215a Homework exercises 1, Fall 2015, due Oct. 5

"Tong problem $n.m$" refers to exercise set n, problem m. Follow links from website.

1. Consider a complex scalar field with

$$\mathcal{L} = \partial_\mu \phi^* \partial^\mu \phi - m^2 \phi^* \phi - \frac{\lambda}{2}(\phi^* \phi)^2$$

Note that the theory is invariant under $\phi \to e^{i\alpha}\phi$, with α constant (i.e. a global symmetry). Derive the associated Noether current and verify that it is conserved, using the field equations satisfied by ϕ.

2. Tong problem set 1, exercise 8.

3. Tong problem set 1, exercise 9.