MME 529 HW 9

1. Complete the table of binary operations for the Dihedral Group D4.

Dihedral Group D4

	R90	R180	R270	R360	H	V	D1	D2
R90	R180	R270	R360	R90	D1	D2	V	H
R180	R270	R360	R90	R180	V	H	D2	D1
R270	R360	R90	R180	R270	D2	D1	H	V
R360	R90	R180	R270	R360	H	V	D1	D2
H	D2	V	D1	H	R360	R180	R270	R90
V	D1	H	D2	V	R180	R360	R90	R270
D1	H	D2	V	D1	R90	R270	R360	R180
D2	V	D1	H	D2	R270	R90	R180	R360

Rxx	refers to clockwise rotations about origin by xx degrees
H	reflection about X axis
V	reflection about Y axis
D1	reflection about y = -x line
D2	reflection about y = x line

2. Is the group D_4 commutative?

No. Consider, for example, that $D_1 H \neq H D_1$

3. Are there any proper subgroups of D_4?

Yes. The set $G_1 = \{R_{90}, R_{180}, R_{270}, R_{360}\}$ is a subgroup of D_4. This is not the only proper subgroup.