Week 5 (due Nov. 6)

1. Problem 11.1 (Srednicki)
2. Consider free scalar field ϕ of mass m. Show that the Green's function

$$G^{(2)}(x) = \langle 0|T(\phi(x)\phi(0))|0\rangle$$

satisfies

$$(-\partial^2 + m^2)G^{(2)}(x) = -i\delta^4(x).$$

You are not allowed to use the explicit expression for $G^{(2)}(x)$ as an integral over k; rather, you should use the fact that $\phi(x)$ satisfies

$$(-\partial^2 + m^2)\phi = 0,$$

and the canonical (equal-time) commutation relations for ϕ and $\partial_0\phi$.

3. The theory of a complex scalar field ϕ describes spinless bosonic particles and their anti-particles. Write down the version of the LSZ reduction formula which expresses the scattering amplitude of an arbitrary number of particles and anti-particles in terms of time-ordered vacuum expectation values of the fields ϕ and $\phi^\dagger$. You do not need to provide a derivation.