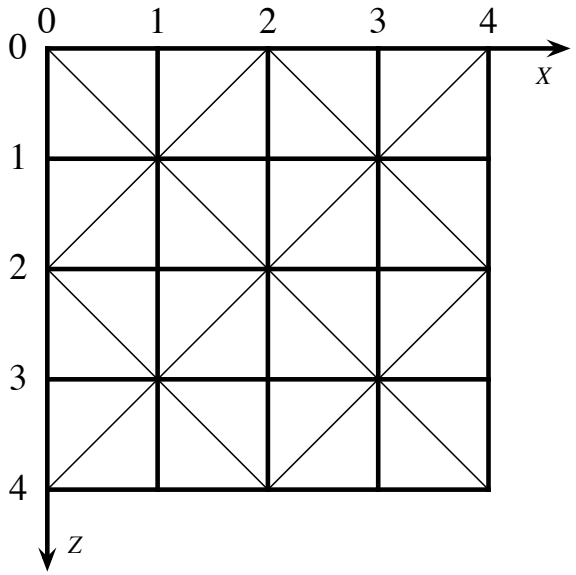
CMSC 23700 **Autumn 2017**	**Introduction to Computer Graphics**	**Homework 5** **Due November 28**

1. Consider a height-field mesh H with $(n+1) \times (n+1)$ posts that are distance w apart (*i.e.*, the size of the height field in world coordinates is $nw \times nw$). Also assume that the mesh is triangulated as in the following illustration, with the world-space origin coinciding with the north-west corner of the height field.



   Give pseudo code for a function that maps an $\langle x, z \rangle$ world-space coordinate onto the surface of the mesh and returns both the surface position $\mathbf{p} = \langle x, y, z \rangle$ and the surface normal at $\mathbf{p}$. (To simplify your answer, you may ignore the case where $\mathbf{p}$ lies on the edge of a mesh triangle).

   Hint: read the discussion of Barycentric coordinates in Section 6.21 of the text (pp. 141–143).

2. How many edges does a *closed manifold triangle mesh* of N faces have? Justify your answer.

3. Consider the *winged-edge* representation of meshes described in Handout 2. Let's assume that the polygons in the mesh are all triangles (*i.e.*, that it is a trimesh).

   (a) Write a function (in pseudocode) that returns the unit normal of a face.

   (b) Write pseudocode that when given a direction vector (*i.e.*, a vector pointing toward a viewer or a light) and a silhouette edge (w.r.t. the direction vector), walks the loop of edges that defines the mesh's silhouette.