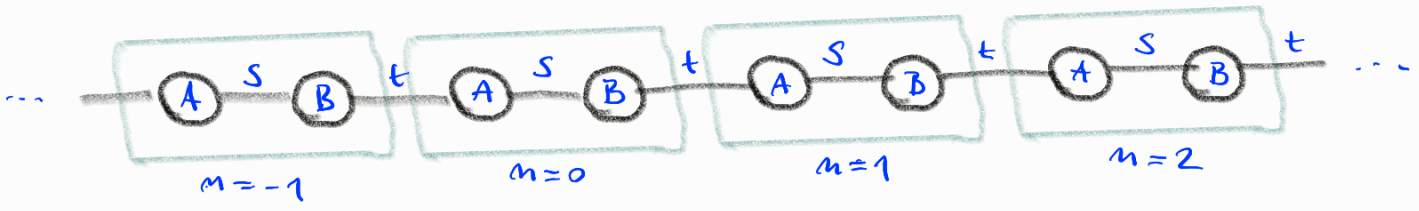
Homework 1a

Consider tight-binding model with scheme



i.e. there are two types of atoms $|nA\rangle$; $|nB\rangle$

$n = -\infty, \dots, -1, 0, 1, 2, \dots +\infty$ gives position in the chain

with Hamiltonian

$$H = \sum_n \{-s|nA\rangle\langle nB| - s|nB\rangle\langle nA| - t|nB\rangle\langle (n+1)A| - t|(n+1)A\rangle\langle nB|\}$$

- Find spectrum of this Hamiltonian.
- Find size of the band-gap.
- Find the effective mass of the upper valence band assuming that the distance of the nearest atoms is a.