Week 5 (due Feb. 12)

Reading: Srednicki, sections 43,44.

1. It follows from eq. (42.13) that the propagator for the free Dirac field is the Green's function for the Dirac wave operator. Derive this result in a different way, without using the momentum-space representation eq. (42.11). Instead, use the definition eq. (42.7) and the equal-time commutation relations (39.2) and (39.3).

2. Compute the integral (42.11) in the special case $m = 0$ and find the propagator in coordinate space.

3. Consider a free Weyl fermion with zero mass (its action is given by eq. (36.2) and the commutation relations are given by eq. (37.7)). Find the propagator both in momentum space and coordinate space.

4. Compute the anti-commutator at not-necessarily-equal times

$$\{\Psi(x), \bar{\Psi}(y)\}$$

using the expansion of the free Dirac fields Ψ and $\bar{\Psi}$ in terms of creation and annihilation operators. Show that the anti-commutator vanishes when the space-time points x and y are space-like separated.