**EEE472/CSE422 [C02]**

**Strange Bank Problem**

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Suppose, you are the owner of a bank that operates in a strange way. Customers can lend money from your bank (just like a normal bank) and they can also deposit money in your bank. A register is maintained to track the daily transactions. However, being the strange owner of a strange bank, you have a fascination with finding out whether a portion of your daily transactions (in/out) balance out to zero. For example, suppose

| 1 | Lend | 100 |
| --- | --- | --- |
| 2 | Deposit | 150 |
| 3 | Lend | 400 |
| 4 | Lend | 500 |
| 5 | Deposit | 1000 |
| 6 | Lend | 460 |
| 7 | Deposit | 160 |
| 8 | Deposit | 200 |
| 9 | Lend | 500 |
| 10 | Deposit | 100 |

In this case, there is a portion of the transactions that would balance itself out. (6th, 7th, 8th, and 10th transactions would amount to 0).

Your task is to use a genetic algorithm to solve this strange bank problem.

**Task Breakdown:**

1. Model the transaction register in a way suitable for the problem.
2. Write a fitness function. Hint: It is the sum of the non-zero elements of a register.
3. Write the crossover function.
4. Write the mutation function.
5. Create a population of randomly generated registers.
6. Run genetic algorithms on the population until highest fitness has been reached and/or number of maximum iterations has been reached.

**Input**

The first line has a number denoting the number of daily transactions followed by lines each starting with either ***l*** or ***d*** and a number denoting the amount of transaction. Here:

**Output**

The output would be a binary string denoting the specific transactions that balance themselves to zero or -1 if such a string cannot be formed. String consisting of all zeros won’t be accepted.

**Example:**

| **Sample Input 1** |
| --- |
| 7  l 120  l 289  d 475  l 195  d 6482  l 160  d 935 |
| **Sample Output 1** |
| 1011010 |

| **Sample Input 2** |
| --- |
| 5  l 100  l 450  d 500  l 7923  d 9055 |
| **Sample Output 2** |
| -1 |