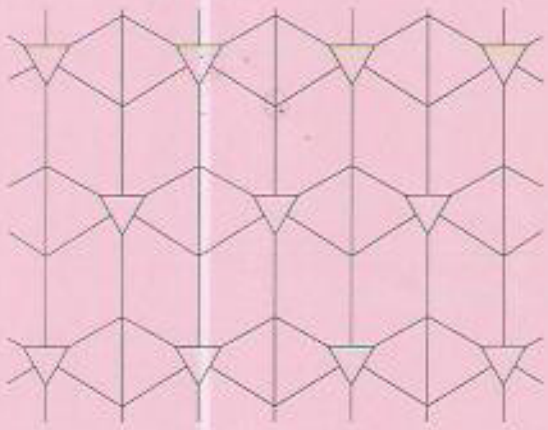
Part I

You may attempt **ALL** *the questions in this part and are advised to spend about* **90 minutes** *on it.*

The marks for each question are given beside the question.

Question 1

Consider the following tiling, $\mathcal{T}$.



$\mathcal{T}$

5

(a) Write down all the tile types and vertex types in $\mathcal{T}$. [3]

(b) Is $\mathcal{T}$ edge-to-edge? [1]

(c) Which one of the vertex types corresponds to two distinct vertex orbits under the symmetry group of $\mathcal{T}$? [1]

Question 2

The group G is given by the presentation

$$G = \langle r, s : r^4 = e, r^2 = s^2, sr = r^3 s \rangle$$

and the elements are written in standard form as

$$r^m \text{ and } r^m s, \qquad m = 0, \ldots, 3.$$

5

Note that G is *not* D_4.

(a) Express the element $(r^2 s)^2$ in standard form. [3]

(b) Prove that the element $r^2 s$ has order 4. [2]