1 Express the joint probability e_{kk'} in terms of N,⟨k⟩, number of nodes with degree k, N_k, and E_{kk'} (note that E_{kk'} is twice the number of links when k = k').

The textbook shows that

$$E_{kk'} = e_{kk'} < k > N$$

We rewrite this to get

$$e_{kk'} = \frac{E_{kk'}}{< k > N}$$

2 Express the conditional probability P(k'|k) in terms of N, ⟨k⟩, N_k, and the number of links connecting nodes of degree k and k', E_{kk'} (note that E_{kk'} is twice the number of links when k = k').

$$P(k|k') = \frac{\frac{E_{kk'}}{\sum_k kN_k}}{\frac{<k>N_k}{\sum_k kN_k}}$$

where \sum_kkN_k is the total number of links in the model.This simplifies to

$$P(k|k') = \frac{E_{kk'}}{< k > N_k}$$

3 Express the probability q_k, discussed in this chapter, in terms of number of nodes N, average degree ⟨k⟩, N_k, and E_{kk'}.

$$q_k = \frac{kN_k}{\sum_k kN_k}$$

4 Based on these expressions, show that for any network we have e_{kk'}=q_kP(k'|k)

$$e_{kk'} = q_k P(k'|k)$$
$$q_k P(k'|k) = \frac{kN_k}{\sum_k kN_k} \frac{E_{kk'}}{<k> N_k}$$