H.3] a) $H(0) = -J \sum_{i=1}^{N} \sigma_i^z \sigma_{i+1}^z$, $J > 0$, $\sigma_i^z |\uparrow\rangle = |\uparrow\rangle$, $\sigma_i^z |\downarrow\rangle = -|\downarrow\rangle$

→ ENERGY IS MINIMIZED IF ALL SPINS ARE ALIGNED (OTHERWISE CONTRIBUTIONS OF SINGLE SPINS ADD UP TO ZERO)

$$H(0) \underbrace{|\uparrow\uparrow\ldots\uparrow\rangle}_{N \text{ TIMES}} = E_0 |\uparrow\uparrow\ldots\uparrow\rangle \quad , E_0 = -J \cdot N$$

OR

$$H(0) |\downarrow\downarrow\ldots\downarrow\rangle = E_0 |\downarrow\downarrow\ldots\downarrow\rangle \quad , E_0 = -J \cdot N$$

(DEGENERATE GROUNDSTATE)

b) $t \in [0, T]$ → $H(T) = -J \sum_i \sigma_i^z \sigma_{i+1}^z - h_f \sum_i \sigma_i^x$, $h_f > 0$ FINAL FIELD STRENGTH

$$\Rightarrow H(t) := \left(1 - \frac{t}{T}\right) \cdot \left(-J \sum_i \sigma_i^z \sigma_{i+1}^z\right) + \frac{t}{T} \left(-J \sum_i \sigma_i^z \sigma_{i+1}^z - h_f \sum_i \sigma_i^x\right)$$

$$= -J \sum_i \sigma_i^z \sigma_{i+1}^z - \frac{t}{T} h_f \sum_i \sigma_i^x$$