Social and Technological Networks Edinburgh, 2015

Lecture 4. Power law networks

TA: Maria Astefanoaei *Solutions to Exercises*

Exercise 0.1. $\Pr[X \geq x] = cx^{-\alpha}$ *or* $\Pr[X = x] = c'x^{-\alpha'}$. *Express* (c', α') *in terms of* (c, α) *and vice versa.*

Answer. We can write $\Pr[X \geq x]$ as an integral:

$$\Pr[X \geq x] = \int_x^\infty c' X^{-\alpha'} dX = c' \frac{x^{1-\alpha'}}{\alpha' - 1},$$

where we have used that $\int y^{-a} dy = \frac{y^{1-a}}{1-a}$+constant.

Equating the two identities we get:

$$\Pr[X \geq x] = cx^{-\alpha} = c' \frac{x^{1-\alpha'}}{\alpha' - 1},$$

therefore we can write (c', α') as $(c \cdot \alpha, \alpha + 1)$

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

Answer. Real world networks have stronger clustered community structure. This is likely to give them a smaller expansion factor than, say preferential attachment. The reason is that expansion is the worst case outgoing edge factor. Thus, if there is only one community with few external edges, that will bring down the expansion.