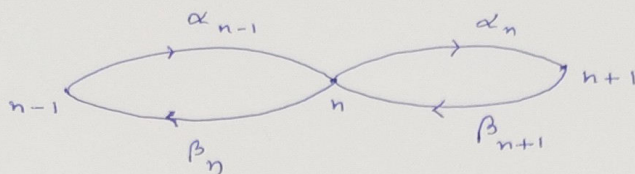# Assignment 1

1) For a markov process

Show that $\dfrac{d \langle n^2(t) \rangle}{dt} = \langle 2n (\alpha_n - \beta_n) \rangle + \langle \alpha_n + \beta_n \rangle$
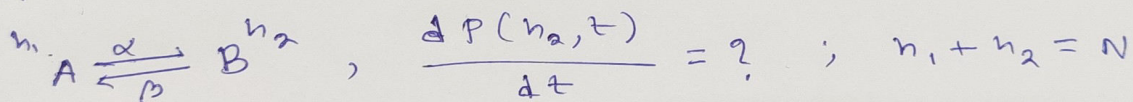
2) The master equation for a markov process is

$$\frac{dP(k,t)}{dt} = \sum_{\ell \neq k}^{N} \left[W(k|\ell) P(\ell,t) - W(\ell|k) P(k,t) \right]$$

Show that for detailed balanced condition

$$P^{eq} = \left\{ 1 + \sum_{\ell \neq k}^{N} \frac{W(\ell|k)}{W(k|\ell)} \right\}^{-1}$$

3) Write the master equation for the chemical reaction

$$\overset{n_1}{A} \underset{\beta}{\overset{\alpha}{\rightleftharpoons}} \overset{n_2}{B} \quad , \quad \frac{dP(n_2,t)}{dt} = ? \quad ; \quad n_1 + n_2 = N$$

Write the equation for the generating function

$$f(z) = \sum_{n_2} z^{n_2} P(n_2, t)$$

Calculate $\langle n_2 \rangle$ at steady state

4) construct the $W-$ matrix for this case
when $N = 3$, $\dfrac{dP(t)}{dt} = W(P(t))$.