DTB-Assignment 1

Supply-Chain Management

Your team has been given the task of creating a transparent supply chain which can be used by 5 clients and their customers.

The clients are either ***Suppliers, Manufacturers or Customers***.

1. Actors

Manufacturers: There are 2 clients (Tata and Maruti) who manufacture cars, and sell them to the customers. For simplicity, we assume a car requires two components: Wheels and Car-body.

Suppliers: There are 3 suppliers (Vedanta, MRF and CEAT). Each of them supplies a single material.

- Vedanta has a market monopoly and supplies car-body to both Tata and Maruti.
- MRF supplies wheels to Tata and CEAT supplies to Maruti.
- Each supplier has a limited supply of the material which they produce (which can be set by calling a function) and this limit is publicly known

Customers: Customers buy the product from the Manufacturers at the retail-price.

2. Market Interaction

The market interaction goes as follows:

1. Suppliers set supply limit on their products
2. Manufacturers place their bids[&] (**bids should be secret till all manufacturers have placed their bid**)
3. Smart contract performs resource optimal distribution[$] of materials to manufacturers
4. Manufacturer takes materials to create product and sets price for the product
5. Customer buys the product from the manufacturer.

3. Goals

Goal 1: & = Bidding should be secret. We assume that all manufacturers will place their bid in time. The bidding should be such that the following conditions is met:

- *No manufacturer should be able to find out another manufacturer's bid unless everyone has placed their bids.*

This condition is enforced to ensure bids from each of the manufacturers which reveal their true evaluation of the material.

Note that a bid contains price and quantity. Therefore, even though revealing the bidding price for wheels will not give any advantage to either manufacturer because the suppliers are different; revealing the quantity of wheels ordered might allow the competition to infer the amount of car-bodies ordered. Therefore, we want to keep all bids secret.

Goal 2: $ = Optimal supply means that the number of products put to use (not lying on shelf) should be maximized.

For example: Consider 10 units of material A and B are required by E and 20 units of A and C are required by F.
The supply limits on A, B, C are 27, 15 and 15.
Bid by F on product A is higher than bid by E.

Profit maximizing distribution: Send 20 Units of A to F and 7 Units of A to E. Send 10 units of B to E and 15 Units of C to E.

Resource Optimal distribution: Send 10 Units of A to E and 17 units of A to F. Send 10 units of B to E and 15 Units of C to E.

Definition *[Resource Optimal Distribution]*
A supply-chain follows optimal distribution of materials if the quantity of material which is kept on the shelf is minimized, i.e. the amount of resource utilized is maximized.

Our goal is to optimize the supply chain, therefore we will implement an *resource optimal distribution* method.

Note that this is one of the many advantages of having a blockchain based trustless and decentralized supply-chain that such globally optimal methods can be implemented instead of selfish strategies opted by each party leading to resource wastage and slowing down of supply-chain.

Goal 3: *Validity of the product:* This property requires:

- Each product is not duplicated (same UID is not sent to different users)
- Each product is authentic (suppliers create and distribute as much product as specified by their supply limit, manufacturers create and distribute products as much supply of materials they have).
- These two things should be verifiable by the buyer (he can make sure that the materials are from said supplier and product is from said manufacturer).

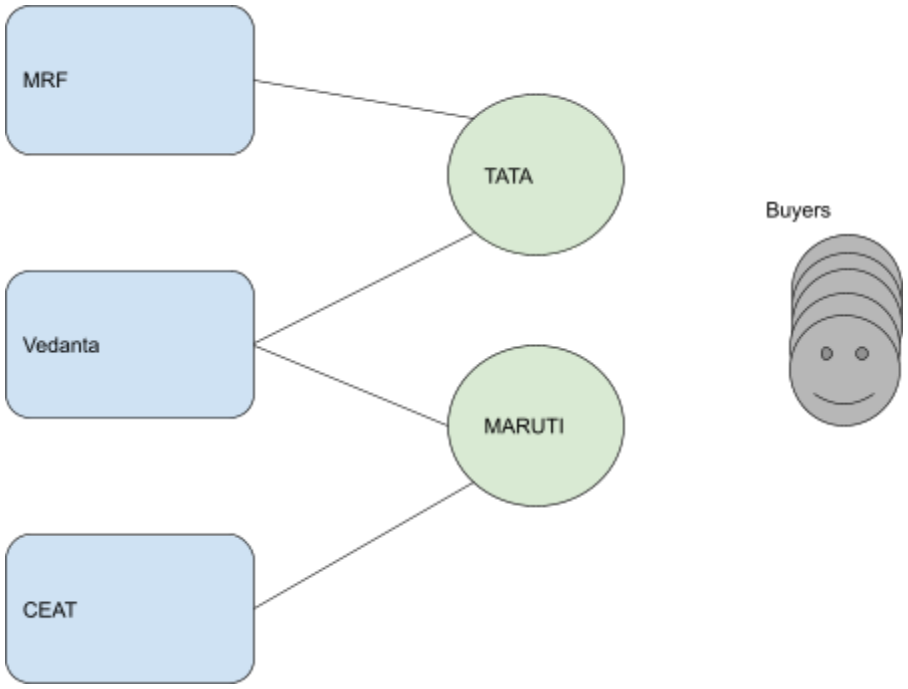

Fig. A description of the supply chain

4. Evaluation metrics:

Validity of product and ownership	15%
Supply chain (correct flow in the market)	20%
Fairness in bidding by manufacturers	15%
Optimal supply of materials to manufacturers (by smart contract)	15%
Test cases	10%
Coding style & comments	5%
Documentation & Explanation	10%
Viva/Evals	10%
[BONUS] Add your own features (like escrow payments etc.)	5%

5. Test Cases and Documentation

Construction of test-cases:

At least one test-case for each of the following should be there:

1. Demonstrating the flow of the supply chain (this means everything, from creating raw-materials, placing bid etc. to selling the product should be there)
2. Checking validity of the product and its material by the buyer as well as showing that bids are secret to everyone till all bids are made for the material.
3. Demonstration of optimal supply (a case where optimal supply is explicitly observable, such as the one demonstrated in example above)

In documentation minimum expectations are to include explanation of flow, logic for each of the Goals (1,2,3), what the test cases achieve and any additional features that you might have added.

6. Submission Format

Submission format: TeamName.zip (no spaces, convert space to '-'). Wrong format of submission will lead to penalty.