Barbasi-Albert model for N/W Evolu^n.

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Erdos-Renyi Model to generate random graphs.

Random graphs : GNM → N - no. of nodes, M - no. of edges

GNP → N - no. of nodes, P - prob. that a pair (i, j) will have an edge.

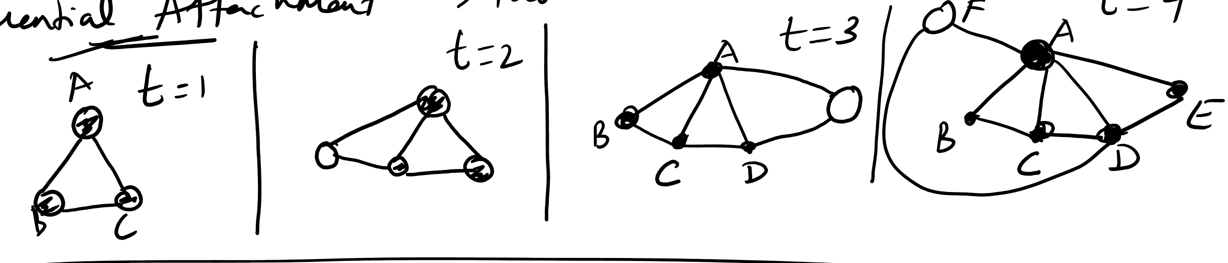
Real graphs
- WWW ↗
- Cita^n ↗
- Collabora^n
- Biological (Proteins-Protein interac^n)

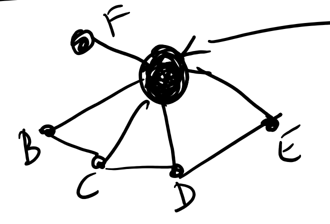
Requirement:
→ Why Generate a N/W that resembles real world N/W
- a) Define a null model to test assump^ns @ N/W properties
- b) To generate similar looking N/W
- c) To extrapolate @ how a N/W will look in future

In Erdos-Renyi Mode
→ Assumed that No. of nodes are fixed. But in real N/W, nodes keep on going (Growth)

→ Assumed that we randomly choose interac^ns (edges) (Preferential attachment)

Preferential Attachment → Probabilistic mechanism





Nodes w' high degree (degree > avg. deg of nodes) are called hubs.

Growth : At each time step, we add a new node w' m links.

Prob. that link of new node connects to an node i in existing N/W dep on deg(i).

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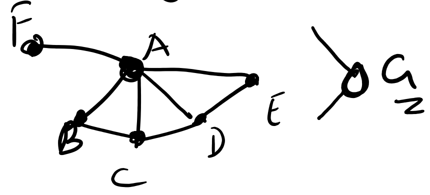
$$\Pi(k_i) = \frac{k_i}{\sum_j k_j} = \frac{5}{\cancel{2\times16}} \Bigg\} \quad \frac{2}{16}$$



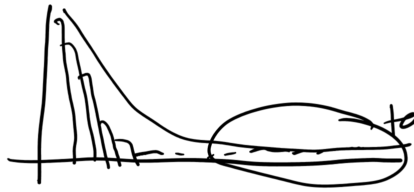
if a node that is new, has a choice bet^n
New-node.
5-deg node and 2-degree node, to link with
then definitely, new node gets attached to
5-degree node (By the concept of preferential attachment).

N/w created w/ those principles is Scale-free N/w

What is scale-free N/w ?
The N/w that follows power-law distrib^n

Power law distrib^n. P_k = the frac^n of nodes having degree k.

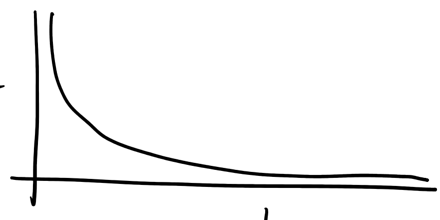
P_K



K

tail
degree k is high
but no. of nodes
w/ such high
degree is less
Such nodes are forming/called
hubs

log scale



k

No. of nodes w/ degree $k \propto \frac{1}{k^2}$

$$k \propto \frac{(1)\,c}{k^{(2)\to\alpha}}$$

$$1 \cdot k^{-2}$$

$$P_k = c \cdot k^{-\alpha}.$$

$$\ln P_K = -\alpha \ln k + c$$

Constants.

$$e^{\ln P_K} = e^{-\alpha \ln k + c}$$

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$$p_k = e^{-\alpha \ln k} \cdot e^{c}$$

$$p_k = c k^{-\alpha}$$