CS 765 Assignment 3

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1 Submission Structure

This report, in `report.pdf` contains an account of our observations of the run experiments. The contract is in `contracts/Payment.sol`, and the client file (along with the configuration parameters) are in `client.py`. Three example runs along with detailed logs, information and graphs are under the out/ directory. See `README.md` for more details.

2 Transaction Success Rate

As specified in the Problem Statement, we instantiate a random graph of $N = 100$ nodes, with the degrees following the Power-law distribution. Every edge indicates a joint account, with an initial balance of an equal amount from both parties, equal to a randomly sampled number from an exponential distribution of mean $\mu = 10$, and rounded to the nearest integer. We show an example connectivity graph in Figure 1.

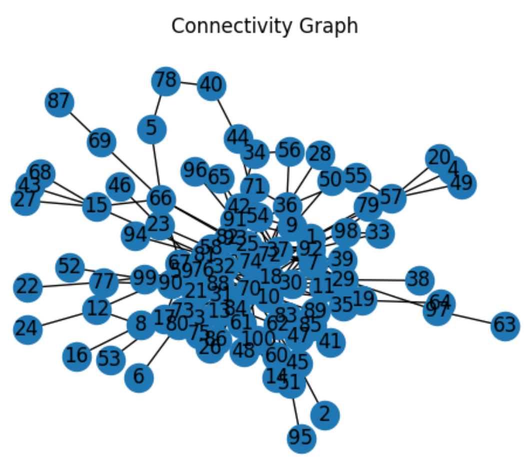

Figure 1: An example connectivity graph between the users.

We then fire $T = 1000$ random transactions between nodes. The transactions always attempt to follow the shortest path as returned by Dijkstra's algorithm. A transaction fails if any node on the path lacks sufficient funds in its joint account with the next one to transfer the specified amount. We record the success rate of the attempted transactions, and plot them against the number of attempts, in multiples of 100 of the latter. We show the corresponding plot for three such randomly initialized runs in Figure 2.

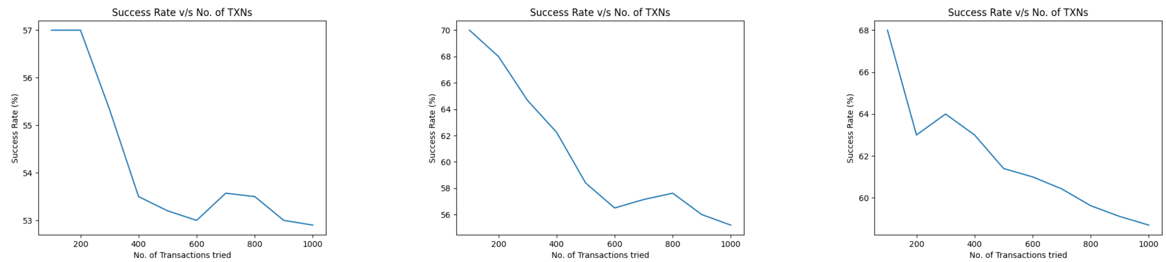

Figure 2: Three example plots of success rate v/s number of attempted transactions, corresponding to three randomly initialized runs.

We make the following comments about our observed success rates.

(a) **The success rate decreases with an increase in number of total attempted transactions**. This is unsurprising, since as we fire transactions, certain edges become unsuable in one direction as all of their balance accumulates on one end. Subsequently, later transactions have to find a path among fewer feasible edges, leading to the observed phenomenon.

(b) **The success rate varies somewhat between runs**. Depending on the graph intialization, we may have more or less connectivity due to both the edges that are present in the graph and the randomly initialized amounts in the corresponding joint accounts (a greater balance implies more uses before the edge becomes unusable in one direction).

(c) **Even after a while, the success rate remains reasonably high**. There are two reasons for this. First, since on average a joint account starts out with 10 coins from both users, it has to be used ten times successively (or "cumulatively" considering the other direction as -1 uses) on average before it runs out. It is statistically likelier that it sees use both ways, so it takes a while for an edge to run out. Second, there often exist multiple paths from one node to another of the same smallest length, so even if an edge on one runs out, the funds could be routed via other paths.