Social and Technological Networks Edinburg, 2015

Lecture 4. Power law networks

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We covered the following in class:

- www shows a power law degree distribution
- The exponential vs polynomial drop makes a large difference: Number of hubs.
- Log-log plots are useful in seeing power law, but should be used with care
- The mean of power law is finite iff $\alpha > 2$.
- Preferential attachment mechanism and model
- power law can arise from other types of optimization and heuristics

There are two ways of writing the power law (see [Kempe, 2011]). Suppose X is the variable in question, then:

- $\Pr[X \geq x] = cx^{-\alpha}$

  OR
- $\Pr[X = x] = c'x^{-\alpha'}$

Exercise 0.1. *Express (c', α') in terms of (c, α) and vice versa.*

*** Exercise 0.2.** *Show that preferential attachment networks have small diameter. (Take all edges as undirected.)*

*** Exercise 0.3.** *Do preferential attachment networks have expansion above a constant? (Take all edges as undirected.)*

*** Exercise 0.4.** *What do you think happens to diameter and expansion in real world power law networks?*

Exercise 0.5. *It is the in-degrees of nodes in www that are expected of have power law distribution. The code we tried in class took all degrees. Write your version to plot the in-degrees.*

References

[Kempe, 2011] Kempe, D. (2011). Structure and dynamics of information in networks, lecture notes. Technical report, U.S.C.