An $s$-workspace algorithm is an algorithm that has read-only access to the values of the input and only uses $O(s)$ additional words of space. We give a randomized $s$-workspace algorithm for triangulating a simple polygon $P$ of $n$ vertices, for any $s$ in the range between $s = \Omega(\log n)$ and $s = O(n)$. The algorithm runs in $O(n^2/s)$ expected time.

We extend the approach to compute other similar structures such as the shortest-path map or the shortest-path tree from a point $p \in P$, or a partition of $P$ using only diagonals of the polygon so that the resulting sub-polygons have $\Theta(s)$ vertices each.

We consider the following two problems:

(a) Floodlight illumination: We are given $n$ infinite wedges (sectors, spotlights) that can cover the whole plane when placed at the origin. They are to be assigned to $n$ given locations (in arbitrary order, but without rotation) such that they still cover the whole plane.

(b) Convex partition: We are given a convex $m$-gon $P$ and a finite set of points $S$ from the interior of $P$, and $m$ positive integers $s_i$ with $s_1 + \cdots + s_m = |S|$.

We want to partition $P$ into $m$ convex parts. The $i$-th part should contain the $i$-th edge of $P$ and $n_i$ points of $S$.

We will show that these two seemingly quite different problems can be solved in a uniform way by a reduction to a minimum-weight bipartite matching problem.