Exercise 2.1  The pockets of a simple polygon are the areas outside the polygon, but inside its convex hull. Let $P_1$ be a simple polygon with $n_1$ vertices, and assume that a triangulation of $P_1$ as well as of its pockets is given. Let $P_2$ be a convex polygon with $n_2$ vertices. Show that the intersection $P_1 \cap P_2$ can be computed in $O(n_1 + n_2)$ time. (CGAA Ex. 3.12)

Exercise 2.2  The stabbing number of a triangulation of a simple polygon $P$ is the maximum number of diagonals intersected by any line segment interior to $P$. Give an algorithm that computes a triangulation of a convex polygon that has stabbing number $O(\log n)$.

Exercise 2.3  Prove that the following polyhedron $\mathcal{P}$ cannot be tetrahedralized using only vertices of $\mathcal{P}$, namely its interior cannot be partitioned into tetrahedra whose vertices are selected from the vertices of $\mathcal{P}$ (see the enclosed figure).

Let $a, b, c$ be the vertices (labeled counterclockwise) of an equilateral triangle in the $xy$-plane. Let $a', b', c'$ be the vertices of $abc$ when translated up to the plane $z = 1$. Define an intermediate polyhedron $\mathcal{P}'$ as the hull of the two triangles including the diagonal edges $ab', bc'$, and $ca'$, as well as the vertical edges $aa', bb'$, and $cc'$, and the edges of the two triangles $abc$ and $a'b'c'$. Now twist the top triangle $a'b'c'$ by $30^\circ$ in the plane $z = 1$, rotating and stretching the attached edges accordingly: this is the polyhedron $\mathcal{P}$.

![Diagram](image)

Figure 1: The untetrahedralizable polyhedron is constructed by twisting the top of a triangular prism (a) by $30^\circ$ degrees, producing (b), shown in top view in (c)

Notice that there are additional exercises on the other side of the page.

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1This construction is due to Schönhardt, 1928. The description here is taken from O’Rourke’s *Art Gallery Theorems and Algorithms*. 
Exercise 2.4  Let $P$ be a simple polygon with $n$ vertices and let $G$ be a set of $k$ points inside $P$, which are the placements of cameras. Give an algorithm to determine whether the cameras in $G$ cover the polygon $P$ (in the “art-gallery” sense). Analyze the complexity of your algorithm.

Exercise 2.5  On $n$ parallel railway tracks $n$ trains are going with constant speeds $v_1, v_2, \ldots, v_n$. At time $t = 0$ the trains are at positions $k_1, k_2, \ldots, k_n$. Give an $O(n \log n)$ time algorithm that detects all trains that at some moment in time are leading.

Exercise 2.α  Study the deterministic linear time algorithm for solving two-variable linear programs by Meggido. It is clearly described in Section 7.2.5, TWO-VARIABLE LINEAR PROGRAMMING of the Computational Geometry book by Preparata and Shamos, the 1985 Edition. **No need to submit anything here.**