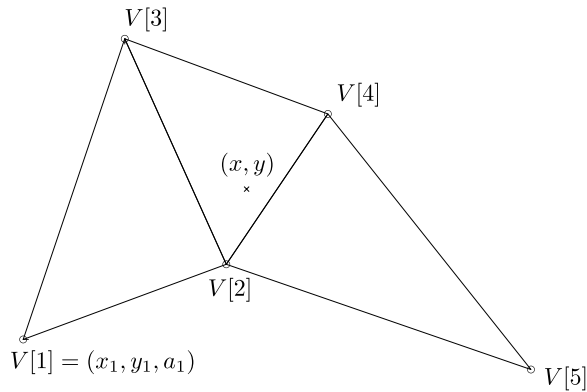


3 Introduction to Graphics (rkm38)

You are provided with a 2D triangle mesh defined by a set of vertices  $V[k] = (x_k, y_k, a_k)$  for  $k = 1, \dots, N$ , and a triangle index table  $T$  of dimension  $M \times 3$ , where  $M$  is the number of triangles.  $x_k$  and  $y_k$  are the coordinates of vertex  $k$  and  $a_k$  is its scalar attribute. An example of such a triangle mesh is shown below.



- (a) Write down the triangle index table of the mesh shown in the figure above. Ensure that all triangles are forward-facing. [4 marks]
- (b) Write pseudocode for a function  $a = \text{lookup\_a}(x, y, V, T)$ , which returns the value of the linearly interpolated attribute at the point  $(x, y)$  when the point lies on the mesh and  $-1$  otherwise. Use square brackets to index vertex ( $V[i]$ ) and triangle ( $T[i, j]$ ) tables. The pseudocode should include the formulas needed to compute the interpolated attribute value and to check whether the point is inside the triangles. [10 marks]
- (c) Suppose that now vertices also include a depth, so that  $V[k] = (x_k, y_k, z_k, a_k)$ , and triangles overlap and occlude one another. How do you need to modify the pseudocode to return the attribute of the visible triangle that has the lowest  $z$ -value at a given point? Due to memory limitations, you cannot use the Z-buffer algorithm. [6 marks]