

Problem Set 2

Part 1 Do the Webwork problems 1, 2, 3.

Part 2 Complete and hand in questions 1 and 2 of the worksheet from the Jan 16th class. Partial solutions for question 1 are posted on the course website.

Part 3 Calculate

$$\langle \psi | \hat{\mathcal{O}}^2 | \psi \rangle - \langle \psi | \hat{\mathcal{O}} | \psi \rangle^2 \quad (1)$$

for a state $|\Psi\rangle$ and an operator $\hat{\mathcal{O}}$ associated with an observable \mathcal{O} . Express your answer in terms of the eigenvalues λ_n of \mathcal{O} and the probabilities P_n for measuring these values in the state $|\Psi\rangle$. Show that this is equal to the square of the uncertainty for the observable \mathcal{O} in the state $|\Psi\rangle$. *Hint: it's simplest to work in the basis of eigenstates of \mathcal{O} . As a warm-up, calculate $\langle \psi | \hat{\mathcal{O}} | \psi \rangle$ and show that this is equal to the expectation value of \mathcal{O} .*

Note: $\langle \psi | \hat{\mathcal{O}} | \psi \rangle$ is the inner product between $|\psi\rangle$ and $\hat{\mathcal{O}}|\psi\rangle$.