# Calculating the circulating supply of a token

In this project, you will work with a list of transactions and calculate the "circulating supply" of a cryptocurrency token.

A cryptocurrency works in the same way as a regular currency such as the US dollar or Renminbi. A central bank issues money (also known as minting), and can also hold money (also known as burning). A part of the currency is used for trading and exchanging of goods and services, this part is "circulating". Therefore, the money in your bank account can be considered part of the Chinese yuan's circulating supply. Currency that is held back by the central bank is "locked".

For this exercise, work with the file `fluence_raw.csv`.

Some basic information about the file:

- Each row in this file has one transaction, sent from one user ("`from`") to another user ("`to`"). The user's address has the form `0xabc...defgh`
- The amount sent in the transaction is "`value`"

## 1 Basics of Pandas

1. Load the file into a Pandas dataframe.

2. The list of transactions have a time, given as `blockNumber`. However, this value is given to you in hexadecimal. Create a new column `block_number` which converts the hexadecimal to an integer in base 10. This is a one-line command in Pandas.

3. How much token is minted? This is the total amount of token sent from the minting address `0x0000000000000000000000000000000000000000`. This is a one-line command in Pandas.

4. Filter out all the transactions sent from the address `0x568235236f039253f348f1503ce0690ba291675b`. This is a one-line command in Pandas.

5. How do you display a random selection of 10 transactions? How do you display the top 10 and last 10 rows of the dataframe?

## 2 Calculating the balance

Here you will calculate how much token each user in your dataset is holding. (Hint: look up the "group by" function in Pandas.)

A. From the dataframe, calculate how much each user **received** from other users. The result is a table like this. You can generate this table with one line in Pandas.

| **from** | **value** |
|---|---|
| 0xabc123asdfsdf234alsdkfjsad | 12345 |
| 0xabc123asdfsdf234alsdkfjsad | 12345 |

B. From the dataframe, calculate how much each user **sent out** to other users.

| **to** | **value** |
|---|---|
| 0xabc123asdfsdf234alsdkfjsad | 12345 |
| 0xabc123asdfsdf234alsdkfjsad | 12345 |

C. Try to read up about the concept of "joining" or "merging" tables in Pandas. Join the tables in (1) and (2), and obtain a table like this

| **user** | **value_received** | **value_sent** |
|---|---|---|
| 0xuser1 | 1000 | 500 |
| 0xuser2 | 2000 | 2000 |

D. Since you have the full history of transactions, the amount of money each user is holding is just value_received - value_sent. Calculate the balance of each user.

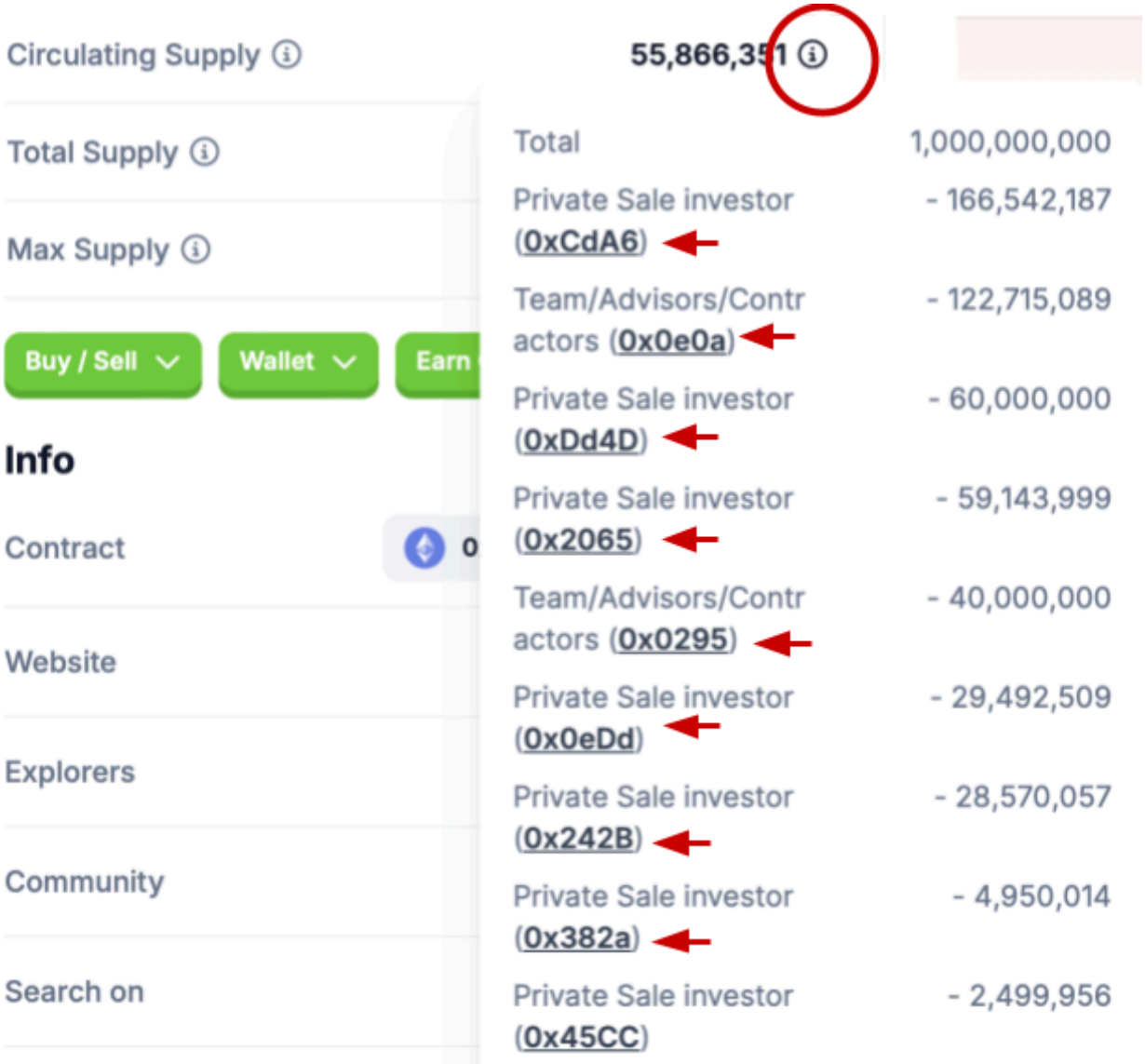
| **user** | **balance** |
|---|---|
| 0xuser1 | 1235 |

| | |
|---|---|
| 0xuser2 | 112 |

## 3 Calculate the circulating supply

By now, you have the total balance of token each user is holding. We now want to find out how much of this cryptocurrency is "circulating", that is, the amount of the cryptocurrency that is freely available to the public.

Go to Coingecko.com to find the Fluence token: https://www.coingecko.com/en/coins/fluence




Click on the links to obtain the addresses. Each of these address corresponds to a wallet that contains "locked token": the currency is not available to the general public.

You can now calculate the circulating supply by taking the list of wallet balances you have calculated in part 2D, and then filtering out these addresses.

What is the circulating supply that you get?

You should get about 53 million, slightly smaller than the number reported on the Coingecko website. (This is because I downloaded this dataset about 1 month ago.)