**Problem 30**

Consider the dihedral group $D_4 = \langle r, s | r^4 = s^2 = (rs)^2 = 1 \rangle$:

(1) Identify its five conjugacy classes and define the corresponding class operators;

(2) Work out its class multiplication table;

(3) (*Optional*) Diagonalize the class operators (with the help of some software such as python or Mathematica$^©$ if needed) to determine its character table. You should recover the character table here [1].

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[1] http://symmetry.jacobs-university.de/cgi-bin/group.cgi?group=304&option=4