PoCS Assignment 6

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PoCS Assignment github repo: https://github.com/alexburn17/BurnhamPoCS

Worked with: Yu Han, Edison & Kewang

Problem 1:

a)

Step 1: set up problem

$$p^2(1-p) = 1, 1, 1, 0 \; and \; (l = 3)$$

$$(1-p)p(1-p)p^2(1-p)p^3(1-p)\dots p^n(1-p)$$

Step 2: factor out $(1-p)$

$$(1-p)(p+p^2+p^3\dots p^n) = 1$$

this is infinite series...

$$(1-p)\Big(\frac{1}{1-p}\Big) = 1$$

simplify:

$$p(l) = p^{(l-1)}(1-p)$$

b)

Step 1: set up problem

$$E = (1-p)[(1+2)(p+3)(p^2+4)...]$$

Step 2: multiply by p

$$PE = (1-p)[(p+2p^2+3p^3...]$$

Step 3: factor out $(1-p)$ to show infinite series

$$(1-p)E = (1-p)[(p+p^2+p^3\dots p^n)]$$

simplify...

$$E = \Big(\frac{1}{1-p}\Big)$$

As p goes to 1, E goes to infinity making p=1 the giant component.

Problem 2:

p' is the probability that there is percolation in a single triangle

There are three cases where two nodes in the triangle are trees

There is one case where all nodes are trees

In notation....

$$p' = 3p^2(1-p) + p^3$$

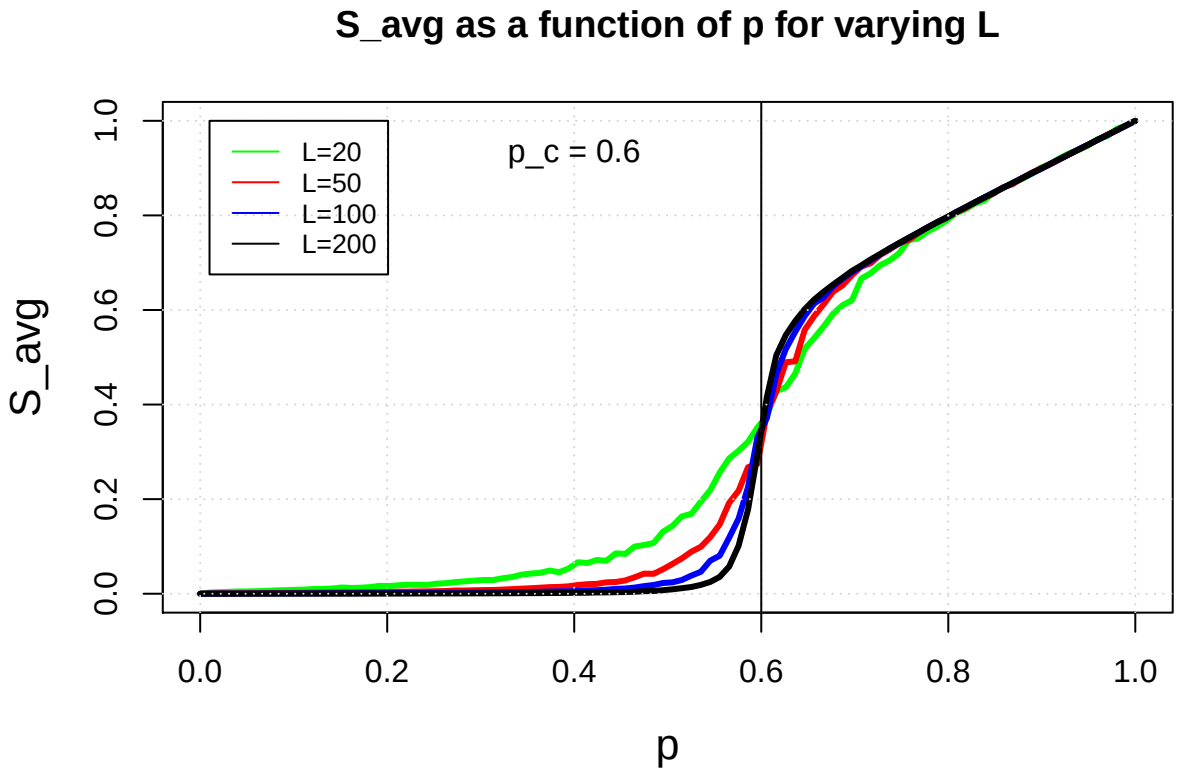
p becomes p_c

and simplify

$$p_c = 3p_c^2 - 2p_c^3$$

Problem 3:

a)

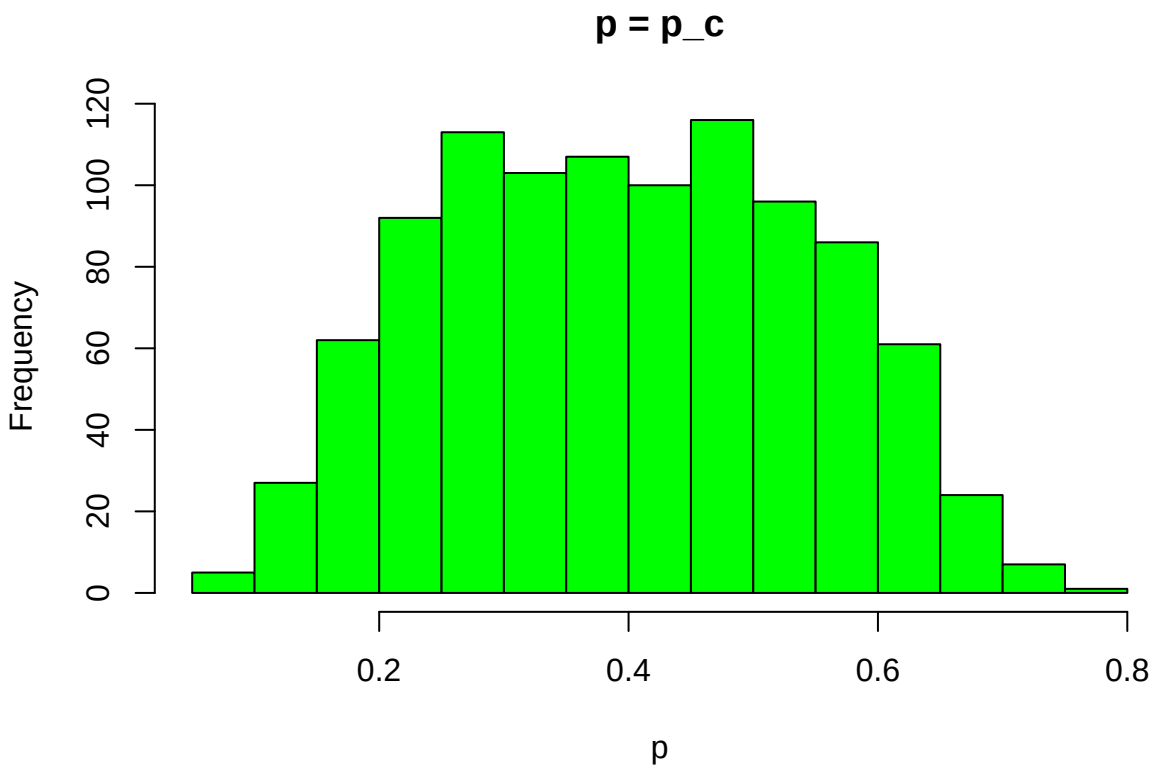


b)

As L increases, the accuracy (lack of stochasticity or variance) increases. The curve tends to smooth out. The estimate for p_c_ is 0.59 which is the inflection point on the most accurate curve (L=200).

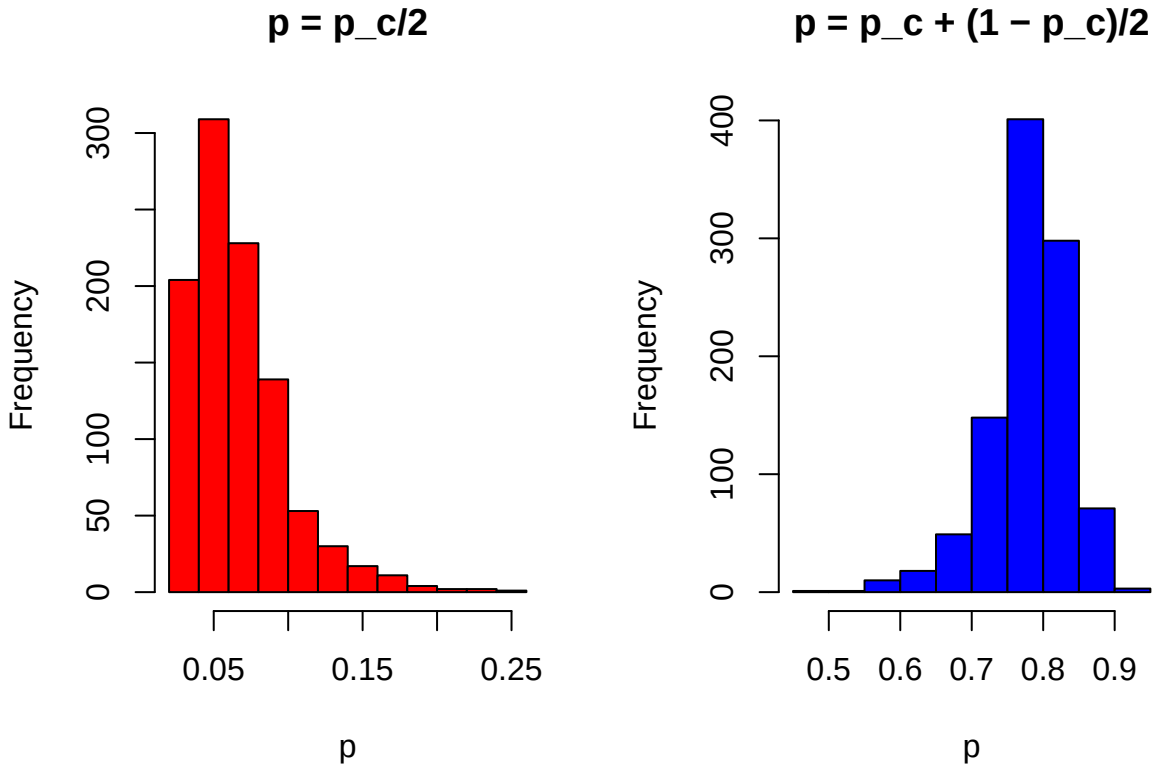
Problem 4:

a)



In the case of p=p_c_, the distribution looks to be fairly normal with an N of 1000

b)

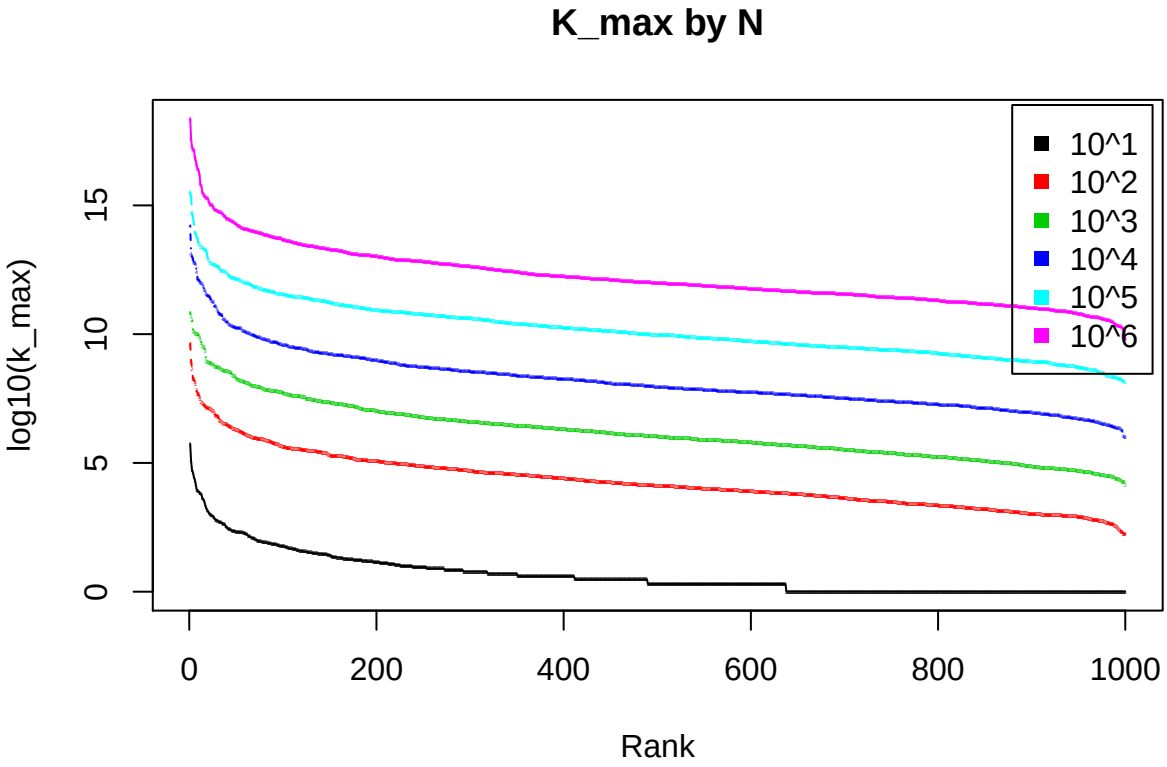


For p_c_/2 (well below), the distribution is skewed right with a small range of values (p=0.05-0.25). For p_c_ + (1 - p_c_)/2 (well above), the distribution is skewed left and values have alarger range and the

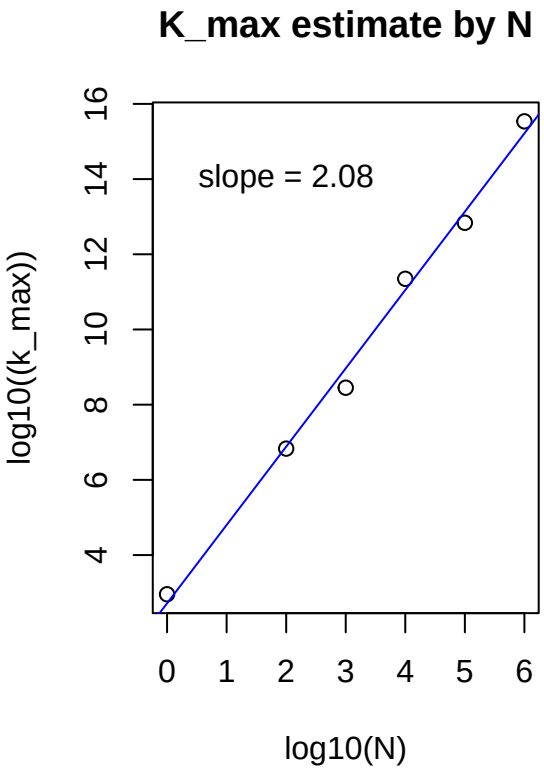
higher frequency area is on larger values of p.

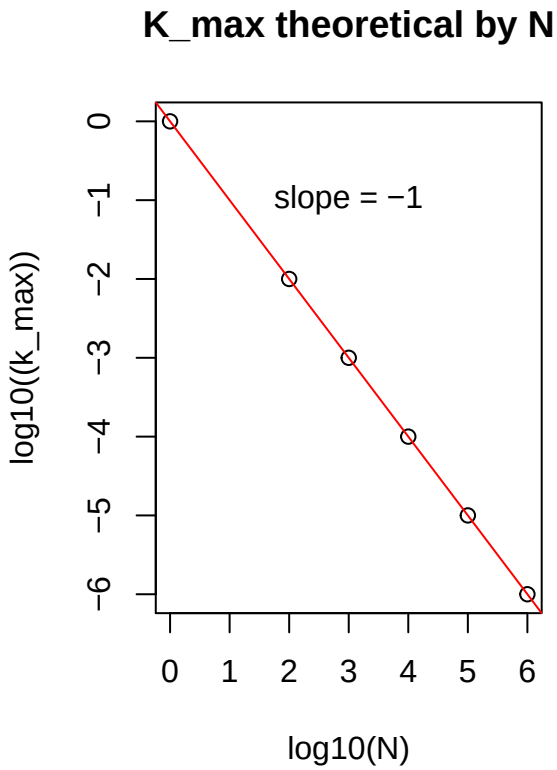
Problem 5:

a)



b)





Based on a theoretical k_mean estimation of kmeanTher = ((gamma-1)/(gamma-2))*Nˆ((2-gamma)/(gamma-1)), my theoretical value and empirical values do no match up. The slope of the theoretical value is half that of the estimate and negative. The one I calculated by sampling a powerlaw distribution has a positive slope of around 2. This makes sense as the max k should increase as the sample size increases. However, my derivation of the theoretical max k has a negative slope of -1 This does not make sense and leads me to believe that my model is correct and the theoretical values are incorrect. K_max should increase as N increases as this increase in N gives higher probability of capturing a large K. The theretical value looks like it is flipped about the y axis as the spacing of the points is simaler. However, te change from 5/2 t0 3/2 makes sense as the lower scaling exponant should allow for larger values to be selected more frequently driving the m_max values up.