The total average number of inputs per node $\langle K_T \rangle$ is given by

$$\langle K_T \rangle = \frac{T}{N_T} = \langle K \rangle + \frac{\langle L \rangle}{N} \quad (4)$$

In the exploration of the space of possible MRBNs, the following measures are useful:

To study the relationship between number of nodes and modules, the node-to-module ratio μ is simply

$$\mu = \frac{N}{M} \quad (5)$$

To study the relationship between internal (K) and external (L) links, the probability κ that a link is *intramodular* is given by

$$\kappa = \frac{\langle K \rangle}{\langle K_T \rangle} \quad (6)$$

while the probability λ that a link is *intermodular* is the complement of κ:

$$\lambda = 1 - \kappa \quad (7)$$

4 Experiments

The open software laboratory RBNLab [18] was extended to explore the properties of MRBNs. RBNLab and its Java source code are available at http://rbn.sourceforge.net.

For all experiments, $p = 0.5$ and a total number of nodes $N_T = 20$ was used. Even when this is a relatively small size of MRBN, the effects of modularity can be already appreciated. The size of networks severely limits the statistical explorations, since each additional node doubles the size of the state space $S = 2^{N_T}$.

For each case and each K_T, one thousand networks were generated randomly, exploring one thousand randomly chosen initial states for ten thousand steps. This implies at least 10^{10} updates per MRBN ensemble [28].

We performed two sets of experiments: one to explore the statistical properties of different