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**CSC 403 Homework 7B**

*Largest connected components in a Graph*

By varying p, the probability that an edge will be created between two vertices in the Erdos-Renyi creation process, it becomes clear that the entire Graph is highly likely to be connected as one component as soon as p is larger than ~0.5. As such, we’ll analyze the more interesting area of this plot, where 0 < p < 0.5. For each value of p, 20 random graphs of size N = 100 were generated using this probability as input. Averaging each runs largest component size lets us explore the relationship between this value and p.

This shows us a relationship not dissimilar from the cumulative distribution function. As the probability that edges will be created increase, there are marginally increasing increases in the average largest component size. This can be explained by understanding that each increase in the edge creation probability increases the chances of many possible paths that will connect two components. After a certain inflection point (~1.5% probability), the increases are marginally decreasing as it begins to plateau to a maximum possible size of N (100 in this example). Increasing N (to 200, say), lowers the inflection point’s probability (to ~0.075, roughly by half).

*Largest strongly connected components in a Digraph*

Following the exact same methodology we also created random Digraphs and plotted their largest strongly connected component sizes against the probability, p. Again, we ran 20 repititions for each probability.

The results here were very similar, and for the same reasons. For random graphs of the same size (N = 100), the inflection point occurred around the same value, but slightly higher (~1.75%). When doubling the size of the randomly created graphs, the inflection point rises to a probability of ~1.875%.