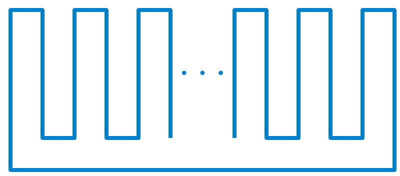
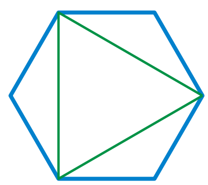
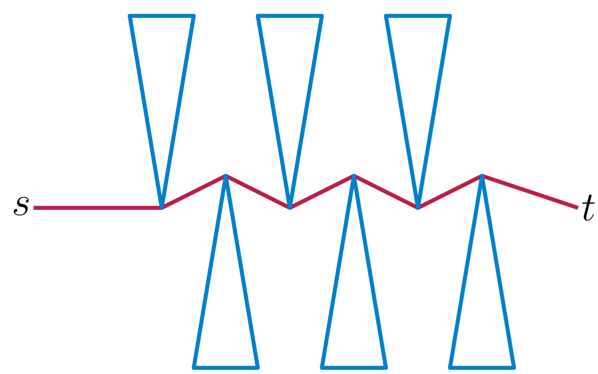
3.2 The following construction is a modification of the one given in class. This polygon has $n = 4k$ edges and requires k guards.



3.3 This statement is not true. For example the regular hexagon is a monotone polygon, and it is possible to triangulate it such that the dual graph is a star.



15.1 From class we know that the shortest path only turns at obstacle vertices. Furthermore, no vertex is ever visited twice, as this would form a loop that should be removed. Thus the path turns at most $O(n)$ times, and therefore has at most $O(n)$ vertices. The following construction shows that $\Theta(n)$ segments may be needed in the worst case. Here we make the triangle tall enough to force the path to wind through the middle.



15.2 We compute the linear arrangement of the set of lines that form the dual of all the vertices. Given a point p consider the line p^* in the dual space. To get the order of the other points, around p we consider the order is which their duals intersect p^*. This order is the same as the order of the slopes of the lines (in the primal space) through the two points. However, sorting by the slopes is not enough, we also need to know if the point is to the left or right of p to recover the sorted order. This is given to us by the slope in the dual. In particular, q is to the right of p if and only if its slope is greater than p's slope. This yields an $O(n^2)$ algorithm for finding all the sorted orders, but does not speed up the algorithm (asymptotically), as we still have $O(n^2 \log n)$ from the BST operations.

3.11 A linear time algorithm for this problem is explained in full detail in the (4 page) paper: "Testing a simple polygon for monotonicity" by Preparata and Supowit.

3.14 See "A linear algorithm for computing the visibility polygon from a point" by Gindy and Avis. The idea is to use a stack instead of a BST when implementing the radial sweep line algorithm.

15.4 There are at most 2^{3n} paths, as there are $3n$ vertices and a shortest path between two points is determined by a subset of the vertices. The construction below show that there may be as many as $2^{2/n}$ shortest paths. In this constructions the blue lines are the triangles (that for all practical purpose behave like lines) and the shortest path are formed by following a path of red and green subpaths. So there may be as many as $2^{\Theta(n)}$ paths. The construction is from `http://mathoverflow.net/a/95702`.