$\boxed{\text{OPTI 570 RECAP Tue Sep 2}}$

· pset questions

· pset p2 (CT ch II ex 1)

$$U(m,n) = |\varphi_m\rangle\langle\varphi_n|$$

a. $$U^{+}(m,n) = |\varphi_n\rangle\langle\varphi_m|$$

b. $\hat{H}$ is a Hermitian operator

$$\hat{H}^{+} = \hat{H}$$

$$[\hat{H}, U(m,n)] = \hat{H}\,U(m,n) - U(m,n)\,\hat{H} =$$

$$= \hat{H}\,|\varphi_m\rangle\langle\varphi_n| - |\varphi_m\rangle\langle\varphi_n|\,\hat{H} =$$

$$= \ldots$$

$$\hat{H}\,|\varphi_m\rangle = E_m\,|\varphi_m\rangle \quad |^{+}$$

$$\langle\varphi_m|\,\hat{H}^{+} = \langle\varphi_m|\,\underset{\text{real}}{E_m^{*}}$$

$$\langle\varphi_m|\,\hat{H} = \langle\varphi_m|\,E_m$$

problem 1

(b2) $\psi(x)$ – continuous everywhere in space

– $\dfrac{d\psi(x)}{dx}$ – continuous everywhere

– $\displaystyle\int_{-\infty}^{+\infty} |\psi(x)|^2\,dx = 1$

$$M = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$$

$$M^{+} = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} = M \Rightarrow M\text{ - Hermitian} \Rightarrow \text{eigenvalues are real.}$$

$\det(M - \lambda I) = 0 \Rightarrow \lambda_1, \lambda_2$ must be real.

$\hat{P}_\psi^2 = \hat{P}_\psi$ IF AND ONLY IF $|\psi\rangle$ is normalized.