Week 2 (due Jan. 17)

1. (20pts) Consider Lorenz group in three-dimensional space-time (i.e. one timelike direction, two spacelike directions). Show that the group is three-dimensional. Construct a 2-1 homomorphism from $SL(2,\mathbb{R})$ (the group of real 2×2 matrices with unit determinant) to the 3d Lorenz group. This shows that representations of $SL(2,\mathbb{R})$ can be thought of as projective representations of the 3d Lorenz group. The tautological 2-dimensional representation of $SL(2,\mathbb{R})$ can be taken as the spinor representation. It is obviously real (i.e. the complex-conjugate of the spinor representation is isomorphic to the spinor representation). Is it self-dual, i.e. does taking dual gives an equivalent representation? How many inequivalent spinor representations are there in 3d?

2. Problem 36.3 (30pts).

3. Problem 36.4 (a-f) (40pts).