

COMPUTATIONAL GEOMETRY

Kirkpatrick's Point Location Hierarchy – Example

Build the Kirkpatrick point location hierarchy for the triangulation shown below. At each step, when you identify an independent set, apply Algorithm 7.4 on page 277, breaking ties when you select a node in favor of the lowest numbered vertex. When you retriangulate a hole, use the simple ear-clipping algorithm (*Triangulate*, page 39), starting at the bottommost vertex of the hole (as “ v_0 ” in *Triangulate*, the first one tested for earity), and proceeding counterclockwise. (Ties (if any) for bottommost should be broken by picking the rightmost among the bottommost vertices.)

(a). List the independent sets corresponding to each stage of the algorithm. Also, for each stage, draw the corresponding triangulation.

The independent sets at each stage are given by: $\{2, 5\}$; $\{3, 7\}$; $\{4\}$; $\{6\}$.

See the sequence of figures below. In each step, the independent sets are shown with blue circled vertices.

(b). Draw the final hierarchy as a DAG, with each node of the hierarchy labeled by the triangle to which it corresponds. (When you label a node, please list the triangle as a triple with the vertex indices in order; e.g., the triangle with vertices “1”, “8” and “9” should be written as “189” (not as “819” or “918”, etc).)

The DAG is shown below.

(c). Highlight in the final hierarchy those nodes that are explored when point location is performed for point p , as shown in the figure.

The nodes are circled in red below.





