Homework Assignment 2
Review

Practice Problems

These problems are graded on effort only.

Griffiths: P1.4, P1.14a

Additional Problems

Problem 1: Consider the discrete probability distribution function $P(n)$ with:

$$P(0) = \frac{1}{6}$$

$$P(3) = \frac{1}{3}$$

$$P(4) = \frac{1}{2}$$

and $P(n) = 0$ for all other n.

(a) Is $P(n)$ properly normalized? Show your work.

(b) Find the expectation value $\langle n \rangle$ of the random variable n.

(b) Find the variance σ^2 of the random variable n.

Problem 2: Suppose the wave function for a particle is:

$$\Psi(x,t) = \begin{cases} \sqrt{\dfrac{\pi}{2L}}\, e^{it/t_0} \sqrt{\sin\left(\dfrac{\pi x}{L}\right)} & 0 \le x \le L \\ 0 & \text{otherwise} \end{cases}$$

(a) Plot $|\Psi(x,t)|^2$ as a function of x. Does the time t matter?

(b) Is Ψ properly normalized? Show how you determined this.

(c) For any position b what is the probability that you observe the particle with $x \le b$? (Hint: consider three cases $b < 0$, $0 \le b \le L$, and $b > L$.)

Problem 3: Define $P_{ab}(t)$ as the probability of measuring a particle in the range $a < x < b$, at time t. Show that:

$$\frac{dP_{ab}}{dt} = J(a,t) - J(b,t),$$

where:

$$J(x,t) \equiv \frac{i\hbar}{2m} \left(\Psi \frac{\partial \Psi^*}{\partial x} - \Psi^* \frac{\partial \Psi}{\partial x} \right)$$

Hint: look closely at the section on Normalization in Chapter 1 of the *lecture notes*.

Need one more problem...