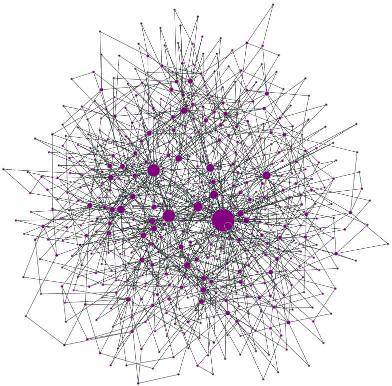
Barabási-Albert model

- Model for undirected networks
- Vertices are added one by one; the new vertex has degree c
- The new vertex connects to the old vertices preferentially
- The minimum value of the degree is always c



Solution of the Barabasi-Albert model

- Imagine the network to be directed as in the Price case
- Then in BA model, the probability should be proportional to $k_i + c$
- Hence, the distribution of in-degrees in this network is same as that of the Price model when $a = c$:

$$p_q = \frac{B(q+a, 2+a/c)}{B(a, 1+a/c)} = \frac{B(q+c, 3)}{B(c, 2)}$$

- $$p_k = \begin{cases} \frac{B(k,3)}{B(c,2)} & \text{for} \quad k \geq c \\ 0 & \text{for} \quad k < c \end{cases}$$

Solution of the Barabasi-Albert model

Using the definition of beta functions:

$$p_k = \frac{\Gamma(k)\Gamma(3)}{\Gamma(k+3)} \times \frac{\Gamma(c+2)}{\Gamma(c)\Gamma(2)}$$

Simplyifying,

$$p_k = \frac{2c(c+1)}{k(k+1)(k+2)}$$

Asymptotically,

$$p_k \sim k^{-3}$$

Extensions of preferential attachment models

- Addition of extra edges
- Removal of edges
- Non-linear preferential attachment
- Intrinsic-fitness models

Other models of network formation

- Vertex copying models
- Network optimization models
- Triadic closure models
- Small-world models