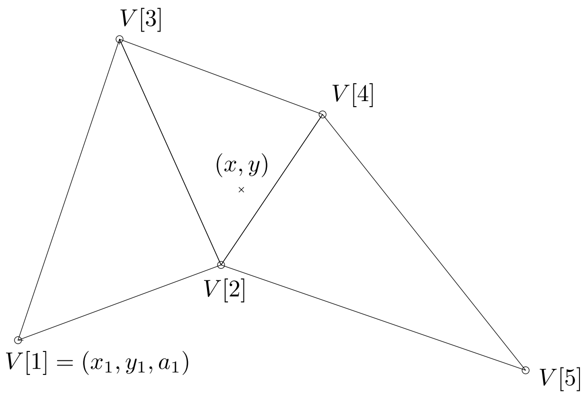
3 Introduction to Graphics (rkm38)

You are provided with a 2D triangle mesh defined by a set of vertices $V[k] = (x_k, y_k, a_k)$ for $k = 1, \ldots, N$, 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]