main_code

December 16, 2016

In [1]:
```
import math
import networkx as nx
import pandas as pd
import numpy as np
from sympy import LambertW


## Random graph model
@np.vectorize
def giant_component_fraction(mean_degree):
        return 1 + LambertW(-mean_degree * np.exp(-mean_degree))\
           / mean_degree if mean_degree >= 1. else 0.

fct = np.vectorize(math.factorial)

def dist_node_component(s, c):
        return np.exp( - s * c) * c * (s * c) ** (s-2) / fct(s-1)

def dist_comp_sizes(s, c):
        return 1 / s * dist_node_component(s, c)

def avg_comp_size(c):
        S = giant_component_fraction(c)
        return 1 / (1 - c + c * S)

def largest_comp_fraction(c=0.4, n=100):
    s = np.linspace(1,20,20)

    S = np.asscalar(giant_component_fraction(c))
    dist_component_sizes = pd.Series(dist_comp_sizes(s, c), index=s)
    k = int(np.ceil( dist_component_sizes.sum() * n))
    x_s = (dist_component_sizes * n / k)
    cdf_s = x_s.cumsum()
    y = (cdf_s ** k)
    yy = y.diff()
    yy[1] = y[1]
    exp_yy = np.sum(yy.index.values * yy) / n
    return max(exp_yy, S)#, yy, k, dist_component_sizes, S
```

```
In [2]: from bokeh.palettes import inferno
        from matplotlib import pyplot as plt

In [3]: from scipy.stats import expon

In [4]: g = lambda x, α: expon.pdf(x, scale=1/α) / (1-np.exp(-α))
        G = lambda x, α: expon.cdf(x, scale=1/α) / (1-np.exp(-α))

In [5]: ρ = np.linspace(0, 1., 100)
        n = 100

In [6]: α = 5
        n = 100
        c = (1-G(ρ, α)) * (n-1)

        f_largest = np.vectorize( lambda c: largest_comp_fraction(c=c, n=n))
        l = f_largest(c)
```

```
/usr/local/anaconda3/lib/python3.5/site-packages/ipykernel/__main__.py:16: RuntimeW
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```

```
In [7]: %matplotlib inline
        plt.figure(figsize=(6,3))
        plt.title("$n = %d$" % n, fontsize=14)
        plt.hold(True)
        plt.xlabel("$\\rho$", fontsize=13)
        plt.ylabel("$Y$", fontsize=13)

        alphas = [0.5, 1.0, 3., 5., 10.]
        colors = inferno(len(alphas))
        lines = []
        vals = {}
        for i, α in enumerate(alphas):
            c = (1-G(ρ, α)) * (n-1)
            l = f_largest(c)
            vals["%f" % α] = l
            ll, = plt.plot(ρ, l, label="$\\alpha = %.1f$" % α)
            lines.append(ll)

        lgd = plt.legend(handles = lines, loc='best')
        # plt.savefig("../figures/3_largest_component.png", bbox_extra_artists=(lgd
```

```
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```

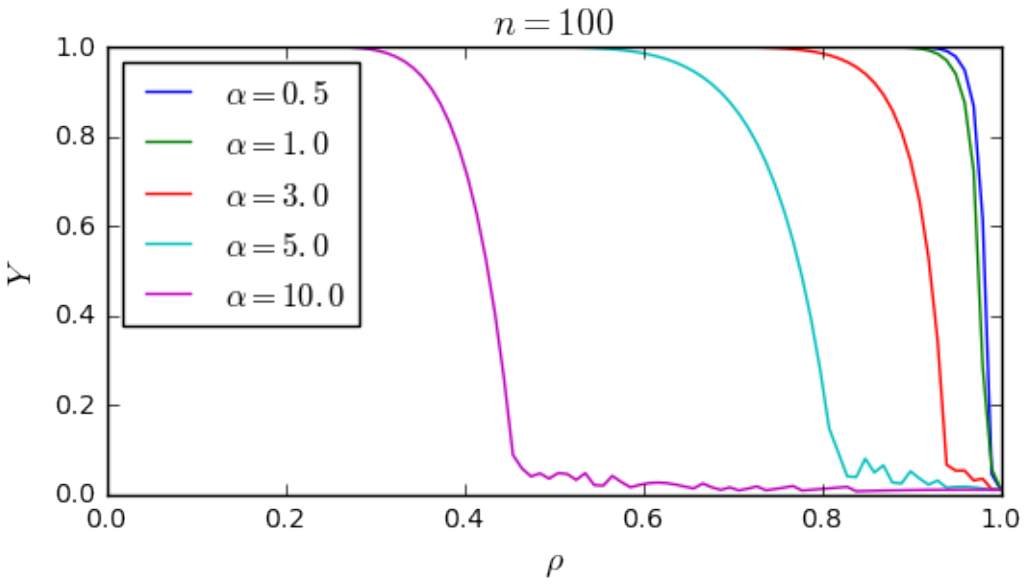
$n = 100$
$\alpha = 0.5$
$\alpha = 1.0$
$\alpha = 3.0$
$\alpha = 5.0$
$\alpha = 10.0$
Y
ρ
0.0
0.2
0.4
0.6
0.8
1.0