Q2) for triangle Packing Problem.

If we are coloring the nodes with 'k' colors

'n' → nodes

'k' → colors

total ways of coloring the nodes = k^n

Prob of finding 'k' monochromatic triangles

$$= \frac{k!\, k^{n-3k}}{k^n} > \frac{k^k/e^k}{k^{3k}} = \frac{1}{e^k k^{2k}} = \frac{e^{-k}}{k^{2k}}$$

Prob of finding 'k' disjoint triangles of unique color $= e^{-k}/k^{2k}$

(6)

If we are trying to color the graph with 3k colors and trying to find 'k' disjoint triangles

Prob of finding 'k' node disjoint triangles would be

$$P = \frac{(3k)!\,(3k)^{n-3k}}{(3k)^n} > \frac{(3k)^{3k}/e^{3k}}{}$$

If we color the graph with 3k colors, the probability that we find 'k' colorful triangles would be e^{-3k}