**1. How much volume would you expect to trade in a day?**

As the dominance on Binance is 2.6% and on Coinbase is 4.1%, and the respective volumes are 100M and 80M it's expected that the trading volume would be within these ranges.

Considering that the strategy is arbitraging between two exhanges it means that the volumes should be very close on both of them.

So we can calculate the volume for each exchange:

Binance: 100M \* 2.6% = 2.6M

Coinbase: 80M \* 4.1% = 3.28M

Usually volume is measure in the base asset in our case - DOUBLEDOGE coin.However in the process of simulation of the trading activity within defined rules it appeared that the mean trading volume measured in the DOUBLEDOGE coins stands at 4851 per day, with minimum of 4060 and maximum of 5670 which does not align with picture described in the task. Converting the daily trading volume into USD show mean value of 24 205. Which is also far from expected.

The answer is that considering the information from the task the expected volume should be from 2.6M to 3.28M a day.

Considering the execution of the strategy following the conditions expected volume is around 4850 DOUBLEDOGE or 24 205 USD.

count 100.0000

mean 4844.1163

**std 331.0953**

**min 4130.5558**

25% 4640.1339

50% 4855.1960

75% 5014.8131

**max 5827.0908**

**2. What should the optimal balances be for DOUBLEDOGE\_coinbase, DOUBLEDOGE\_binance, USD, USDT?**

Following the probabilities described in the task, it's reasonable to hold more USD on Coinbase because we have a chance of buying DOUBLEDOGE for USD here 57% of the time, which corresponds to the necessity of holding the respective amount of DOUBLEDOGE on Binance.

And at the same time we have a 43% chance of buying DOUBLEDOGE for USDT on binance to sell it on coinbase for USD.

Considering the probabilities, trade size, daily traded volume on both exchanges and time between rebalancing the portfolio, the approach is next:

Take a mean value of traded volume during each day which is 4860 DOUBLEDOGE. Take maximum value 5656 which is a 2.56 standard deviations above the mean value and multiply it by the number of days which have to pass between rebalancing of the portfolio would be executed. In this case we would take 30 days.

**It means that the balance should be:**

**DOUBLEDOGE\_coinbase 43% 79 415**

**DOUBLEDOGE\_binance 57% 105 271**

**DOUBLEDOGE\_total 184 686**

Daily volume in USDT is stable and doesn't have any significant deviations due to a constant trade size and its mean value is 24 249 USDT.

**Considering this, the balances for should be:**

**USD 57% 414 833**

**USDT 43% 131 2944**

**Total USDT 727 777**

**3. What is the max balance you would allow for each asset/exchange?**

If there are no changed in the parameters of this strategy, like trade size, frequency, probabilities of the arbitrage opportunities, number of the exchanges, then the balances described above represent the maximum allowed balances of assets at the exchanges, because inefficient use of money means being exposed to unnecessary risk.

**4. At what point would you want to make a transfer between exchanges?**

The transfers between exchanges should be minimized due to it cost. One direct rebalancing operation to restore initial values on all the exchanges for DoubleDoge, USD and USDT costs $114. Which is 50% of expected daily profits.

Exploring this scenario:

If we do rebalancing operation:

- once in 7 days it costs 7.17% of expected profit;

- once in 14 days it costs 3.58% of expected profit;

- once in 30 days it costs 1.67% of expected profit;

The 30 day cumulative volume is 149 011 DoubleDoge with mean price of 4.94 which is $736 771 or 7.36% of AUM.

Rebalancing the portfolio in a 30 day period reduces the expenses on the moving funds between exchanges but increases the exposure of the risk by forcing to hold the volatile asset for at least 30 days.

Remembering that the strategy executes trade every hour, we can take advantage of selling excessive DOUBLEDOGE to usd or USDT and transfer it to the desired exchange with smaller fees.

In this way the transfer fees to rebalance portfolio would be to $7 (from Binance to Coinbase and from Coinbase to Binance) + 3.9bp fee to sell and buy DOUBLEDOGE and fees to trade USD/USDT.

Considering that we want to return back DOUBLEDOGE and usd every day, the cost of such transfer with commissions would be around 484 which is 2 times more then expected daily profit.

daily\_volume\_doubledoge = 4882 / 2

daily\_volume\_usd = 24249 / 2

transfer\_cost = 7

exchange\_percent = 3.9 / 100

fees\_for\_exchange = daily\_volume\_doubledoge \* exchange percent \* 5.0194

fees\_for\_exchange + transfer\_cost = 484.8418606

**So the option of using the fixed size of transaction cost without causing additional fees is more optimal.**

**It means that any point starting from day 7 could be accepted to transfer funds between exchanges.**

**5. How many trades do you expect in a day?**

The expected amount of daily trades is based on the condition that the coin fluctuates 5% in either direction every hour.

So it means that we expect to execute one arbitrage trade every hour, having **a total of** **24 trades in a day.**

**6. Do you want to take out the loan?**

To understand if the loan is an acceptable option we have to consider a few facts like:

- expected income

- cost of the loan

- risk of the strategy

One more fact to consider is that the loan is available only on binance and it means that on the Coinbase it would be necessary to usd additional capital to equal the sizes of positions on both exchanges. This may lead to two consequences:

- keeping on the exchange and using more capital

- more frequent execution of rebalancing which would cause additional expenses.

The average daily traded volume is 4800 of DOUBLEDOGE. Half of this volume is traded on binance. It means that we can borrow the half of this volume to operate with x2 leverage, for 3% daily, which would cost us around 73.2 DOUBLEDOGE per day.

At the average price of 4.94 the price of the loan in dollars is around 361 USD.

At the same time daily profit would be decreased 92 dollars, which does not consider expenses connected to rebalancing which would happen faster with the strategy without margin.

**Conclusion is that I would not take loan for this strategy because it's too expensive and it doesn't increases strategie’s expected value.**

**7. What is our expected total profit for the day?**

Expected profit per day **is $227**.

With 23 trades of $7.6 and 1 of $52 during "special hour"

Considering the traded volume of 24249 USDT it’s around **0,93%** a day.

**8. What would be some risk measures you could introduce?**

Risk measures to be introduced are:

* keep on the exchange only the necessary amount of funds to trade the strategy considering the frequency of rebalancing to mitigate risk of loosing money due to exchange’s issues;
* maintain the ratio between "money" and DoubleDoge, avoiding excessive exposure for an altcoin;
* keep watching the liquidity to ensure that it's possible to execute the trades with desired amount without causing too much slippage.
* in case of using loans - be sure that there is a proper level of maintain margin to avoid high risk situations and possibilities of going into liquidation of a position.

**9. What are some key metrics you would monitor?**

In case of this strategy monitor such metrics as:

* frequency of trades which are clear and is not supposed to change unless other condition have changed;
* average returns to understand if the strategy performs within expected values. This strategy has a fixed profit values so any changes would be easy to see;
* balances of funds (USD, USDT, DOUBLEDOGE) at each exchange to ensure that its sufficient to execute strategy and no unexpected changes have happened;
* frequency of rebalancing, correctness of the amounts of funds transferred, cost of these transactions and proper timing;
* if margin is applied in the strategy - watch for level of maintenance margin and if loans are repaid in time;
* deposit, withdrawals and balances of DOUBLEDOGE token on the exchanges to adjust the strategy for sharp movements;
* social media sentiment, news about the project specifically, and about the market in general to assess the narrative and general direction of the market and adjust the strategy parameters.

**10. Would you put stop loss/take profit for DOUBLEDOGE? If yes, at what prices would you put them?**

* I'd put a limit order to execute profit orders at +1.6% price, to try to minimize the fees for orders execution.
* One more option to reduce the fees is to try to put limit buy order into the spread.
* I think it makes sense to have a time based stop loss rather than solely price based. Arbitrage supposed to work quickly and having some statistics behind the idea, it's possible to do an estimation of how fast this type of trade works out and if this time passes how the probability of profit is changing.

**11. How could you otherwise improve the system?**

* Consider increasing trade size to the size appropriate for the trading volume of an asset.
* Use dynamic position sizing based on the liquidity in the market at the moment of execution.
* Incorporating time based stop loss for the strategy
* Incorporate limit orders execution to minimize fees
* Find out if the strategy could be scaled to other assets at these exchanges.