

# Implementation documentation

Tracing algorithm was largely underestimated in the requirements documentation. Algorithm's rough progression:

1. Choose a vertex  $v$  from which point of view other vertices are traced.
  2. Choose another point  $p$ . Store the direction and distance from  $v$  to  $p$ . Also store direction and distance from  $v$  to  $p.right$ , assuming that  $p$  is a part of a polygon and thus has a connection with a left and right neighbour which are a part of the same polygon. This data can be represented as a sector of two directions.
  3. Repeat 2 for every point in the field. Sectors are stored in a heap, where a sector with the smallest left direction value is placed on top of the heap. Time requirement:  $O(p \cdot \log(p))$  Memory requirement:  $O(p)$ , where  $p$  is amount of geometry points.
  4. Go through the sectors and remove redundant and overlapping sectors. Each stored sector is pulled from the heap (Time:  $O(p \cdot \log(p))$ ) and stored in a tree (Time:  $O(p \cdot \log(p))$ ), where sectors with smaller destination value are stored as a left child. Using this technique, amount of stored sectors is reduced significantly. However the factor of sector reduction is hard to estimate. Memory requirement:  $O(p)$ .
  5. All vertices are checked whether they are obstructed by any sector. Time requirement:  $O(w \cdot s)$ , where  $w$  is amount of vertices in a field (which is less than  $p$ ) and  $s$  is amount of usable sectors (also less than  $p$ ). Memory requirement:  $O(q)$ , where  $q$  is amount of points that are unobstructed to the  $v$ . That way  $q \leq p$ .
  6. Repeat this for every  $v$  in the field.
- Overall time requirement:  $O(w \cdot ((p \cdot \log(p)) + (w \cdot s))) < O(p^3)$ . Memory requirement:  $O(p)$ .