touching unit circle graph* or *coin graph* if it can be produced by n non-overlapping circles in contact, where each circle represents a node and each pairwise contact represents an edge.

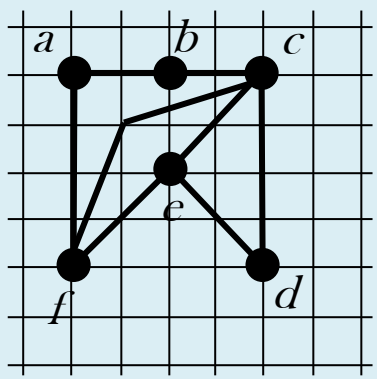
Known Result:
Every planar graph can be represented as a contact graph of circles (Koebe's Theorem).

Polyline Grid Drawing

Q. Does every outerplanar graph admit a polyline grid drawing in O($n$log$n$) area with at most two bends per edge?



Outerplanar graph

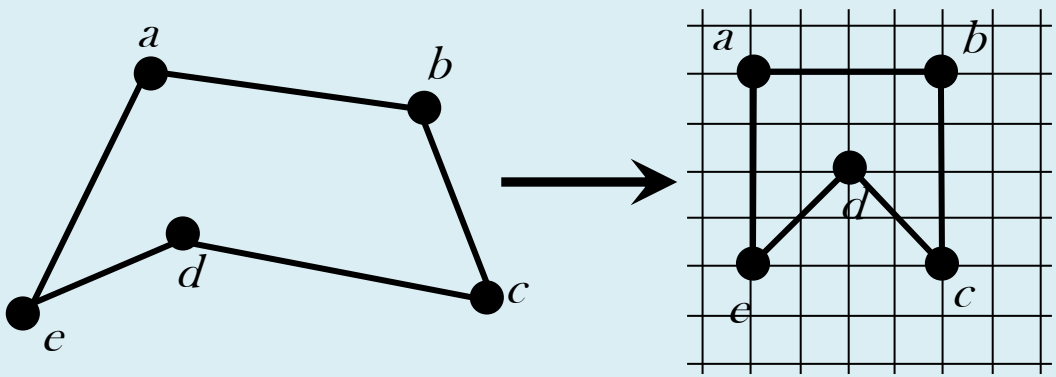


Polyline grid drawing

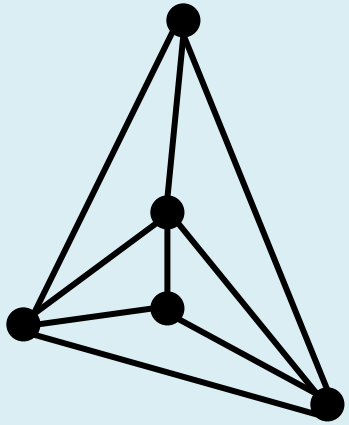
Known Result:
Every outerplanar graph admits a polyline grid drawing in O($n$log$n$) area with at most three bends per edge.

Minimum Segment Drawing

Q. Is the problem solvable in polynomial time if the input graphs are plane 3-trees, even when the maximum degree is bounded by a fixed constant?



Minimum segment drawing



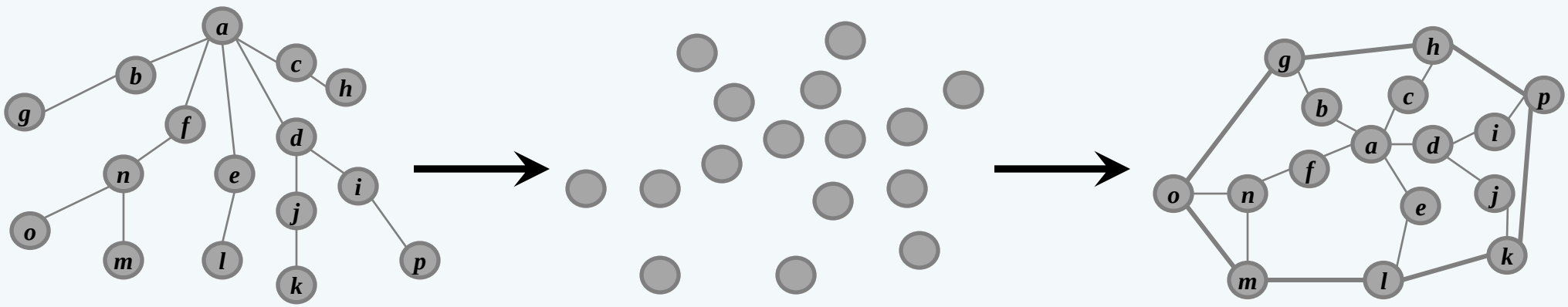
Plane 3-tree

Known Results:

- NP-hard in general.
- Polynomial time solvable for series parallel graphs with maximum degree 3 and 3-connected cubic graphs.

Point-set Embedding

Q. Given a tree of n vertices and a set of n points in general position, is it possible to decide in polynomial time whether the tree admits a point set embedding such that all the leaves can be joined in order with straight line segments to form a cycle?

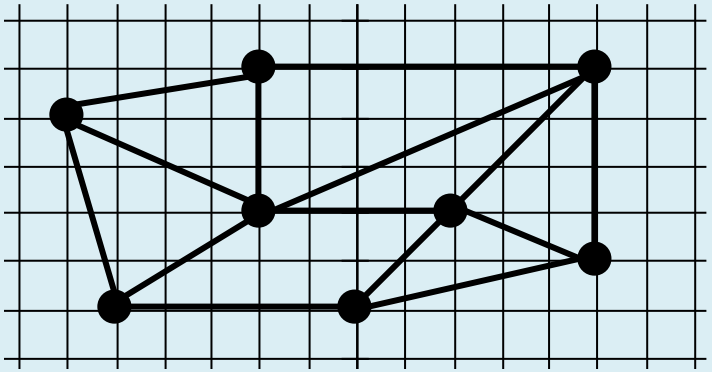


Tree T | Point set P | Point set embedding of T on P

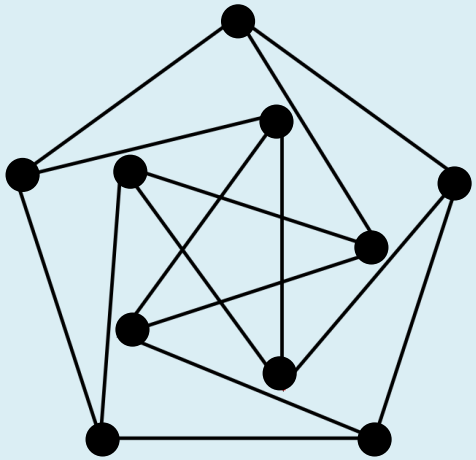
Consequence:
Polynomial time decision algorithm for point-set embedding of Halin Graphs.

Straight-line Grid Drawing

Q. Characterize the planar graphs that admit a straight-line grid drawing Γ s.t for every pair of vertices (u,v) in G, a shortest path between u and v in G is also a shortest path in Γ.



Straight-line grid drawing



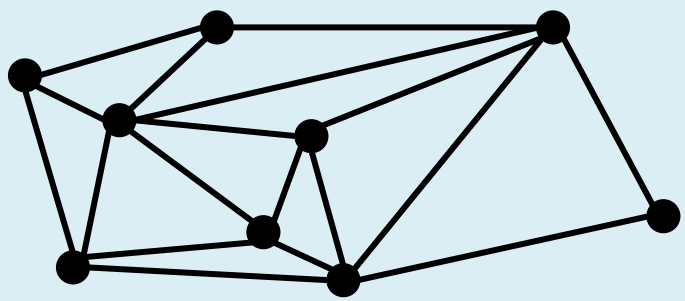
Unit edge length graph

Known Result:
Partial results come from unit edge length graph drawing.

Graph Representation

(Touching Triangle Representation)

Q. Given a planar graph, is it possible to decide whether it admits a straight-line drawing in polynomial time s.t all facial polygons are drawn as triangles?



A straight-line drawing of a planar graph, with all facial polygons drawn as triangles

Known Result:
Necessary and sufficient conditions for 3-connected plane graphs (but no polynomial-time algorithm is known to verify these conditions.)