F R E E L A N C E R

A programming challenge based on the space trading and combat simulation game Freelancer from 2003.

Made by CODE.STAR — Powered by ORDINA Ahead of change

Introduction

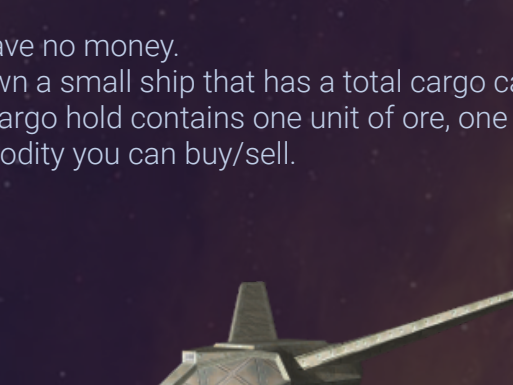
The destruction of Freeport 7 left you with almost nothing. The only thing you managed to save was your ship (with a bit of ore, water and engine parts stored in the cargo hold) and a star map.

You decide to head to you home planet in the Codestar system and rebuild, trading at each planet you find along the way, so you have plenty of money when you arrive.

Your star map contains a list of all the planets you pass on your way to your new home. For each planet, it contains the prices for each commodity you might want to buy or sell. Planning what commodities you will buy/sell at which planet will be your challenge for today.

Your situation

1. You have no money.
2. You own a small ship that has a total cargo capacity of 10 units of cargo.
3. Your cargo hold contains one unit of ore, one unit of water and one unit of engine parts: one of each commodity you can buy/sell.

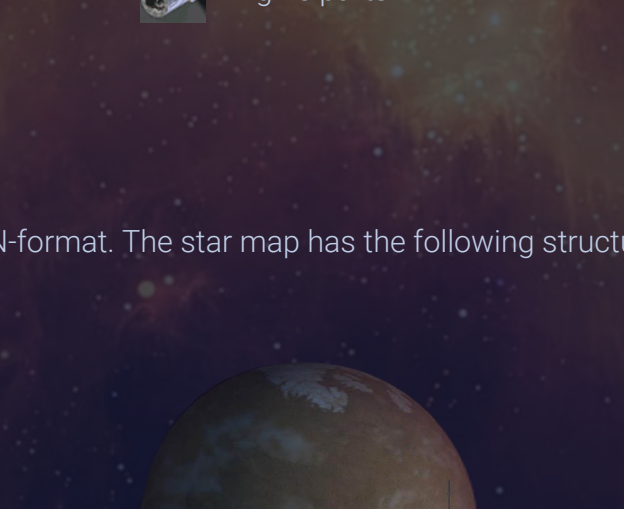


Maximum cargo capacity: 10

Commodity	In cargo hold
Ore	1
Water	1
Engine parts	1

Your star map

Your star map contains a list of planets in JSON-format. The star map has the following structure:



```
[
  {
    "name": "CRETE",
    "orePrice": 7,
    "waterPrice": 7,
    "enginePartsPrice": 7,
  },
  {
    "name": "BADEN_BADEN",
    "orePrice": 13,
    "waterPrice": 14,
    "enginePartsPrice": 17,
  },
  ...
]
```

As promised, it contains the price of each commodity that you can buy/sell at that planet.

You can find your star map at https://u3jbutkvth.execute-api.eu-west-1.amazonaws.com/prod/planets.

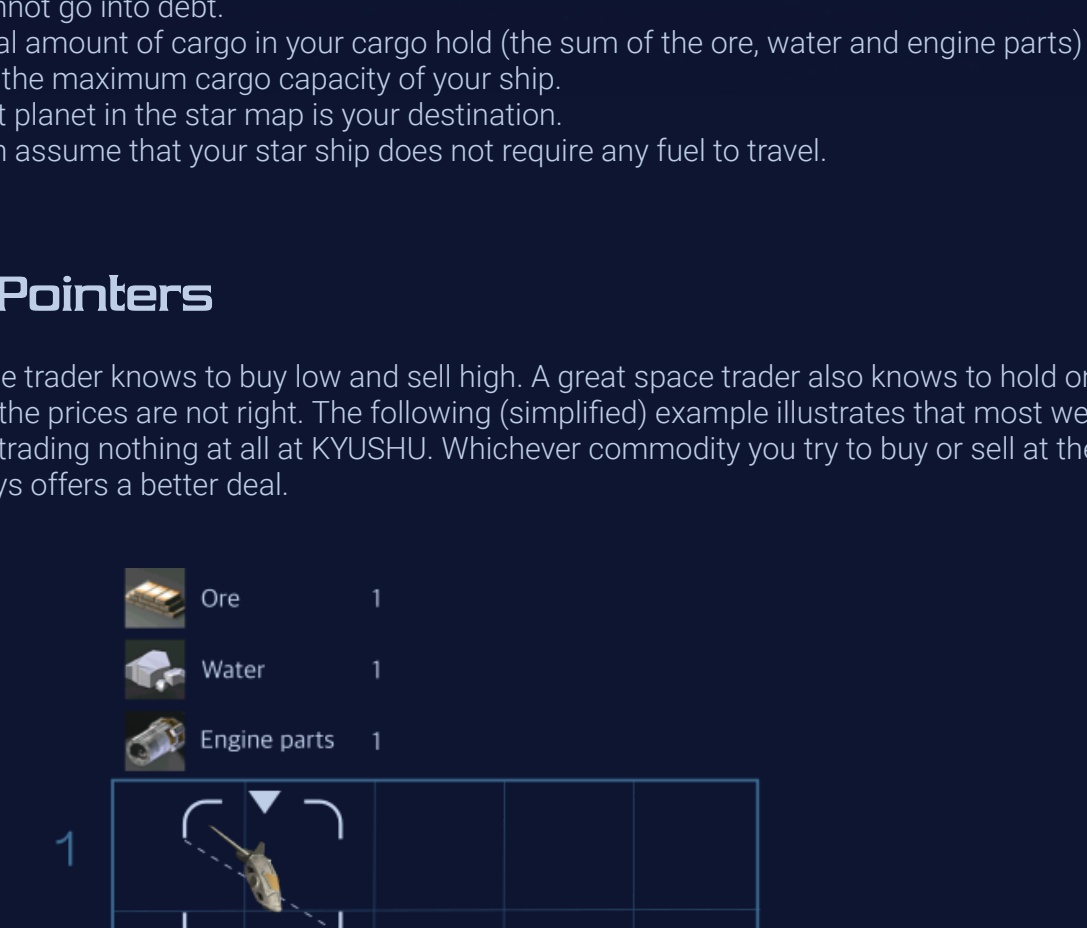
Note: each planet contains a few properties (`deltaContraband`, `faction` and `contracts`) that will be used in additional challenges. You can ignore these for the moment.

The rules

- You have to visit the planets in the order given in the JSON.
- You cannot go back to revisit a planet.
- You cannot go into debt.
- The total amount of cargo in your cargo hold (the sum of the ore, water and engine parts) cannot exceed the maximum cargo capacity of your ship.
- The last planet in the star map is your destination.
- You can assume that your star ship does not require any fuel to travel.

Some Pointers

A good space trader knows to buy low and sell high. A great space trader also knows to hold on to his/her cargo when the prices are not right. The following (simplified) example illustrates that most wealth can be obtained by trading nothing at all at KYUSHU. Whichever commodity you try to buy or sell at the first planet, LEEDS always offers a better deal.



It's your job to design an algorithm that determines the sequence of trades that results in the most money!

There are many ways to tackle this problem:

- You could use a *brute-force search*, although you might need require something like a Spark cluster if you try that for the additional challenges.
- You could create a smart trading algorithm, finding the best possible prices in the next couple of planets.
- You could also implement a *backtracking algorithm* (basically a more sophisticated brute-force search) like you would do to solve the N-queens problem.
- You could approach this problem with a *Monte Carlo simulation* (doing many different, random trades over the course of many simulations to find the one that performs best).
- You could even implement a *genetic algorithm*!

Be creative, but most of all: have fun!

Checking your solution

You can use our API to check your solution.

```
POST https://u3jbutkvth.execute-api.eu-west-1.amazonaws.com/prod/solution HTTP/1.1
Content-Type: application/json

{
  "name": "Edison Trent",
  "email": "edison.trent@freelancer.com",
  "transactions": [
    {
      "planet": "CRETE",
      "deltaOre": -1,
      "deltaWater": -1,
      "deltaEngineParts": 2,
    },
    {
      "planet": "BADEN_BADEN",
      "deltaOre": 0,
      "deltaWater": 0,
      "deltaEngineParts": -3
    },
    ...
  ]
}
```

You'll have to provide a transaction at every planet you visit (whether you actually make a trade there or not). The `deltaOre`, `deltaWater` and `deltaEngineParts` properties describe changes to your cargo hold at that planet. Negative means you are selling cargo, while positive means that you are buying a commodity. If everything checks out (you are not selling more of a commodity than you have in your cargo hold, and you are not buying more of a commodity than you can pay for) you'll receive a response along the lines of

```
HTTP/1.1 200 OK
Content-Type: text/plain
Content-Length: 53

Your final account balance (17877) has been recorded!
```

You may have noticed that we would also like to know your name and e-mail address.

We'll use your name for the hall of fame. You can check out how your score compares to others at http://freelancerleaderboard.s3-website-eu-west-1.amazonaws.com/).

The e-mail address is required to uniquely identify you as a player. It is also required to compete for cool prizes (otherwise we won't know how to contact you). The Freelancers with the highest three scores will receive a Lego Star Wars set. Don't worry about providing your e-mail address though, we won't use it for recruitment purposes! You have until Thursday, November 12 to submit your best score and claim the gold!

A final request from us to you: the solution checker was not built for high loads, so please don't use it as part of your brute force search. We would appreciate it if you could only send solutions of which you are confident that they are valid.

Additional challenges

For a bigger chance at winning!

Buying a bigger ship

At some point, you will likely grow out of your little ship. At each planet you can buy one of the following larger ships:

Type	Name	Price	Cargo capacity
Light freighter	RHINO	500	15
Medium freighter	DRONE	1000	20
Heavy freighter	HUMPBACK	2000	30

These ships are available on all planets you visit. When you buy a new ship, you leave behind your old ship. You get nothing in return.

You can buy a ship with the (optional) `shipPurchase` property:

```
{
  "planet": "ATKA",
  "deltaOre": 0,
  "deltaWater": -10,
  "deltaEngineParts": 15,
  "shipPurchase": "RHINO"
}
```

Smuggling contraband

Each system belongs to one of two factions:

LIBERTY_POLICE   XENOS

`LIBERTY_POLICE` planets are heavily patrolled, while `XENOS` planets are only loosely governed. Certain goods that can be bought and sold at `XENOS` planets are considered contraband in `LIBERTY_POLICE` territory, and they have to be sold before visiting these planets (you will be arrested when you arrive with contraband on `LIBERTY_POLICE` planets). Naturally, contraband cannot be bought on `LIBERTY_POLICE` planets.

Two other properties, `contrabandPrice` and `faction`, that you might have seen on your star map describe the alignment of each planet. Here's what the star map looks like with those properties:

```
[
  {
    "name": "CRETE",
    "orePrice": 7,
    "waterPrice": 7,
    "enginePartsPrice": 7,
    "contrabandPrice": 0,
    "faction": "LIBERTY_POLICE"
  },
  {
    "name": "BADEN_BADEN",
    "orePrice": 13,
    "waterPrice": 14,
    "enginePartsPrice": 17,
    "contrabandPrice": 32,
    "faction": "XENOS"
  },
  ...
]
```

Similar to ore, water and engine parts, you can buy/sell contraband with the (optional) `deltaContraband` property:

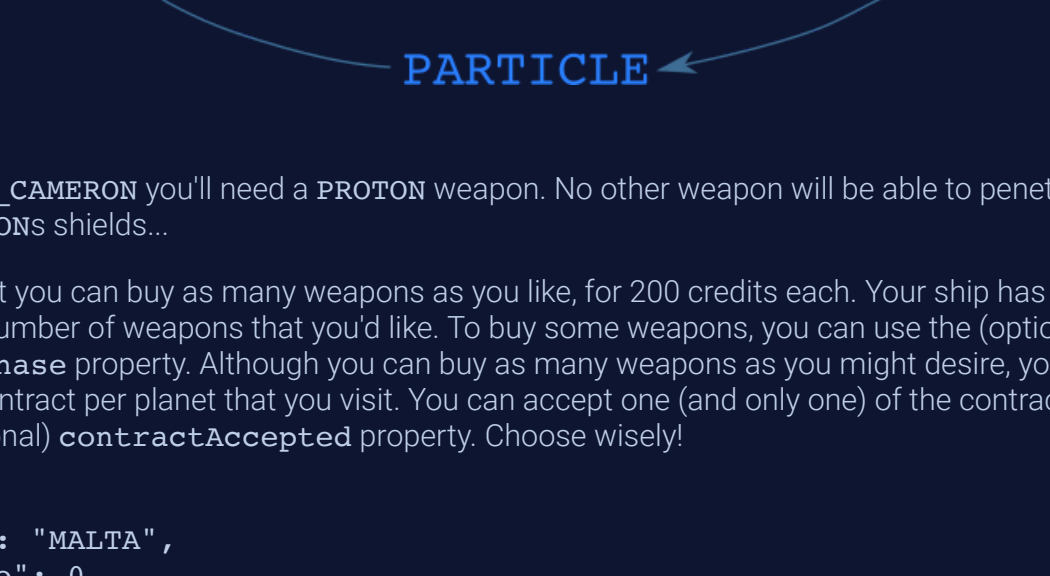
```
{
  "planet": "TEGAKIS",
  "deltaOre": 0,
  "deltaWater": -15,
  "deltaEngineParts": 0,
  "deltaContraband": 15
}
```

Space combat

Trading is not the only way you can make money. The universe is a big and dangerous place, and you will encounter many smugglers, terrorists, pirates and lane hackers on your journey home. Some of these criminals will have a bounty on their heads on planets that you might visit. If you are particularly brave, you can choose to engage these criminals and claim that bounty. You can consult your star map to check which criminals are residents of which planet. Every planet in your star map has a property `contracts` that contains bounty contracts, much like the following bounty for `CARL_CAMERON`:

```
{
  "criminalName": "CARL_CAMERON",
  "weaponType": "TACHYON",
  "bounty": 43
}
```

To be able to beat `CARL_CAMERON` in space combat and claim a whopping 43 credits, you'll need your own weapons installed on your ship. Not just any type of weapon will do, though. Each weapon has its own strengths and weaknesses, which are shown in the figure below.



To beat `CARL_CAMERON` you'll need a `PROTON` weapon. No other weapon will be able to penetrate `CARL_CAMERON`s shields...

At every planet you can buy as many weapons as you like, for 200 credits each. Your ship has room enough to outfit any number of weapons that you'd like. To buy some weapons, you can use the (optional) `weaponPurchase` property. Although you can buy as many weapons as you might desire, you can only accept one contract per planet that you visit. You can accept one (and only one) of the contracts on offer with the (optional) `contractAccepted` property. Choose wisely!

```
{
  "planet": "MALTA",
  "deltaOre": 0,
  "deltaWater": -15,
  "deltaEngineParts": 0,
  "weaponPurchase": ["PROTON", "LASER"],
  "contractAccepted": "TAHLIA_WEBSTER"
}
```

Note that engagements take place **after** you (optionally) buy new weapons. That way, you can immediately take your new gadgets for a spin. Pew, pew!

Wormholes and other intergalactic modes of transportation

Near every planet you'll typically find some jump holes to nearby planets, which allow you to change your route a bit for more efficient trading. They have a limitation though: you can only jump at most 3 planets ahead (or back, if you fancy). If your star map contains the following planets, it is possible to jump forward from `MANHATTAN` to `MAINE` or back from `MACTAN` to `MALTA` but not further! Smaller jumps are perfectly fine as well.

- `MANHATTAN`
- `MALTA`
- `MALLORCA`
- `MAINE`
- `MACTAN`

You can't visit the same planet twice, and you have to start at the first planet and end at the last planet in the start map, so take some time to carefully plan your journey.

Taking a jump hole is really easy. Just use the (optional) `jumpTo` property:

```
{
  "planet": "MALTA",
  "deltaOre": 0,
  "deltaWater": -15,
  "deltaEngineParts": 0,
  "jumpTo": "MAINE"
}
```

If you don't specify a jump hole, you will continue your journey as planned (according to the order given by your star map). Make sure you did not visit that planet already, or your solution will be rejected.

Attribution

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- Image of planet KYUSHU from http://fl-guide.de/base.php?id=76
- Image of planet LEEDS from https://freelancer.fandom.com/wiki/Leeds_system
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