August 31, 2015

PHY 752 – Problem Set #3

Read Chapter 1.4 in **GGGPP**

1. Consider a one-dimensional tight-binding model system described by a tridiagonal Hamiltonian which has non-trivial matrix elements $H_{nn'}$ of the form:

$$H_{nn} = \alpha \quad \text{and} \quad H_{n(n\pm1)} = \beta$$

for all site indices n, where α and β are real energy parameters.

   (a) Consider the case where the site indices n, n' take the values 1, 2, 3 exclusively and find the numerical values of the 3 eigenvalues.

   (b) Consider the case where the site indices n, n' take the values $1 \ldots 8$ exclusively and find the numerical values of the eigenvalues.

   (c) Consider the case where the site indices n, n' have an infinite range $(-\infty \leq n, n' \leq \infty)$. Compare the energy range for this system with that of the previous two samples.