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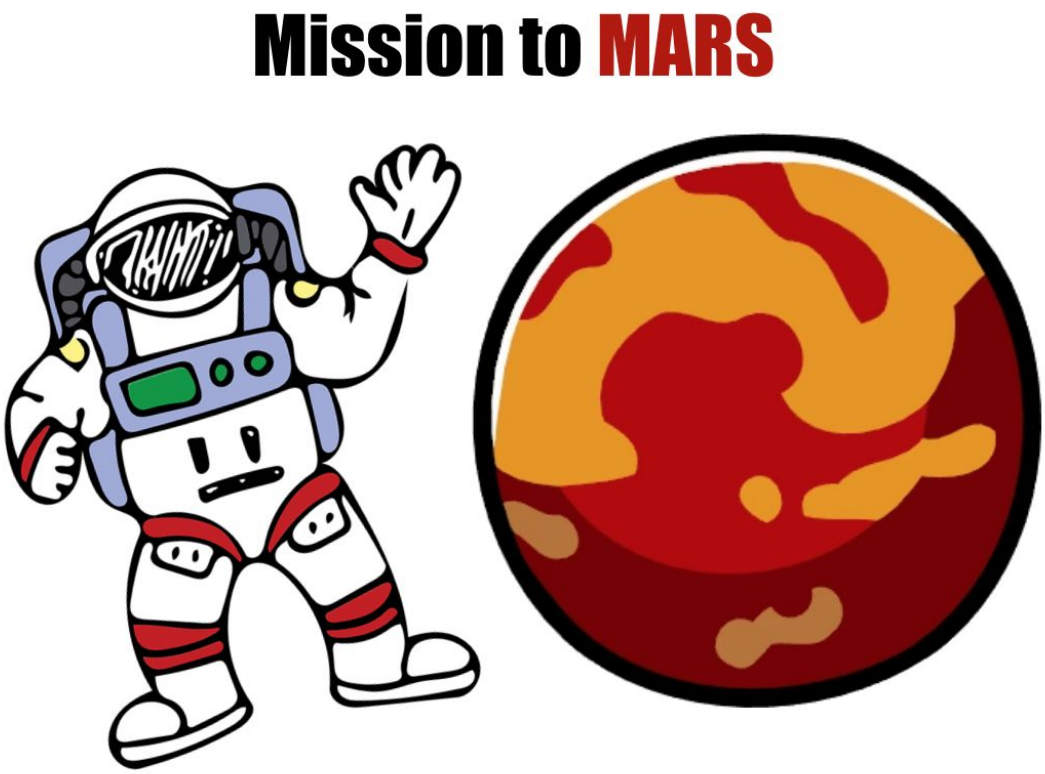

Space Challenge

In this project, you will build a simulation that will help us with our mission to Mars!

The mission is to send a list of items (Habitats, bunkers, food supplies, and rovers) to Mars, but we need to run some simulations first to pick the correct fleet of rockets.

We've already designed 2 rocket prototypes, but we need your help to design and run some simulations to help us decide which type to use.

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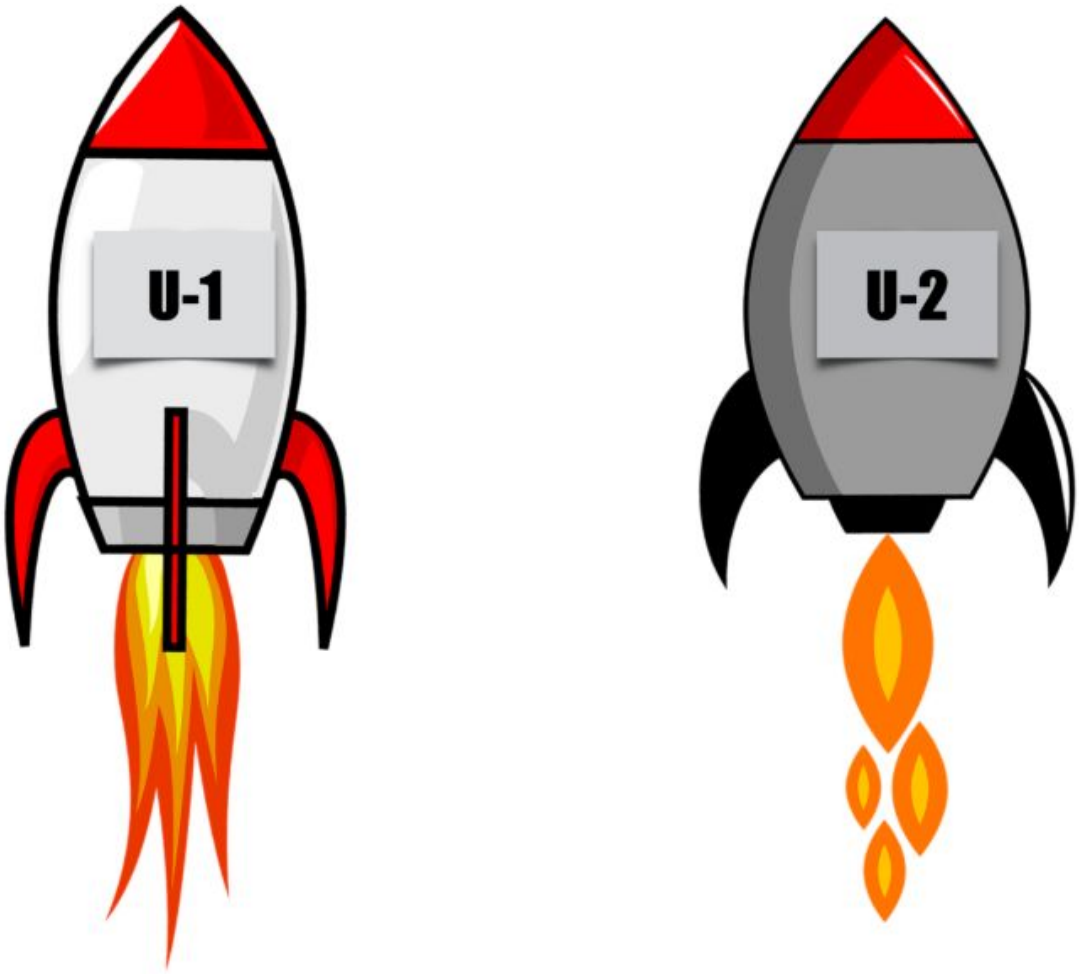

U-1

The U-1 Rocket is light weight, agile and pretty safe, but can only carry a total of 18 tonnes of cargo. It costs $100 Million to build and weighs 10 tonnes. It has a slim chance of crashing while landing but a bigger chance of exploding when launching, both chances depend on the amount of cargo carried in the rocket.

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U-2

The U2 Rocket heavier than the U-1 but much safer and can carry a lot more cargo; to a total of 29 tonnes. However, it costs $120 Million to build and weighs 18 tonnes. It has a greater chance of crashing while landing than while launching, but just like the U-1 both chances depend on the amount of cargo carried.

The Mission

The mission consists of 2 phases:

Phase-1:

This phase is meant to send building equipment and construction material to help build the colony. In the resources tab, you will find a text file that contains the list of all items that we need to send called 'Phase-1.txt`. Each line in the file contains the item name as well as its weight in Kgs.

The file is here.

Phase-2:

This phase is meant to send the colony of humans along with some food resources. In the resources tab, you will find a text file that contains the list of all items that we need to send called 'Phase-2.txt`. Each line in the file also contains the item name and its weight in Kgs.

The file is here.

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Your job is to run some simulations and test both rocket types for each phase separately.

Ready? let's have a look at the details ...

Specs

U-1

```
Rocket cost = $100 Million
Rocket weight = 10 Tonnes
Max weight (with cargo) = 18 Tonnes
Chance of launch explosion = 5% * (cargo carried / cargo limit)

Chance of landing crash = 1% * (cargo carried / cargo limit)
```

U-2

```
Rocket cost = $120 Million
Rocket weight = 18 Tonnes
Max weight (with cargo) = 29 Tonnes
Chance of launch explosion = 4% * (cargo carried / cargo limit)

Chance of landing crash = 8% * (cargo carried / cargo limit)
```

Here's what you need to do:

PART 1: The design

1. Create an `Item` class that includes a `String` name and an `int` weight that will represent an item to be carried by the rockets
2. Create a `SpaceShip` Interface that includes the **definitions** of these methods:
    - `launch`: a method that returns either `true` or `false` indicating if the launch was successful or if the rocket has crashed.

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- `land`: a method that also returns either `true` or `false` based on the success of the landing.
- `canCarry`: a method that takes an `Item` as an argument and returns `true` if the rocket can carry such item or `false` if it will exceed the weight limit.
- `carry`: a method that also takes an `Item` object and updates the current weight of the rocket.

3. Create a class `Rocket` that implements the `SpaceShip` Interface and hence implements all the methods above.
    - `launch` and `land` methods in the `Rocket` class should always return `true`. When U1 and U2 classes extend the Rocket class they will override these methods to return true or false based on the actual probability of each type.
    - `carry` and `canCarry` should be implemented here and will not need to be overridden in the U1 and U2 classes
4. Create classes `U1` and `U2` that extend the `Rocket` class and override the `land` and `launch` methods to calculate the corresponding chance of exploding and return either `true` or `false` based on a random number using the probability equation for each.

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PART 2: The simulation

Create a `Simulation` class that is responsible for reading item data and filling up the rockets. The Simulation class should include these methods:

- `loadItems`: this method loads all items from a text file and returns an ArrayList of Items:

  Each line in the text file consists of the item name followed by `=` then its weigh in kg. For example:
  `habitat=100000`

  `colony=50000`

  `food=50000`

- `loadItems` should read the text file line by line and create an Item object for each and then add it to an ArrayList of Items. The method should then return that ArrayList.
- `loadU1`: this method takes the ArrayList of Items returned from `loadItems` and starts creating U1 rockets. It first tries to fill up 1 rocket with as many items as possible before creating a new rocket object and filling that one until all items are loaded. The method then returns the ArrayList of those U1 rockets that are fully loaded.

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- `loadU2`: this method also takes the ArrayList of Items and starts creating U2 rockets and filling them with those items the same way as with U1 until all items are loaded. The method then returns the ArrayList of those U2 rockets that are fully loaded.
- `runSimulation`: this method takes an ArrayList of Rockets and calls `launch` and `land` methods for each of the rockets in the ArrayList. Every time a rocket explodes or crashes (i.e if `launch` or `land` return false) it will have to send that rocket again. All while keeping track of the total budget required to send each rocket safely to Mars. `runSimulation` then returns the total budget required to send all rockets (including the crashed ones).

PART 3: Running the Simulation

Create a `Main` class with the main method and start running the simulation:

1. Create a `Simulation` object
2. Load Items for Phase-1 and Phase-2
3. Load a fleet of U1 rockets for Phase-1 and then for Phase-2
4. Run the simulation using the fleet of U1 rockets and display the total budget required.
5. Repeat the same for U2 rockets and display the total budget for that.