Blockchain Assignment 3 - Layer 2 DAPP on Blockchain

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1 Introduction

This assignment focuses on building a layer 2 DAPP on top of blockchain. An etherium node is run on our local machines using ganache/ truffle. We first start off by spawning a graph (according to the power law degree distribution) of 100 nodes, with edge weights sampled from the exponential distribution with mean 10 - where he edge weights are the total balance in the account represented by that edge. It looks similar to the graph shown below.

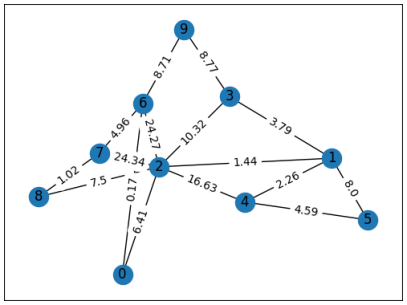
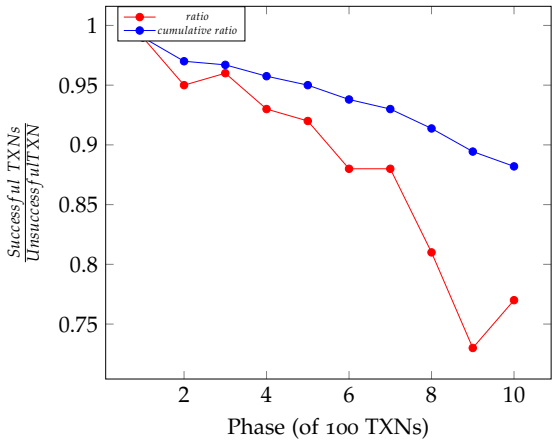


Figure 1: Power law degree distribution graph with 10 nodes

2 Results

2.1 Random selection



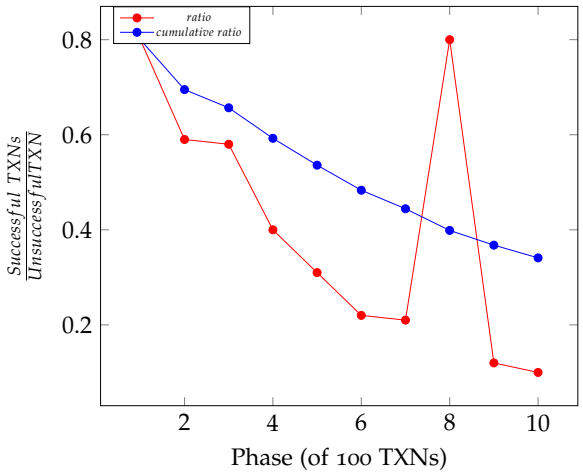
The plotted quantities are defined as:

1. $ratio = \frac{\#\ Successful\ TXNs\ in\ a\ phase}{Total\ \#\ of\ TXNs\ in\ a\ phase\ (100)}$

2. $cumulative\ ratio = \frac{\#\ Successful\ TXNs\ till\ the\ end\ phase\ i}{Total\ \#\ of\ TXNs\ till\ end\ of\ a\ phase\ (100i)}$

The above graph is plotted by selecting two nodes randomly in the entire network, and transferring 1 ETH from one node to another.

2.2 Partitioned Network



The above graph is plotted by randomly selecting a node from node id 0 to 49 (group 1) and another randomly chosen node from node id 50 to 99 (group 2), and transfer from node in group 1 to node in group 2 (With ratio and cumulative ratio as defined above)

3 Explanation

Both the ratio and cumulative ration of the number of successful to unsuccessful transaction decrease as more and more TXNs are executed. The reason for this is that initially almost all the nodes have sufficient balance in their accounts (only a very small fraction of nodes have 0 ETH to begin with). As the number of TXNs increase, the since the nodes are chosen randomly, the nodes with less amount of ETH run out of balance first, causing the number of unsuccessful TXNs to increase as time goes by.

The decrease in ratio and cumulative ratio is even more sharp, when ETH is transferred from group 1 to group 2 (as defined above) of the partitioned network. The reason for that is obvious - the accounts in group 1 are being drained continuously when the nodes between which transfer has to take place, are not chosen randomly.
When they are chosen randomly, it is equally likely that sometimes, the account of nodes in group 1 gets replenished, therefore the decrease is not that sharp.