Problem C14.1 Why is second quantization called second quantization?
Show that the operator equation of motion for a non-interacting field ψ looks exactly the same as the Schrödinger equation for the corresponding 1-particle wave function Ψ. Let

$$D\psi(t, \mathbf{x}) = 0$$

with a linear differential operator D be the operator equation of motion. In the Schrödinger picture a position eigenstate can be written as

$$|\mathbf{x}\rangle = \psi^\dagger(\mathbf{x})|0\rangle$$

and the wave function for the state $|\Psi(t)\rangle$ is

$$\Psi(t, \mathbf{x}) = \langle \mathbf{x}|\Psi(t)\rangle$$

(a) Show that the wave function satisfies

$$D\Psi = 0$$

(b) What goes wrong with this identification once you include interactions?