Key points of 04/11 lecture

Alternative view on cluster expansion:

$$\frac{VP}{kT} = \log \mathcal{Q} = \log\left(\sum_{N=0}^{\infty} z^N Q_N(V,T) \right)$$

by def.

at this point, system can be classical or quantum

$$\approx Q_1 z + \left(Q_2 - \frac{Q_1^2}{2} \right) z^2$$

small z Taylor expansion

$$+ \left(Q_3 - Q_1 Q_2 + \frac{Q_1^3}{3} \right) z^3$$

$$+ \ldots$$

Comparing with $\frac{P}{kT} = \frac{1}{\lambda^3} \sum_{\ell=1}^{\infty} b_\ell z^\ell$, we find

$$b_1 = \frac{\lambda^3}{V} Q_1$$

$$b_2 = -\frac{\lambda^3}{V} \left(\frac{Q_1^2}{2} - Q_2 \right)$$

$$b_3 = \frac{\lambda^3}{V} \left(\frac{Q_1^3}{3} - Q_1 Q_2 + Q_3 \right)$$

$$\ldots$$

If we are treating a quantum system, then $Q_2, Q_3, \ldots$ need to account for the exchange symmetry.