1. **Random graphs with given expected degree:** Suppose that each node $i$ is given an integer $k_i$ and we want to generate a network with $L$ links in expectation. Assume that $\sum_i k_i = 2L$. In our model, the link between node $i$ and $j$ appears with probability $p_{ij}$, which is $\frac{k_i k_j}{2L}$ if $i \neq j$ and $\frac{k_i^2}{4L}$ otherwise. Show that the expected degree of a node $i$ is indeed $k_i$.

2. **Configuration model:** Consider a configuration model for $N$ nodes and $L$ links where the fraction of nodes with $k$ stubs, i.e. the probability that a node has degree $k$, is $p_k$.
   
   (a) Given a stub of the graph and a node of degree $k$, what is the probability that the stub attaches to the node?
   
   (b) How many nodes of degree $k$ are there?
   
   (c) Given a stub, what is the probability that it attaches to any node of degree $k$?
   
   (d) Note that the previous is the probability that a random node has a neighbor of degree $k$.
   
   Use this to derive that the average degree of a neighbor of a node is $\langle k^2 \rangle / \langle k \rangle$.
   
   (e) Argue that $\langle k^2 \rangle / \langle k \rangle$ is always at least $\langle k \rangle$. Do you think this is surprising?

3. **Hubs:** Consider Table 4.1 of the book. Compute the expected maximum degree $k_{\text{max}}$ for each of them.