# PHY981 Exercise 2

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## 1 Section

$$\hat{P}_p^+ = a_{p+}^\dagger a_{p-}^\dagger,$$

and

$$\hat{P}_p^- = a_{p-} a_{p+},$$

respectively.

The Hamiltonian (with $\xi = 1$) we will use can be written as

$$\hat{H} = \xi \sum_{p\sigma} (p-1) a_{p\sigma}^\dagger a_{p\sigma} - g \sum_{pq} \hat{P}_p^+ \hat{P}_q^-.$$

$\mathrm{P}_p^+ = a_{p+}^\dagger a_{p-}^\dagger$

$\mathrm{P}_p^- = a_{p-} a_{p+}$

$\mathrm{H}=\xi \sum_{p\sigma} (p-1) a_{p\sigma}^\dagger a_{p\sigma} - g \sum_{pq} a_{p+}^\dagger a_{p-}^\dagger a_{p-} a_{p+}$

$\mathrm{H}=\xi \sum_{p\sigma} (p-1) a_{p\sigma}^\dagger a_{p\sigma} - g \sum_{pq} \hat{P}_p^+ \hat{P}_q^-$