Spring 2005 #2

$H = T + V$ $\quad H_s = T + V_s$ $\quad H_s, V_s$ belong to a one dim. attractive square well. which always has a bound state.

$\Rightarrow \int \psi_s^* (T + V_s) \psi_s \, dx = E_s$ (1)

E_0 is ground state for V, Lets use ψ_s as a trail wave function

(2) $\int \psi_s^* (T + V) \psi_s \, dx \geq E_0$ [main point of variation method]

Sutract (1) from (2)

$\int \psi_s^* (V - V_s) \psi_s \, dx \geq E_0 - E_s$ Since V is negative for all x and V_s always has a bound state no matter what size it is.

$\Rightarrow (V - V_s)$ negative for all x

$\Rightarrow$ negative amount $\geq E_0 - E_s$, or

$E_0 \leq$ negative amount $+ E_s$ And E_s is negative

$\Rightarrow E_0$ is always negative and therefor bound.