

### 18.755 tenth problems, due on Gradescope Wednesday, April 22, 2020

This problem set concerns the notion of *root datum*, which I'll define in class probably early in the week of April 20. To do the problem set, you should look at the notes on root systems <http://www-math.mit.edu/~dav/roots.pdf> linked from the class web site. Root datum is defined in Definition 1.6; just looking at Definitions 1.3, 1.6, and 4.1 should be enough to do the problems.

1. Find all root data living on the lattices  $X_* = \mathbb{Z}$ ,  $X^* = \mathbb{Z}$ .
2. Find all root data living on the lattices  $X_* = \mathbb{Z}^2$ ,  $X^* = \mathbb{Z}^2$  containing the two [root, coroot] pairs

$$[\alpha, \alpha^\vee] = [(1, 0), (2, 0)] \quad [\beta, \beta^\vee] = [(0, 1), (0, 2)].$$

3. For each example in Problem 2, calculate the Weyl group (notes, Definition 4.1).