# High-Level Filtering

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## Filtered Exact Computation Approach

- algs use geometric predicates and geometric constructions
- predicates: *orientation*, *lexicographic order*, ...
- predicates are evaluated correctly
- filtering is used to make predicate evaluation more efficient

## High-Level Filtering

- predicates:
  - *locate a point in a triangulation*
  - *determine a facet visible*
  - *generally, any computation that does not change the data structure*
- predicates are evaluated correctly
- filtering is used to make predicate evaluation more efficient

# Incremental Construction of Delaunay Triangulations

- in order to insert a point $p$ into a Delaunay triangulation $T$
  - locate the triangle containing $p$
  - add it and rebuild by flipping
  - point location takes expected time $O(\log n)$ and rebuilding takes time $O(1)$
- how can we guarantee that point location is correct?
  - standard approach: *guarantee correctness of every single orientation test*
  - refined approach: *guarantee overall correctness, but allow incorrect substeps*
  - standard approach is special case of refined approach

# Point Location

- do point location with imprecise predicates
- this will always terminate since point location alg traverses an acyclic graph
- it will terminate in some triangle, usually the correct one
- check whether we are in the correct triangle with exact predicates
- if necessary, walk through the triangulation to the correct location

- the first item (time $O(\log n)$) incurs no overhead
- check of correctness is $O(1)$
- sometimes, correction phase is necessary

# Experimental Results

- dt_exact: with LEDA rational kernel and floating point filtering
- dt_search: with imprecise search and check
- dt_flip: run and repair

| | 32 | 40 | 52 |
|---|---|---|---|
| dt_exact | 194 | 195 | 192 |
| dt_search | 174 | 170 | 169 |
| dt_flip | 204 | 204 | 201 |

Table 1: Delaunay Triangulation: running time in seconds; 400000 random points

| | 32 | 40 | 52 |
|---|---|---|---|
| dt_exact | 75.4 | 74.7 | 74.8 |
| dt_search | 73.0 | 72.8 | 73.0 |
| dt_flip | 48.2 | 48.3 | 48.4 |

Table 2: Delaunay Triangulation: runnting time in seconds; 100000 points near a circle