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User Manual - Integrative Project

LAPR2 - Integrative Project

ISEP

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1. Introduction

1.1. Purpose and Scope of the Document

This user guide has been prepared in order to help users to understand and work with the Railway Network Simulation Application. It's purpose is to walk users step by step on how to operate the system including the managing infrastructure elements like maps, stations, railway lines, trains, scenarios and simulating freight transport and industrial engagements.

1.2. Type of Product Described

The Railway Network Simulation Application is a railway system operation and logistics based simulation tool developed in Java. It is focused more on the transport dynamics between cities, stations, and industries over time, rather than just one point in time.

With the jaw application, users can simulate hauling and cargo generation, their transformation, export, and movement along railway routes based on resources, time periods, infrastructure, and other constrains available.

1.3. Intended Audience

This user manual is meant for:

- Ordinary users of the application who create maps, stations, and simulations.
- Students and instructors who teach or learn with the application in an academic or training context.
- Developers and testers who need to validate functional workflows during application development have a reference.

There are no prerequisites, apart from having some prior knowledge of simulation and railway system basics.

2. System Overview

2.1. Purpose and Use of the Product

The railway simulation application is a console-based system designed to replicate the essential mechanics of railway network planning and management. It allows users to construct and simulate rail infrastructure by adding cities, stations, and industries, purchasing locomotives and carriages, and assigning them to specific routes. The system aims to teach and demonstrate key principles of resource management, transport logistics, and infrastructure evolution over time.

This product serves both educational and exploratory purposes, offering users an interactive way to engage with historical and strategic elements of railway development.

2.2. Structure of the Product

The system is modularly organized into several interconnected components. Each component encapsulates a specific responsibility within the simulation, ensuring a clear separation of concerns and enabling easy extensibility. The application is built as a layered structure:

- Domain Layer: Contains core entities such as Map, City, Station, Train, Carriage, Locomotive, and Route.
- Repository Layer: Stores and manages domain data in memory, such as city and train repositories.
- Controller Layer: Handles application logic, coordinating between UI and domain layers.
- UI (User Interface) Layer: Provides command-line interaction, offering options and menus for the user to operate the system.

All modules communicate via clean interfaces, maintaining modularity and testability.

2.3. Reference to the Main Features

The application offers the following key features:

- Creation and customization of railway maps
- Addition of cities, industries, and stations
- Purchasing of historically available locomotives and carriages
- Construction of trains using acquired components
- Creation of railway lines and planning of routes
- Real-time financial and calendar tracking
- Simulated interactions between trains and buildings (e.g., cargo transport)

2.4. Highlight of the Main Modules

The railway simulation and management system is organised into several main modules that work together to offer a complete and interactive experience. The station management module allows you to create and edit stations with different functionalities, such as terminals, control centres or depots. The railway lines module deals with creating and updating lines between stations, including options such as single, double and electrified lines.

The train module allows you to build trains with locomotives and carriages, defining properties such as fuel type, capacity and speed. The cargo and resources module simulates the production, transformation and transport of resources, with links to industries, warehouses and consumers. The simulation itself is controlled by a time and events module, which manages the progress of the simulation, pauses and programmed actions.

Interaction with the user takes place via a terminal-based module, with menus and messages to guide use. Finally, the system includes a logging and reporting module, which displays relevant information about the operation of the simulation and the behaviour of the elements on the map. These modules, although distinct, are tightly integrated to ensure smooth and coherent operation.

2.5. Product Structure Diagram

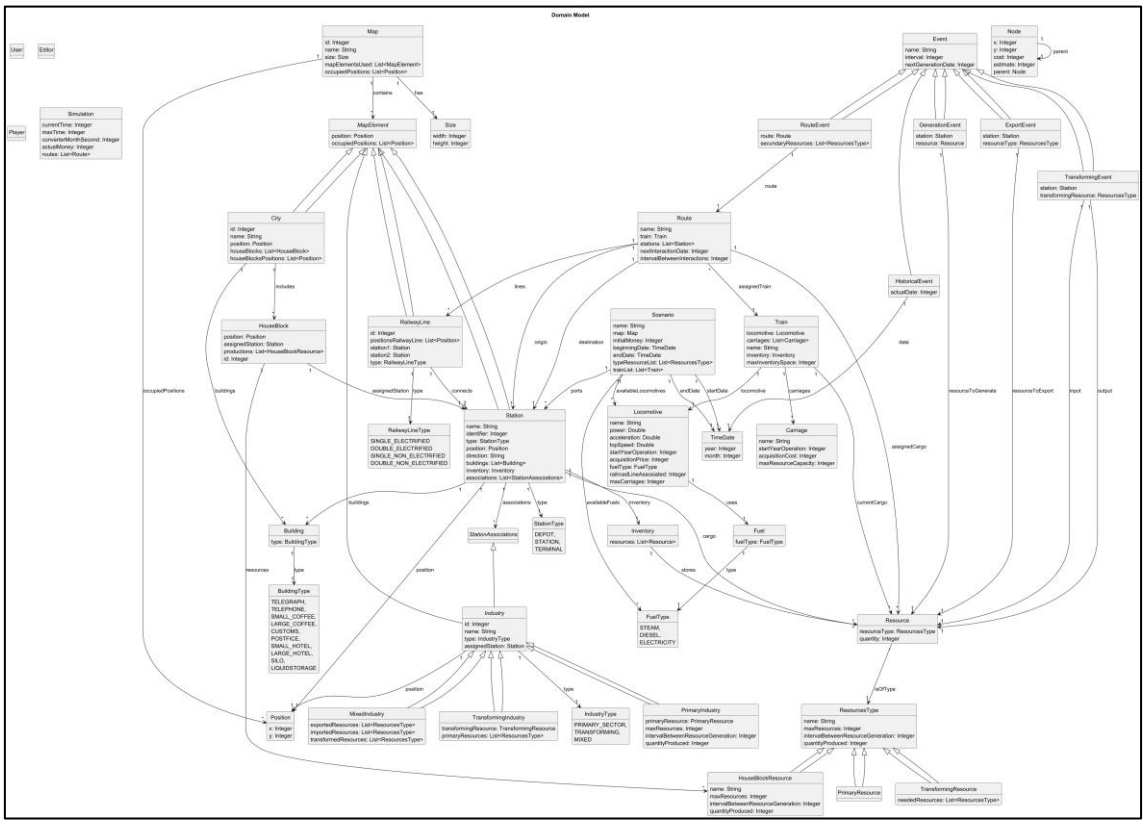


Figura 1 - Domain Model

The domain diagram represents the main structure of the railway simulation and management system, organised around the central Map object, which defines the spatial arrangement of the elements in the scenario. The State class manages the global state of the simulation, including cities, trains, stations, lines and industries. Each city (City) contains Households that consume resources, while stations (Station) can be depots, terminals or control points, connected by railway lines (RailwayLine) with different characteristics (single, double, electrified).

Trains are made up of locomotives and carriages, each with specific properties such as fuel, capacity and speed. Resources (ResourceType) circulate through the network and are produced or transformed by industries (Industry), which follow rules defined in Transformability and Transformation. The system also includes an event engine (Event, HistoricalEvent), feedback messages (Message) and resource flow records (ResourceFlow).

The whole system is supported by a modular structure, with positions and map elements, allowing for the construction, expansion and simulation of a dynamic and interactive railway scenario.

3. System Requirements

In this part, the system requirements and the steps necessary to set up IntelliJ IDEA are provided. IntelliJ IDEA is a Java-based IDE, but it offers secondary support for many other languages, frameworks, and technologies. Ultimate and Community editions are available, each boasting extensive system compatibility.

3.1. Compatible Operating Systems and Environments

IntelliJ IDEA is compatible with the following environments:

- Windows: Windows 10 or later (64-bit systems only; includes service packs)
- macOS: macOS 11.0 (Big Sur) or later
- Linux: Distributions with glibc 2.17 or later and GTK+ 2.0 or higher (e.g., Ubuntu 20.04+)

Note: A GUI environment is required to use the full IDE features. A terminal/CLI is only used to launch or manage the application.

3.2. Software Dependencies and Plugins

- Java Development Kit (JDK):
  - JDK 17 or later is required for development (JDK 21 recommended for full feature compatibility)
- Required Plugins:
  - Core Java plugin is pre-installed
  - Additional plugins (e.g., Maven, Gradle, Kotlin, Spring) may be required depending on the project
- Bundled Runtime: IntelliJ IDEA includes JetBrains Runtime (based on OpenJDK), no separate Java installation is required to run the IDE itself.

3.3. Hardware Requirements

Component	Minimum Requirement
Processor	Dual-core CPU
RAM	4 GB (8 GB or more recommended)
Disk space	3 GB (for application files) + additional space for projects, caches, and plugins (10 GB recommended)
Display	1024×768 minimum resolution (1920×1080 recommended)
Internet	Required for plugin installation and updates

3.4. Installation Procedure

Windows:

1. Download the .exe installer from the *official JetBrains website*.
2. Run the installer and follow the setup wizard.
3. Choose whether to add IntelliJ IDEA to the PATH and associate .java files.
4. Launch IntelliJ and install any necessary plugins during the initial setup.

macOS:

1. Download the .dmg image.
2. Open the disk image and drag IntelliJ IDEA to the Applications folder.
3. Launch the application and follow the setup wizard.

Linux:

1. Download the.tar.gz package from the website.
2. Extract the archive and run the idea.sh script inside the bin folder.
3. Optionally create a desktop entry for easier access.

3.5. Additional Technical Notes

IntelliJ IDEA does not require internet access to run basic projects, but internet is recommended for plugin installation, updates, and license verification (for Ultimate Edition).

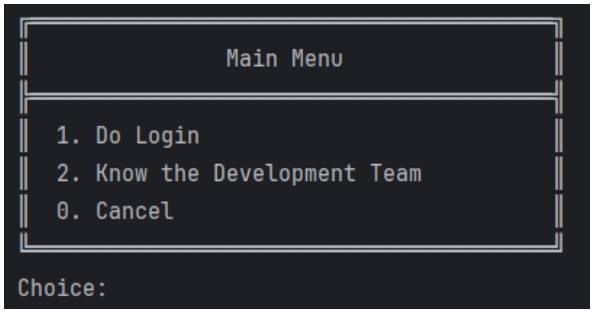
IntelliJ IDEA supports in-memory compilation and advanced features such as code completion, refactoring, and VCS integration.

IntelliJ was tested with:

- IntelliJ IDEA 2023.3.2
- JetBrains Runtime based on OpenJDK 17

4. Features

4.1. Main Menu



In the main menu we have 2 choices, one would be to log in and the other would be to meet the project's development team.

Figura 2 - Main Menu

4.1.1. Login

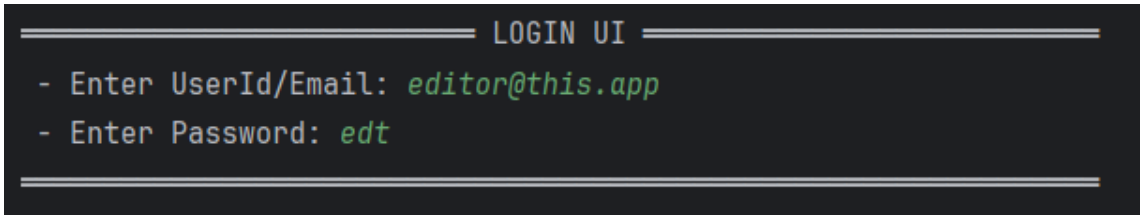


Figura 3 - Login

When you log in, you are asked for the 'UserId/Email' and the 'Password' and then you enter the chosen role of that account, in the case of the image it would be to enter the Editor's menu.

4.1.2. Know the Development Team

By entering 'Know the Development Team' we can see who the project's development team is, showing the name of each member and their respective number.

Figura 4 - Know the development team

4.2. Editor Mode

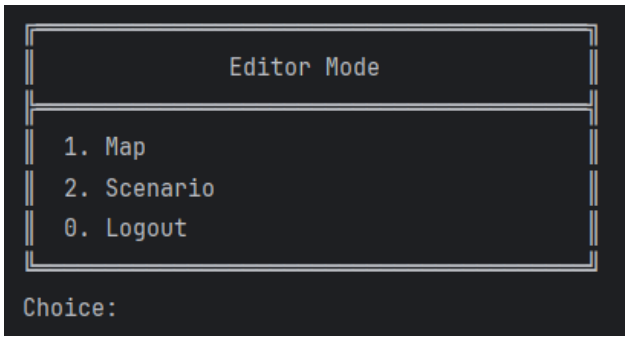


Figura 5 - Editor Mode

In ‘editor mode’ we have the map and scenario choices.

4.2.1. Map

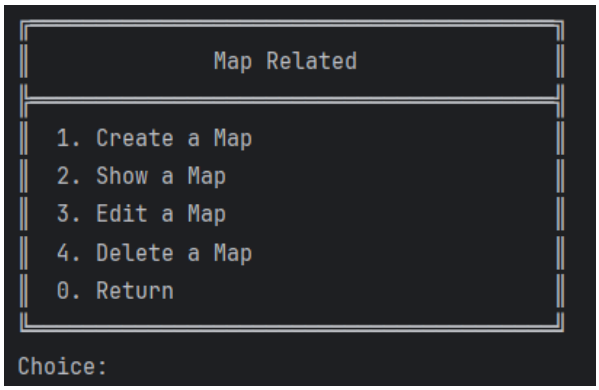


Figura 6 - Map Related

By choosing the ‘Map’ option, four more options appear in the ‘Map-related’ menu: ‘Create a Map’, ‘Show a Map’, ‘Edit a Map’ and ‘Delete a Map’.

4.2.1.1. Create a Map

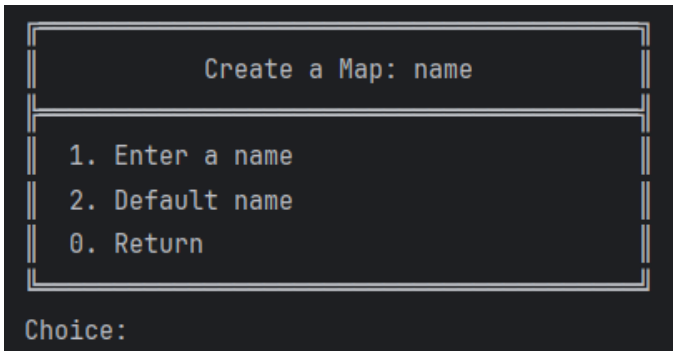
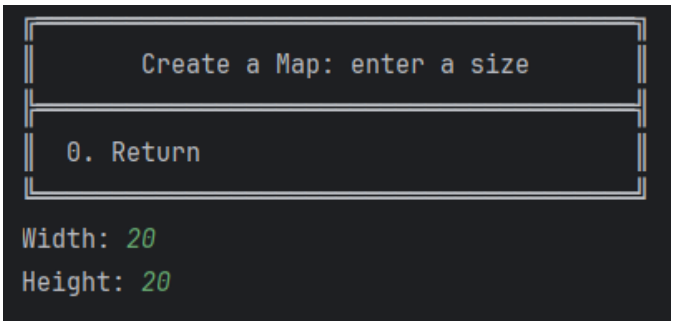


Figura 7 - Create a Map - name

When creating a map, the first thing we're asked about is the name, whether we want to enter a name ourselves or whether we want a ‘default’ name which would be ‘map_1’. The 1 would be incremented if there was already a map with that name, i.e. it would be ‘map_2’ and so on.



After choosing the name, we are asked for the height and width of the map.

Figura 8 - Create a Map: enter a size

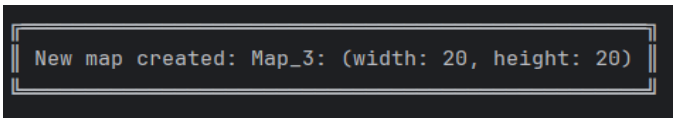


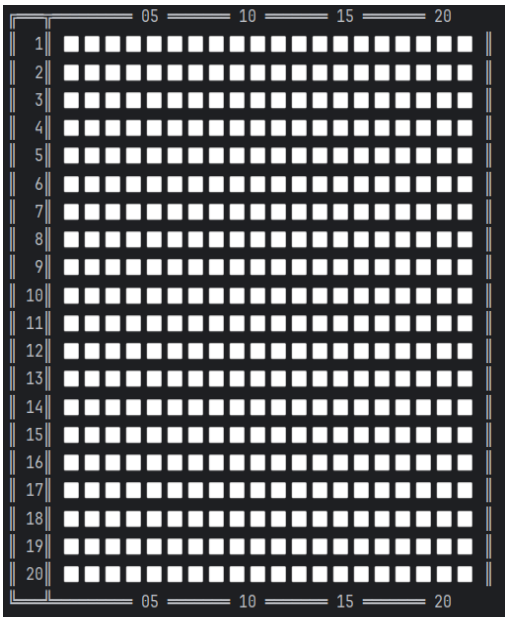
Figura 9 - Map creation message

And after entering the name, height and width, we receive a confirmation message indicating all the data that was entered when the map was created.

4.2.1.2. Show a Map

When you select the 'Show a Map' option, a list of maps is displayed so that you can choose the map you want to see.

Figura 10 - List of maps



Choosing a map will show you what the map looks like graphically, with its vertical and horizontal scale.

Figura 11 - Show map creation

4.2.1.3. Edit a Map

```
╔═══════════════════════════════════════╗
║                List of maps           ╒
╠═══════════════════════════════════════╣
╒  1. Test Map: (width: 70, height: 50) ╒
╒  2. Map_3: (width: 20, height: 20)    ╒
╒  0. Return                            ╒
╚═══════════════════════════════════════╝

Choice:
```

Figura 12 - List of maps

When you choose ‘Edit a Map’, a list of maps, with name and size, is displayed so that you can choose the map you want to see.

```
╔═══════════════════════════════╗
║            Edit a Map         ╒
╠═══════════════════════════════╣
╒  1. Name                      ╒
╒  2. Buildings                 ╒
╒  0. Return                    ╒
╚═══════════════════════════════╝

Choice:
```

Figura 13 - Edit a Map

When you enter ‘Edit a Map’ you have the options ‘Name’ and ‘Buildings’.

4.2.1.3.1. Name

```
╔═══════════════════════════════════════════════════════╗
║                Edit a Map: name                       ╒
╠═══════════════════════════════════════════════════════╣
╒ - Only alphanumeric characters and underscores are allowed ╒
╒ - No spaces, special characters, or accented letters are permitted ╒
╠═══════════════════════════════════════════════════════╣
╒  0. Return                                            ╒
╚═══════════════════════════════════════════════════════╝

New name:
```

Figura 14 - Edit a Map: name

```
╔═══════════════════════════════╗
╒ < New name updated: Test Map -> aaa > ╒
╚═══════════════════════════════╝
```

Figura 15 - Name updated message

When choosing the name option, you can choose another name, taking care of these criteria: ‘Only alphanumeric characters and underscores are allowed’ and ‘No spaces, special characters, or accented letters are permitted’.

4.2.1.3.2. Buildings

```
╔═══════════════════════════════╗
╠═══ Buildings ═══════════════╣
╠═══════════════════════════════╣
╟ 1. Industry                   ╢
╟ 2. City                       ╢
╟ 0. Return                     ╢
╚═══════════════════════════════╝
Choice:
```

Figura 16 - Buildings

When you choose 'Buildings' you have 2 options: 'Industry' and 'City'.

4.2.1.3.2.1. Industry

```
╔═══════════════════════════════╗
╠═══ Industry Operations ═══════╣
╠═══════════════════════════════╣
╟ 1. Add Industry               ╢
╟ 2. Remove Industry            ╢
╟ 0. Return                     ╢
╚═══════════════════════════════╝
Choice:
```

Figura 17 - Industry Operations

The 'Industry' option opens the 'Industry Operations' menu where you can choose 'Add Industry' and 'Remove Industry'.

4.2.1.3.2.2. Add Industry

```
╔═══════════════════════════════╗
╠═══ Select Industry Type ══════╣
╠═══════════════════════════════╣
╟ 1. Primary Sector Industry    ╢
╟ 2. Transforming Industry      ╢
╟ 3. Mixed Industry             ╢
╟ 0. Return                     ╢
╚═══════════════════════════════╝
Choice:
```

Figura 18 - Select industry type

When adding an industry we can choose between the possible types of industry 'Primary Sector Industry', Transforming Industry' and 'Mixed Industry'.

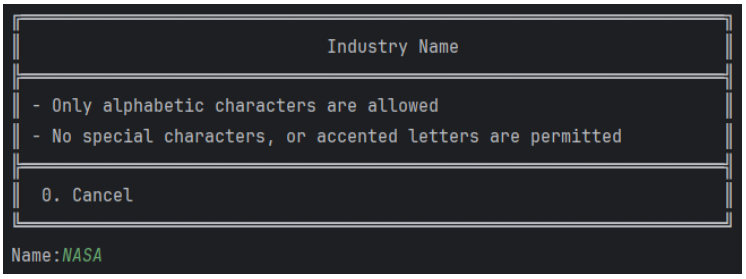


Figura 20 - Industry name

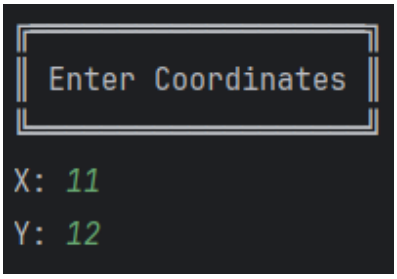


Figura 19 - Industry enter coordinates

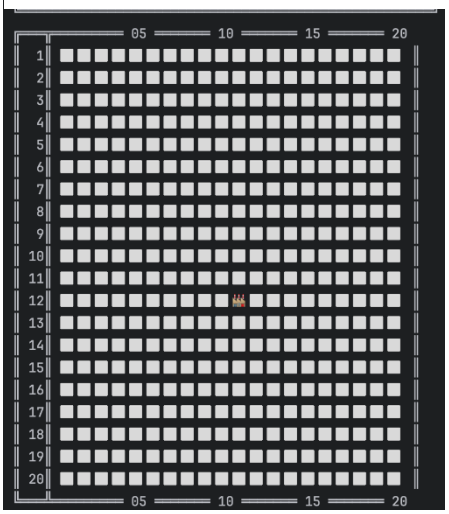


Figura 21 - Industry added message and map

When choosing one of the industry types, we are asked to choose the name and position on the map (X,Y).

And after entering the name and the position, we receive a confirmation message indicating all the data that was entered when the industry was created and it shows in the map where the industry is.

4.2.1.3.2.2.1. Remove Industry

Figura 22 - List of industries

Removing an industry shows us a list of created industries where we can select the one to remove.

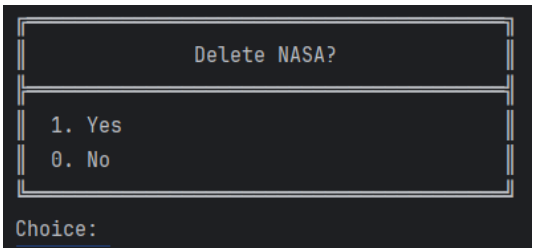
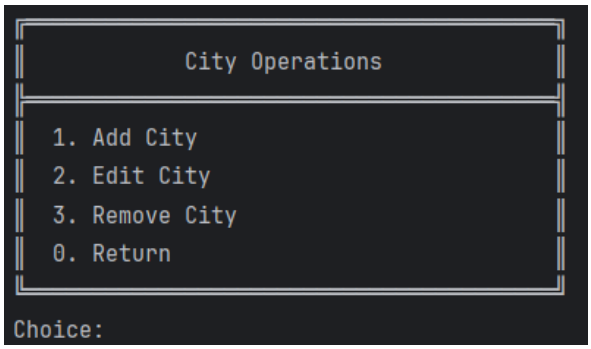


Figura 23 - Delete industry confirmation

When you choose the industry to remove, you get a confirmation message asking if you really want to delete that industry.

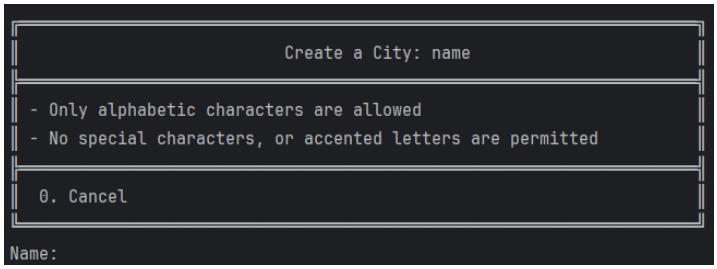
4.2.1.3.2.3. City



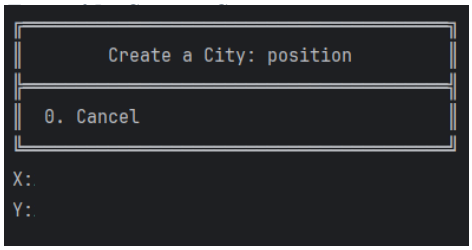
In the 'Buildings' menu, choosing 'City' opens the 'City Operations' menu where you can 'Add City', 'Edit City' and 'Remove City'.

Figura 24 - City operations

4.2.1.3.2.3.1. Add City



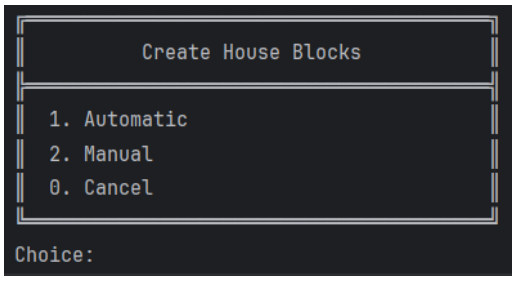
When adding a city, we are asked to enter the name and make sure we follow these criteria: 'Only alphabetic characters are allowed' and 'No special characters, or accented letters are allowed'.



After naming the city, we are asked for the position of the city centre (x,y).

Figura 26 - Create a City: position

4.2.1.3.2.3.1.1. Automatic



Then we are given the choice to choose whether we want to generate the houses automatically or manually.

Figura 27 - Create House Blocks

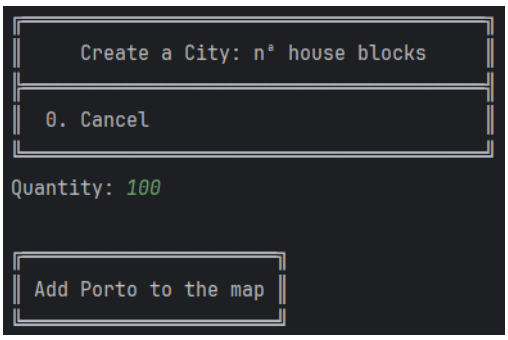


Figura 28 - Create a city:nª house blocks

Choosing automatic will ask how many houses the city will have and send a confirmation message saying that the town has been created.

4.2.1.3.2.3.1.2. Manual

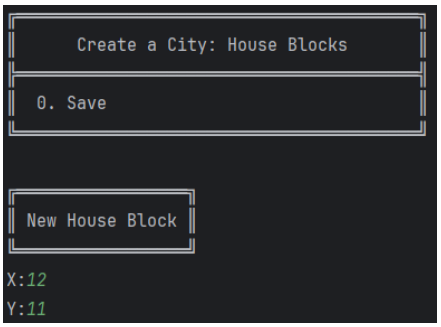


Figura 29 - Create a city: House blocks manual

If the choice has been made manually, we will be asked house by house to enter the position until the value '0' is entered to save the information about the houses and we will also be sent a confirmation message saying that the city has been created.

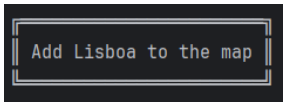


Figura 30 - Confirmation message city added

If the house is too far from the centre, a notice is sent saying that the house is significantly far from the city centre.

Figura 31 - Warning house block away city centre

4.2.1.3.2.3.2. List City

Figura 33 - List of cities

When listing the cities, it lists all the cities available on the map and only shows the name.

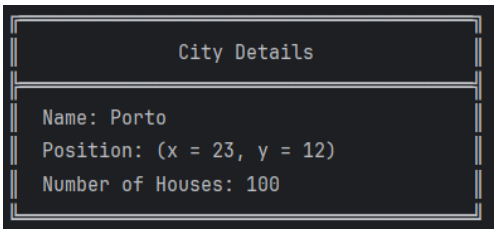


Figura 32 - City details

When choosing one of the cities, it has the name, position and number of houses.

4.2.1.3.2.3.3. Remove City

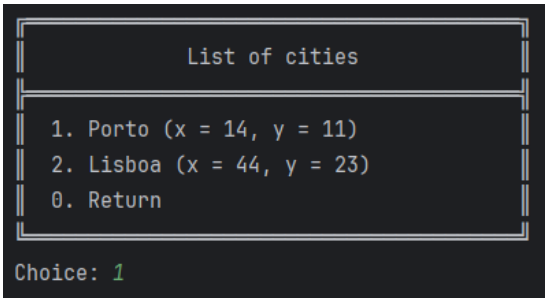


Figura 34 - List of cities

When removing a city, we are given a list of all the cities available on the map.

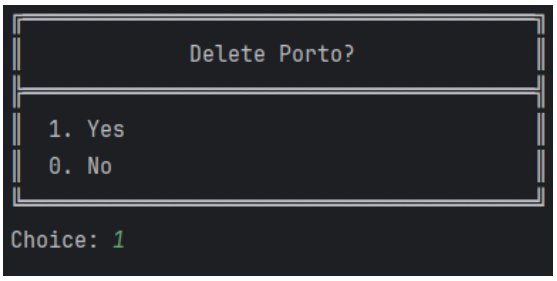


Figura 35 - Delete city confirmation

After choosing a city, we receive a confirmation message if we are sure we want to remove the city.

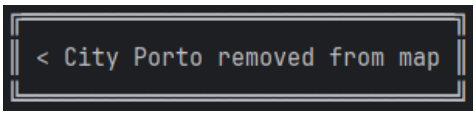


Figura 36 - City removed message

And if we have decided to remove the city, we receive a confirmation message that the city has been removed.

4.2.1.4. Remove Map

Figura 37 - List of maps

Removing a map lists all available maps.

Figura 38 - Delete map confirmation

After choosing a map to remove, a confirmation message is sent to find out if this is what the user really wants to do and, if the user has chosen to remove the map, a confirmation message that the map has been removed is displayed.

Figura 39 - Delete map message

4.2.2. Scenario

```
List of maps

1. Test Map: (width: 70, height: 50)
0. Return

Choice:
```

When entering the scenario it shows me the list of maps.

```
Scenario Related

1. Create a Scenario
2. Show a Scenario
0. Return

Choice:
```

Choosing the map it has two options: "Create a Scenario" and "Show a Scenario".

Figura 41 - Scenario related

4.2.2.1. Create a Scenario

```
Create a Scenario: enter a name

- Only alphanumeric characters and underscores are allowed
- No spaces, special characters, or accented letters are permitted

0. Return

Name:
```

When creating a scenario asks to give a name to the scenario following the following criteria "Only alphanumeric characters and underscores are allowed" and "No spaces, special characters, or accented letters are permitted"

Figura 42 - Create a scenario: enter a name

```
Initial money

0. Return

Initial money:
```

After indicating the name of the scenario, you are asked to indicate the initial money

Figura 43 – Scenario initial money

```
Date

0. Return

Beginning Date (MM-yyyy or 0 to cancel): 12-2000
Ending Date (MM-yyyy or 0 to cancel): 12-2020
```

Now it is the scenario date, the scenario date is used for the program to run the simulator during that period of time and to filter elements necessary for the program.

Figura 44 - Scenario date

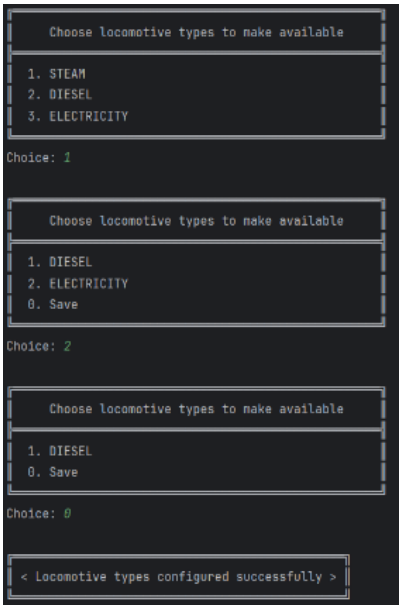


Figura 45 - Choose locomotive types available in scenario

After entering the start and end date of the scenario, we are asked which types of locomotives we want to be available in this scenario, it shows the list of types that exist and the user has to choose at least one of these types.

4.2.2.1.1. Modified configuration

Figura 46 - Modified configuration

By choosing ‘Modified configuration’ we can change the settings of the scenario, starting with the settings of the resource types where in this list we can see that they already have a default value for ‘Max resource storage’, ‘Interval between resouce generation’ and ‘Quantity produced per generation’.

```
Modify resource typePassenger

1. Maximum possible storage per station
2. Generation rate in months
3. Quantity produced per month
0. Save

Choice:
```

Figura 47 - Modify resource type configuration

By choosing one of the features, you can change the default values to something you like.

4.2.2.1.1.1. Maximum possible storage per station

```
Actual maximum possible storage per station: 30

New maximum: 25

< Maximum possible storage per station: 30 --> 25 >
```

Figura 48 - Maximum possible storage per station

When you choose 'Maximum possible storage per station', it asks for the new maximum value and when you enter the new value, the programme sends a confirmation message saying that the old value has been replaced by the new value.

4.2.2.1.1.2. Generation rate in months

```
Actual generation rate in months: 2

New generation rate: 4

< Generation rate in months: 2 --> 4 >
```

Figura 49 - Generation rate in months

When you choose 'Generation rate in months' you are asked for the new value, which would be the number of months the resource will be generated, and the programme sends a confirmation message saying that the old value has been replaced by the new value.

4.2.2.1.1.3. Quantity produced per month

```
Actual quantity produced per month: 1

New quantity produced: 2

< Quantity produced per month: 1 --> 2 >
```

Figura 50 - Quantity produced per month

When you choose 'Quantity produced per month' you are asked for the new value, which would be the quantity of the resource produced per month, and the programme sends a confirmation message saying that the old value has been replaced by the new value.

4.2.2.1.2. Default configuration

```
Choose house block resources to make available

1. Passenger (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
2. Mail (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)

Choice: 1

Choose house block resources to make available

1. Mail (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
0. Save

Choice: 1

< House block resources configured successfully >
```

Figura 51 - House blocks resources available

After saving all the values for the resource types, or going directly into 'Default configuration' mode, it shows me which house block resources I want to have in this scenario, passenger or mail, and at least one of the resources must be chosen.

4.2.2.1.2.1. Primary Sector Industry

```
Generation in the Coal Mine industry

1. Coal (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
2. Iron (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
3. Lumber (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
4. Grain (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
5. Cattle (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
6. Oil (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
7. Copper (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
8. Gold (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
9. Silver (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
10. Sulfur (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
11. Lead (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)

Choice: 1

< Resource Coal configured successfully in the Coal Mine industry >
```

Figura 52 - Generation in the primary industry

Now you need to choose the resource that will be generated in the primary industries (it will repeat for all industries of this type) and after choosing this resource the programme sends a confirmation message saying that the resource will be generated by that industry.

4.2.2.1.2.2. Transforming Industry

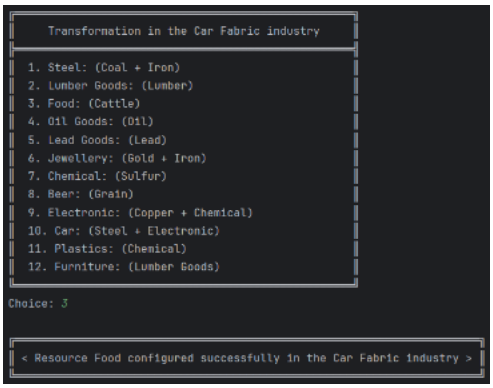


Figura 53 - Transformation in the transforming industry

Now you have to choose the resource that you're going to transform in the manufacturing industries (it will repeat for all industries of this type) and once you've chosen that resource, the programme sends a confirmation message saying that the resource will be generated by that industry.

4.2.2.1.2.3. Mixed Industry

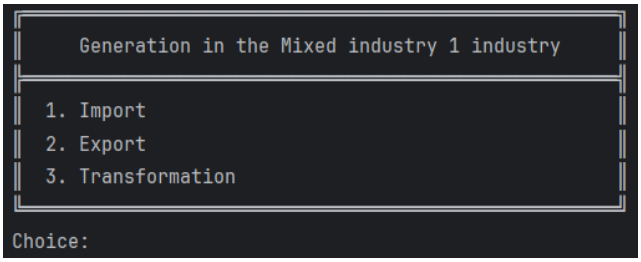


Figura 54 - Generation in the mixed industry

After choosing all the resources that primary and processing industries will generate, it's now up to Mixed Industries to make at least one of the choices: Import, Export and Tranformation.

4.2.2.1.2.3.1. Import

```
Import in the Mixed industry 1 industry

1. Coal (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
2. Iron (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
3. Lumber (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
4. Grain (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
5. Cattle (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
6. Oil (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
7. Copper (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
8. Gold (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
9. Silver (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
10. Sulfur (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
11. Lead (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
12. Steel (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
13. Lumber Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
14. Food (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
15. Oil Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
16. Lead Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
17. Jewellery (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
18. Chemical (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
19. Beer (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
20. Electronic (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
21. Car (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
22. Plastics (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
23. Furniture (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
0. Return

Choice: 1
```

Figura 55 - Import in the mixed industry

Choosing the 'Import' option shows all the resources that the industry will be able to import.

4.2.2.1.2.3.2. Export

```
Export in the Mixed industry 1 industry

1. Iron (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
2. Lumber (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
3. Grain (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
4. Cattle (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
5. Oil (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
6. Copper (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
7. Gold (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
8. Silver (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
9. Sulfur (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
10. Lead (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
11. Steel (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
12. Lumber Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
13. Food (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
14. Oil Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
15. Lead Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
16. Jewellery (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
17. Chemical (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
18. Beer (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
19. Electronic (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
20. Car (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
21. Plastics (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
22. Furniture (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
0. Return

Choice: 4
```

Figura 56 - Export in the mixed industry

Choosing the 'Export' option shows all the resources that the industry will be able to export.

4.2.2.1.2.3.3. Transformation

```
Transformation in the Mixed industry 1 industry

1. Steel (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
2. Lumber Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
3. Food (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
4. Oil Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
5. Lead Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
6. Jewellery (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
7. Chemical (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
8. Beer (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
9. Electronic (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
10. Car (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
11. Plastics (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
12. Furniture (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
0. Return

Choice: 12
```

Figura 57 - Transformation in the mixed industry

Choosing the 'Transforming' option brings up all the resources that the industry will be able to transform.

```
< Scenario ola created successfully >
```

Figura 58 - Scenario created message

After making all these choices, the stage is finally set.

4.2.2.2. Show a Scenario

```
Existing scenarios in Test Map

1. Test Scenario
0. Return

Choice: 1
```

Figura 59 - Existing scenarios in map

Entering the 'Show a Scenario' menu shows a list of all the scenarios created.

```
Scenario: Test Scenario

Map: Test Map
Initial Money: 50000
Beginning Date: Actual date: 1-2000
End Date: Actual date: 5-2025
```

Figura 60 - Scenario initial details

Choosing one of the scenarios from the list displays the initial scenario information.

```
Other characteristics

1. Resources configs
2. House blocks configs
3. Industries configs
0. Return

Choice:
```

Figura 61 - Scenario other configurations details

Then to see more specific information we can choose these options to see other settings

4.2.2.2.1. Resources configs

```
Resources configurations

Passenger (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Mail (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Coal (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Iron (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Lumber (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Grain (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Cattle (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Oil (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Copper (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Gold (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Silver (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Sulfur (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Lead (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Steel (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Lumber Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Food (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Oil Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Lead Goods (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Jewellery (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Chemical (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Beer (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Electronic (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Car (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Plastics (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Furniture (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
```

Figura 62 - Resources configurations

4.2.2.2.2. House blocks configs

```
House blocks resources

Passenger (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Mail (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
```

Figura 63 - House blocks resources

4.2.2.2.3. Industries configs

```
Industries configurations

Coal Mine generates Coal (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Iron Mine generates Iron (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Copper Mine generates Copper (Max resources storage: 30, Interval between resource generation: 2, Quantity produced per generation: 1)
Car Fabric transforms Electronic: (Copper + Chemical)
Steel Fabric transforms Steel: (Coal + Iron)
Beer Fabric transforms Beer: (Grain)
mixed industry 1 makes (Imports: lumber, oil | Exports: iron | Transformation: chemical, oil goods)
```

Figura 64 - Industries configurations

4.3. Player Mode

```
Player Mode

1. Simulation
2. Verify Routes
0. Logout

Choice:
```

Figura 65 - Player Mode

When you log in with a 'Player' account, you enter 'Player Mode', where you have two options: 'Simulation' and 'Verify Routes'.

4.3.1. Simulation

```
List of maps

1. Test Map: (width: 70, height: 50)
0. Return

Choice: 1
```

Figura 66 - List of maps

When you choose the simulation option, a list of all the available maps appears.

```
List of scenarios

1. Test Scenario
0. Return

Choice: 1
```

Figura 67 - List of scenarios available in map

When you choose the map, it shows all the available scenarios on the map.

```
Player Mode

1. Run Simulation
0. Logout

Choice: 1
```

Figura 68 - Player Mode - run simulation

After choosing the map and scenario, we can run the simulation.

```
Simulation started...
Controls: [p] pause  [r] resume  [s] exit  [+/-] speed
```

Figura 69 - Simulation started and controls

These commands work when the simulation is in progress, i.e. ‘s’ exits the simulator and ‘+’ increases the speed at which the months pass.

```
Date: 11 / 2003 | Speed: 3s/month
Saldo: 50000 € | Actual date: 12-2003
Resume Menu
1. Continue Program
2. Station Related
3. Train Related
4. Railway Line Related
5. Route Related
0. Exit
Choice:
```

Figura 70 - Control “p + enter”

When you press ‘p + enter’ the game pauses and opens the pause menu.

```
Increased speed: 1s/month
```

Figura 71 - Control “+”

Running ‘+’ increases the speed at which the months pass.

```
Reduced speed: 3s/month
```

Figura 72 - Control “-“

When ‘-’ is executed, the speed at which the months pass slows down.

```
Reloading...
```

When ‘r’ is executed, the program realoads.

```
Date: 1 / 2000 | Speed: 2s/month
Date: 2 / 2000 | Speed: 2s/month
```

Figura 74 - Simulator date

For every 2 seconds of real life, 1 month passes in the simulation.

```
Production:
• 1   × Coal        @ Braga
• 1   × Iron        @ Braga
• 1   × Passenger   @ porto
• 1   × Mail        @ porto
• 1   × Passenger   @ porto
• 1   × Mail        @ porto
• 1   × Passenger   @ porto
• 1   × Mail        @ porto
• 1   × Passenger   @ porto
• 1   × Mail        @ porto
• 1   × Passenger   @ porto
• 1   × Mail        @ porto
• 1   × Copper      @ terminal_UnknownCity
• 1   × Lumber      @ terminal_UnknownCity
• 1   × Oil         @ terminal_UnknownCity
• 1   × Passenger   @ depot_UnknownCity
• 1   × Mail        @ depot_UnknownCity
```

Figura 75 - Production simulator

When running the simulator, various resources from industry are produced and stored in the stations.

```
Manufacturing:
• 1   × Steel: (Coal + Iron)   @ Braga
• 1   × Oil Goods: (Oil)       @ terminal_UnknownCity
```

Figura 76 - Manufacturing simulator

Manufacturing shows the products that have been processed in the industries and stored in the stations.

```
Export:
  → 1    × Copper
```

No Export shows the products that were exported from the industries.

Figura 77 - Export simulator

```
========================================
Route Event: Route 2
Current Date: 1 / 2007
========================================

Delivering secondary resource: Passenger | Quantity: 30 | Station: Braga
Delivering secondary resource: Mail | Quantity: 30 | Station: Aveiro

Money Earned: 120 €!
Total Balance: 45312 €

========================================
```

The route events show the resources that have been delivered and show the amount and season in which they were delivered. It also shows the money earned and the current money after receiving that earned Money.

Figura 78 - Route Event

4.3.1.1. Pause Menu

```
Saldo: 50000 €   |  Actual date: 3-2000

                Resume Menu

1. Continue Program
2. Station Related
3. Train Related
4. Railway Line Related
5. Route Related
0. Exit

Choice:
```

Running the program and pressing ‘p + enter’ takes you to the ‘resume menu’ where you have 5 options: ‘Continue Program’, ‘Station Related’, ‘Train Related’, ‘Railway Line Related’ and ‘Route Related’.

Figura 79 - Resume menu

4.3.1.2. Station Related

```
          Station Operations

1. Add Station
2. Show Station List
3. Remove Station
4. Edit Station
0. Return

Choice:
```

Entering the ‘Station Related’ option opens the Station Operations menu where you have 4 options: Add Station’, Show Station List’, ‘Remove Station’ and ‘Edit Station’.

Figura 80 - Station operations

4.3.1.2.1.1. Add Station

```
Saldo: 50000 €   |  Actual date: 3-2000

Add Station: Choose Type

1. DEPOT (Cost: 50 €)
2. STATION (Cost: 100 €)
3. TERMINAL (Cost: 200 €)
0. Return

Choice:
```

Figura 81 - Add station: choose type

When adding a station, a list of station types is provided with the type and cost of the station.

```
Create a Station: position

0. Cancel

X:
Y:
```

Figura 82 - Create a station: position

When choosing one of the station types, the position (x,y) is requested.

```
Add Station: Choose Direction

1. North
2. South
3. East
4. West
0. Return

Choose Direction:
```

Figura 83 - Add station: choose direction

When choosing the station type there is a difference, which has to do with choosing a direction 'North', 'South', 'East' and 'West', which serves to define a centre, whereas when choosing the depot type and the terminal type there would only be a geometric centre.

```
Suggested station name: station_Porto

Do you want to keep this name?

1. Yes
0. No

Choice: 0
Enter your desired station name: Estacao

Station added successfully: Estacao
```

Figura 84 - Suggested name and added confirmation message

After choosing the direction of the station type station or if you have only chosen the depot or terminal types, you go directly to the name part, where you are shown a suggested name and asked if you want to keep this suggested name or if you would prefer to make up your own. If you choose your own name, it asks you for the name you want and that is the name of the station and a confirmation message appears that the station has been created.

4.3.1.2.1.2. Show Station List

```
List of Stations

1. Braga                | Position: (x = 14, y = 12)
2. porto                | Position: (x = 31, y = 12)
3. Aveiro               | Position: (x = 58, y =  9)
4. Coimbra              | Position: (x =  6, y = 24)
5. Lisboa               | Position: (x = 69, y = 39)
6. terminal_UnknownCity | Position: (x = 40, y = 31)
7. depot_UnknownCity    | Position: (x = 22, y = 27)
0. Return

Choose a station: 1
```

Figura 86 - List of stations

```
Station Details

Name: Braga
Type: TERMINAL
Position: (x = 14, y = 12)
Direction: N/A
Buildings:
- Telephone
- Large coffe
- Customs
- Silo
Cargoes: None
```

Figura 86 - Station details

Entering 'Show Station List' provides a list of all available stations with their name and position on the map, and choosing a station shows its details such as: name, type, position (x,y), direction, buildings and cargoes.

4.3.1.2.1.3. Remove Station

```
Remove a Stations

1. terminal_UnknownCity(x = 14, y = 12)
2. porto(x = 31, y = 12)
3. depot_UnknownCity(x = 58, y = 9)
4. terminal_UnknownCity_1(x = 6, y = 24)
5. station_UnknownCity(x = 69, y = 39)
6. terminal_UnknownCity_2(x = 40, y = 31)
7. depot_UnknownCity_1(x = 22, y = 27)
8. Estacao(x = 23, y = 22)
0. Return

Choice:
```

```
< Station Estacao removed from map >
```

Figura 88 - Removed station confirmation message

Entering 'Remove Station' provides a list of all available stations with their name and position on the map.

When you choose one of the stations, it asks you if you really want to remove that station and when you select yes, you get a confirmation message that the station has been deleted.

4.3.1.2.1.4. Edit Station

```
List of Stations

1. terminal_UnknownCity(x = 14, y = 12)
2. porto(x = 31, y = 12)
3. depot_UnknownCity(x = 58, y = 9)
4. terminal_UnknownCity_1(x = 6, y = 24)
5. station_UnknownCity(x = 69, y = 39)
6. terminal_UnknownCity_2(x = 40, y = 31)
7. depot_UnknownCity_1(x = 22, y = 27)
0. Return

Choice:
```

Figura 89 - Edit stations - list statios

Entering 'Edit Station' provides a list of all available stations with their name and position on the map.

```
╔═══════════════════════════════════╗
║              Edit a Station       ╕
╟═══════════════════════════════════╢
│  1. Edit Name                     │
│  2. Add Buildings                 │
│  3. Evolve Station Type           │
│  0. Save                          │
╙═══════════════════════════════════╜

Choice:
```

Figura 90 - Edit a station - name and buildings

When editing a station we are given three options: 'Edit Name', 'Add Buildings' and 'Evolve Station Type'.

4.3.1.2.1.4.1. Edit Name

```
╔═══════════════════╗
║ Editing station: porto ╕
╙═══════════════════╜

Enter new name:Porto

╔═══════════════════╗
║ Station name updated. ╕
╙═══════════════════╜
```

Figura 91 - Edit a station - edit name

When editing the name, it shows which station was chosen to edit and the new name, after the new name has been entered, a confirmation message is sent that the name has been updated.

4.3.1.2.1.4.2. Add Buildings

```
Selected station: Porto

Saldo: 49900 €   |  Actual date: 3-2000

Available Building Types

1. Telegraph (Cost: 30 €)
2. Telephone (Cost: 60 €)
3. Small coffe (Cost: 40 €)
4. Large coffe (Cost: 70 €)
5. Customs (Cost: 80 €)
6. Postfice (Cost: 50 €)
7. Small hotel (Cost: 60 €)
8. Large hotel (Cost: 120 €)
9. Silo (Cost: 70 €)
10. Liquidstorage (Cost: 50 €)
0. Cancel

Choose the number of the building you want to add:
```

```
Building 'Telegraph' was successfully added to the station!
```

Figura 92 - Edit a station - add buildings

Entering 'Add Buildings' tells you which station is being edited and shows you a list of buildings to add to the station and their cost. After adding a building, it says that the building has been added to the station.

4.3.1.2.1.4.3. Evolve Station Type

```
Choose Station Type

1. Evolve to STATION (Cost: 100.0 €)
0. Cancel

Choice:
```

```
Station type updated to STATION.
```

Figura 93 - Edit a station - evolve station type

When upgrading a station, it asks if you want to upgrade to the type of station available to upgrade and its cost. When you choose the type you want to upgrade to, a confirmation message is sent saying that the station type has been upgraded to the chosen station type.

4.3.1.2.2. Train Related

```
Locomotive Operations

1. Buy a Locomotive
2. View Acquired Locomotives
3. Buy a Carriage
4. View Acquired Carriage
5. Construct Train
6. View Train
0. Return

Choice:
```

Figura 94 - Locomotive operations

When you enter the 'Train Related' menu you have six options: 'Buy a Locomotive', 'View Acquired Locomotives', 'Buy a Carriage', 'View Acquired Carriage', 'Construct Train' and 'View Train'.

4.3.1.2.2.1. Buy a Locomotive

```
Saldo: 50000 €   |  Actual date: 3-2000

List of Available Locomotive

1. Name: E111          | Power: 2000,0  | Acceleration: 2,5  | TopSpeed: 140,0  | Fuel: ELECTRICITY  | Max Carriages: 3
2. Name: CP1900        | Power: 2200,0  | Acceleration: 1,8  | TopSpeed: 140,0  | Fuel: DIESEL       | Max Carriages: 4
3. Name: CP E214       | Power: 2200,0  | Acceleration: 1,2  | TopSpeed: 95,0   | Fuel: STEAM        | Max Carriages: 2
4. Name: GE AC4400CW   | Power: 4400,0  | Acceleration: 2,0  | TopSpeed: 50,0   | Fuel: DIESEL       | Max Carriages: 8
0. Return

Choice:
```

Figura 95 - List of available Locomotives

```
Locomotive: CP1900 bought successfully!
```

Figura 96 - Locomotive bought confirmation message

When you buy a locomotive, all the locomotives available in the scenario are shown with their details and when one is chosen a confirmation message is sent that they have been bought.

4.3.1.2.2.2. View Acquired Locomotives

```
List of available Locomotives

1. E111
0. Return

Choose a locomotive: 1
```

Figura 98 - List of bought locomotives

```
Locomotive Details

Name: E111
Power: 2000.0 kW
Acceleration: 2.5 m/s²
Top Speed: 140.0 km/h
Start Year of Operation: 2000
Fuel Type: ELECTRICITY
Acquisition Price: 130 €
Max Carriages Allowed: 3
Associated Line ID: None
```

Figura 97 - Locomotive details

Choosing the 'View Acquired Locomotives' option displays a list of purchased locomotives and choosing the locomotive u can see the details of the locomotive.

4.3.1.2.2.3. Buy a Carriage

```
Saldo: 49630 €   |  Actual date: 3-2000
List of Available Carriages
1. Carriage  → name: Carriage Postal | Acquisition Price: 80 €
0. Return
Choice:
```

Figura 99 - List of available carriages

```
Carriage: Carriage Postal bought successfully!
```

Figura 100 - Carriage bought confirmation message

When you buy a carriage, it shows the available carriages in the scene and sends a confirmation message saying that the carriage has been bought.

4.3.1.2.2.4. View Acquired Carriage

```
List of available Carriages to Use
1. Carriage Postal
0. Return
Choice: 1
```

Figura 101 - View Carriages list

```
Carriage Details
Name: Carriage Postal
Acquisition Price: 80 €
Max Capacity: 3
Resources: None
```

Figura 102 - Carriage Details

By choosing the 'View Acquired Carriage' option you can see the carriages that have been purchased and by choosing the carriage you can see its details.

4.3.1.2.2.5. Construct Train

```
Saldo: 49550 €   |  Actual date: 3-2000
Available Locomotives
1. CP1900 | Max Carriage: 4
0. Cancel
Choose the Locomotive you want to use:
```

When building a train, you start by choosing a locomotive and displaying its name and the maximum number of carriages.

```
Saldo: 49550 €   |  Actual date: 3-2000
Available Carriages | Can Coose: 4 more carriages
1. Carriage Postal
0. Cancel
```

Figura 104 - Construct train - available carriages

After choosing a locomotive, you'll be given a list of all the carriages you've bought and told how many you can add according to the maximum number of carriages the locomotive can carry.

```
You have no more carriages available to add to the train.

Train created successfully.
```

Figura 105 - Warning and tain built confirmation message

As I only had one carriage, I was told that I couldn't add any more carriages as I'd used up the only one I had, and the train was successfully built, it said.

4.3.1.2.2.6. View Train

```
List of Trains

1. E111 Train
2. CP E214 Train
0. Return

Choose a train: 2
```

Figura 107 - List of trains

```
Train Details

Name: CP E214 Train
Locomotive: CP E214
Carriages:
  - Carriage Postal
  - Carriage Postal
```

Figura 106 - Train details

When you enter 'View Train' you can see a list of trains that have already been built.

When you choose one of the trains you've built, you can see details of the locomotive and the carriages that make up the train.

4.3.1.2.3. Railway Line Related

```
Saldo: 49550 €   |  Actual date: 3-2000

Railway Line Operations

1. Create Railway Line
2. List Railway Lines
3. Delete Railway Line
4. Upgrade Railway Line
0. Exit

Choice:
```

Figura 108 - Railway line operations

In the railway lines menu you have 4 options: 'Create Railway Line', 'List Railway Lines', 'Delete Railway Line' and 'Update Railway Line'.

4.3.1.2.3.1. Create Railway Line

```
Create Railway Line: Stations

1. terminal_UnknownCity(x = 14, y = 12)
2. Porto(x = 31, y = 12)
3. depot_UnknownCity(x = 58, y = 9)
4. terminal_UnknownCity_1(x = 6, y = 24)
5. station_UnknownCity(x = 69, y = 39)
6. terminal_UnknownCity_2(x = 40, y = 31)
7. depot_UnknownCity_1(x = 22, y = 27)
0. Cancel
```

Figura 109 - Create railway line - stations list

When creating a railway line, a list of all available stations is sent and you are asked to indicate the departure station and the arrival station.

```
Create Railway Line: Electrification

1. Electrified Line
2. Non-Electrified Line
0. Cancel

Choose:
```

Figura 113 - Create railway line: electrification

```
Create Railway Line: Type Line

1. Single Track
2. Double Track
0. Cancel

Choose:
```

Figura 112 - Create railway line: type line

```
Saldo: 49550 €   |  Actual date: 3-2000

Railway Line will cost: 144 €

1. Create Railway Line
2. Don't Create Railway Line

Choice:
```

Figura 111 - Create railway line: confirmation and cost

After choosing the departure station and the arrival station we have to choose the type of railway line, which starts by asking if we want an electrified or non-electrified line and then asks if it is single or double tracks. After the type of railway lines is provided, it shows the current money, how much it will cost and asks if we want to create the line or not.

```
Railway line created successfully.
```

Figura 110 - Railway line created confirmation message

4.3.1.2.3.2. List Railway Lines

```
List of RailwayLines

1. terminal_UnknownCity ↔ porto
0. Return

Choose a line:
```

Figura 114 - List of railway lines

When listing railway lines it shows all lines created on the map with their connections.

```
Line Details

Map: Test Map
Connection: terminal_UnknownCity ↔ porto
Type: Double Non-Electrified Track
```

Figura 115 - Railway line detail

When choosing one of the lines it is possible to see its details, such as map, connection and type

4.3.1.2.3.3. Delete Railway Line

```
List of Railway Lines

1. Double Non-Electrified Track | terminal_UnknownCity ↔ porto
0. Return

Choice:
```

Figura 116 - delete railway line - list railway lines

When deleting lines, a list of railway lines is provided with their name and line type.

```
Delete terminal_UnknownCity ↔ porto?

1. Yes
0. No

Choice:
```

Figura 117 - Delete line confirmation

When choosing one of the lines to delete, a confirmation message is sent asking if it is really that line you want to delete. After deleting the line, a message is sent saying that the line has been deleted.

```
< Railway line removed: terminal_UnknownCity ↔ porto
```

Figura 118 - Delete line confirmation message

4.3.1.2.3.4. Upgrade Railway Line

```
Upgrade Railway Line

1. Double Non-Electrified Track | depot_UnknownCity ↔ porto
0. Return

Select a line:
```

Figura 119 - Upgrade railway line - list railway lines

When upgrading railway lines it shows a list of all lines created with their connection and their type.

```
Saldo: 49766 €   |  Actual date: 3-2000

Upgrade depot_UnknownCity ↔ porto from Non-Electrified to Electrified? (Cost: 130 coins)

1. Yes
0. No

Choice:
```

Figura 121 - Upgrade railway line confirmation

```
< Upgraded depot_UnknownCity ↔ porto >
```

Figura 120 - Upgrade railway line confirmation message

When choosing a line to upgrade if it is already a double it doesn't ask if you want to upgrade to double and if it is already electrified it doesn't ask if you want to upgrade to electrified, only if it is single and/or non-electrified. The example in the image was a Double Non-Electrified so it only asked if you wanted to upgrade from non-electrified to electrified and also indicated the cost of the upgrade. After upgrading, a message is sent saying that the line has been upgraded.

4.3.1.2.4. Route Related

```
Route Operations

1. Create Route
2. View Routes
0. Return

Choice:
```

Figura 122 - Route operations

When entering the "Route Related" menu, there is a menu with two options: "Create Route" and "View Route"

4.3.1.2.4.1. Create Route

```
Saldo: 49520 €   |  Actual date: 3-2000

Available Trains

1. CP1900 Train
0. Cancel

Choose the Train you want to use:
```

Figura 123 - Create route - available trains

When creating a route asks which train we want to use on the route and it shows all built trains.

```
Saldo: 48218 €   |  Actual date: 3-2000

Available Stations

1. Braga
2. porto
3. Aveiro
4. Coimbra
0. Cancel

Choose the Station: 1

Saldo: 48218 €   |  Actual date: 3-2000

Actual Station: Braga

1. porto
0. Return

Choose the Station: 1
```

Figura 125 - Create route - available stations

```
Saldo: 48218 €   |  Actual date: 3-2000

Actual Station: porto

1. Braga
2. Coimbra
0. Save

Choose the Station: 2

Saldo: 48218 €   |  Actual date: 3-2000

Actual Station: Coimbra

1. Aveiro
2. porto
0. Save

Choose the Station: 1
```

Figura 124 - Create route - available stations 2

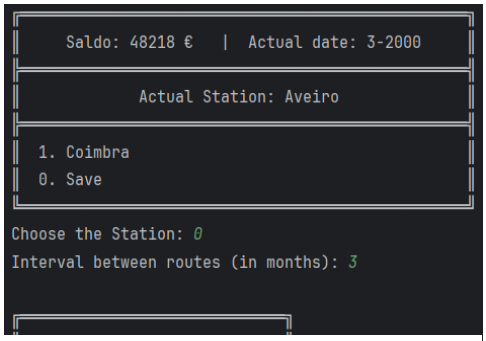


Figura 126 - Create route - interval between routes and confirmation message

After choosing the train it shows the list of available stations, considering the type of fuel the train uses, because if it's electric it could only show the stations that have electric connections. When you choose one of the stations it shows another list of available stations in which it only shows the connections that that station has, for example in the image I chose Braga and Braga only had a connection with Porto but then when I chose Porto I had a connection with Braga and Coimbra after choosing Coimbra it showed the available connections with Coimbra which were Porto and Aveiro and after choosing Aveiro, Aveiro only had a connection with Coimbra and so I saved the route. After choosing all the stations and saving them, I was asked what the route interval would be, i.e. the route would be repeated every 3 months. After making these choices, it confirms that the route has been successfully created.

4.3.1.2.4.2. View Routes

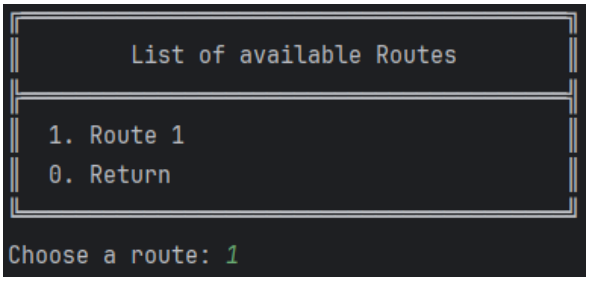


Figura 128 - List of available routes

When visualising routes, a list of all existing routes in the simulation is provided.

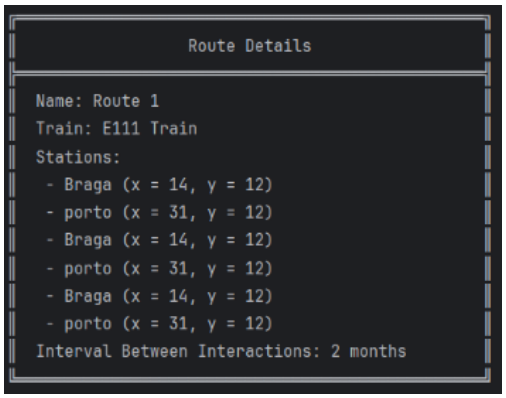


Figura 127 - Route details

By choosing one of the routes we can see the name of the route, the train that runs on it, the stations it passes through and finally the number of months in which it repeats.

4.3.2. Verify Routes

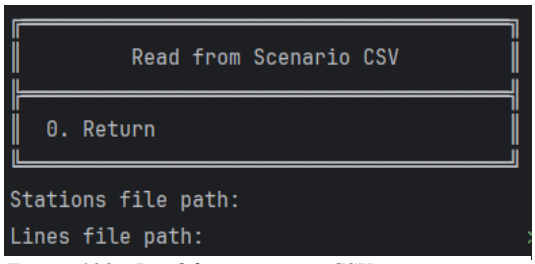


Figura 129 - Read from scenario CSV

Entering the 'Verify Routes' option asks for the path to the csv file where the stations are located and the same for the lines.

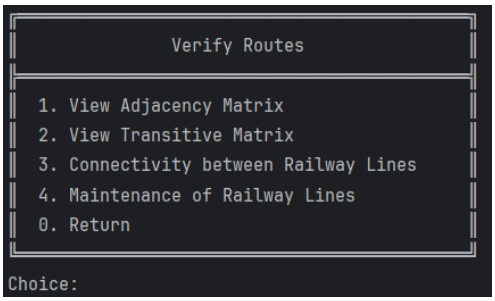


Figura 130 - Verify routes

After supplying the two csv files, we enter the 'Verify Routes' menu, where we have 4 options: 'View Adjacency Matrix', 'View Transitive Matrix', 'Connectivity between Railway Lines' and 'Maintenance of Railway Lines'.

4.3.2.1. View Adjacency Matrix

4.3.2.1.1. Electrical Trains

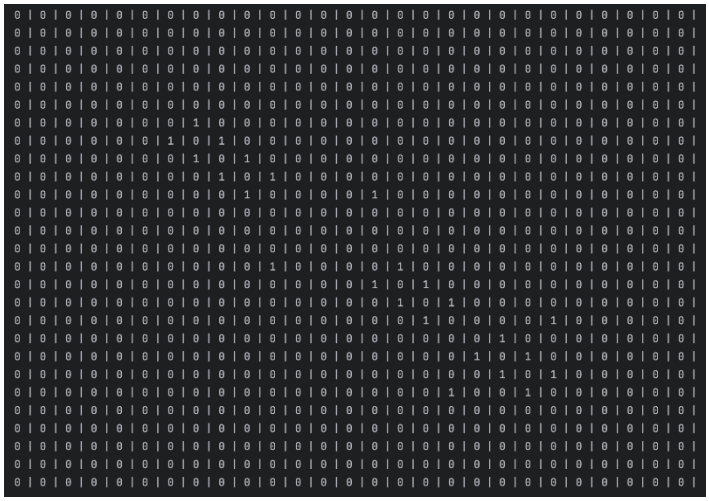


Figura 131 - View adjacency matrix - electrical trains

This section displays the Adjacency Matrix, which represents the direct connections between stations in the railway network with electrical trains. Each row and column correspond to a station, and a value of 1 indicates a direct route between the two respective stations, while a 0 indicates no direct connection. This matrix helps players understand the current structure of the network and is useful for planning routes and analysing connectivity within the game scenario.

4.3.2.1.2. All Train Types

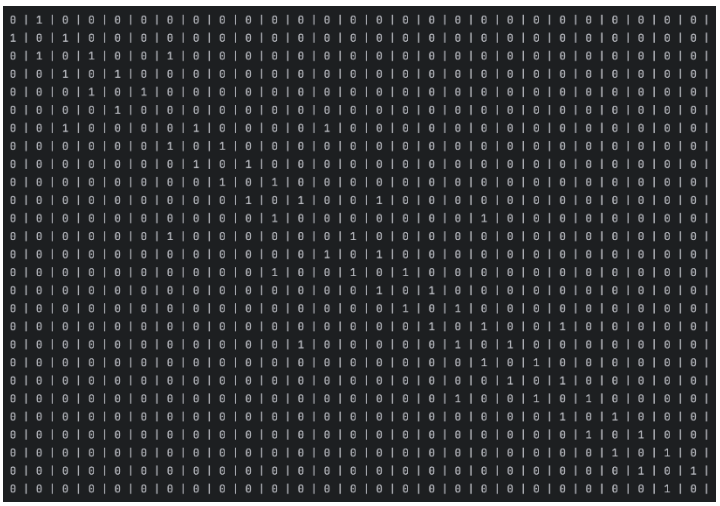


Figura 132 - View adjacency matrix - all types trains

An additional option is available to view the full adjacency matrix including the routes of all trains, giving a complete overview of how the entire railway system is interconnected.

4.3.2.2. View Transitive Matrix

4.3.2.2.1. Electrical Trains

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figura 133 - View transitive matrix - electrical trains

This section displays the Transitive Matrix, which shows the indirect connections between stations in the railway network. Unlike the adjacency matrix that only includes direct links, the transitive matrix reveals whether it is possible to reach one station from another through one or more intermediate stations**.** A value of 1 in a cell means that there is a path (direct or indirect) between the two stations with electrical trains, while a 0 means there is no such connection.

1.1.1.1.1. All Train Types

1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figura 134 - View transitive matrix - all types trains

There is also an option to view the complete transitive matrix including the routes of all trains, providing a comprehensive view of the overall reachability within the railway system.

4.3.2.3. Connectivity between Railway Lines

4.3.2.3.1. Electrical Trains

4.3.2.3.2. All Train Types

```
╔═══════════════════════════════════════════╗
║                Connectivity Menu          ║
╟═══════════════════════════════════════════╢
║  1. Check Connectivity Between Stations   ║
║  2. Check Connectivity Between Two Stations ║
║  3. Visualize Railway Network             ║
║  0. Return                                ║
╚═══════════════════════════════════════════╝
Choose an option:
```

Figura 135 - Connectivity menu

4.3.2.3.2.1. Check Connectivity Between Stations

```
║       Remove stations by Type:            ║
╟═══════════════════════════════════════════╢
║  1. Depot                                 ║
║  2. Station                               ║
║  3. Terminal                              ║
║  0. Save                                  ║
╚═══════════════════════════════════════════╝
Choose an Option: 1

║       Remove stations by Type:            ║
╟═══════════════════════════════════════════╢
║  1. Depot                                 ║
║  2. Station                               ║
║  3. Terminal                              ║
║  0. Save                                  ║
╚═══════════════════════════════════════════╝
Choose an Option: 2

║       Remove stations by Type:            ║
╟═══════════════════════════════════════════╢
║  1. Depot                                 ║
║  2. Station                               ║
║  3. Terminal                              ║
║  0. Save                                  ║
╚═══════════════════════════════════════════╝
Choose an Option: 0

All valid stations are connected (excluding types [D, S]): YES
```

Figura 136 - Check connectivity between stations

4.3.2.3.2.2. Check Connectivity Between Two Stations

```
Station list:
1 - S_Kyle_of_Lochalsh
2 - D_Attadale
3 - S_Dingwall
4 - S_Ardgay
5 - D_Helmsdale
6 - S_Wick
7 - T_Inverness
8 - S_Elgin
9 - T_Aberdeen
10 - S_Arbroath
11 - T_Dundee
12 - D_Inverkeithing
13 - D_Aviemore
14 - S_Kingussie
15 - T_Perth
16 - S_Dunblane
17 - T_Stirling
18 - D_Croy
19 - T_Edinburgh
20 - S_Bathgate
21 - S_Airdrie
22 - T_Glasgow_Queen_Street
23 - S_Dalmuir

Choose the ORIGIN station: 2
Choose the DESTINATION station: 23

Is there a path between 'D_Attadale' and 'S_Dalmuir'? NO
```

Figura 137 - Check connectivity between two stations

4.3.2.3.2.3. Visualize Railway Network

```
╔═══════════════════════════════════════╗
║                Connectivity Menu      ╒
╠═══════════════════════════════════════╣
╒  1. Check Connectivity Between Stations  ╒
╒  2. Check Connectivity Between Two Stations  ╒
╒  3. Visualize Railway Network        ╒
╒  0. Return                           ╒
╚═══════════════════════════════════════╝

Choose an option: 3
```

Figura 138 - Visualize railway network

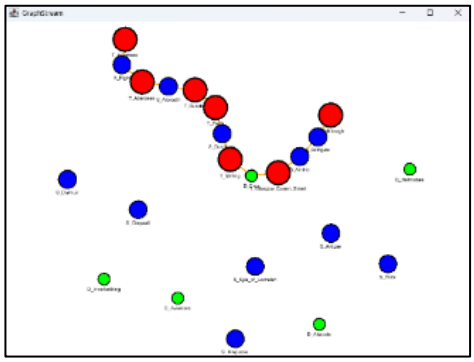


Figura 139 - Visualize railway network - graphic

The *Connectivity between Railway Lines* section allows players to analyse how stations are linked within the railway network. There are three main features available. The first is to check connectivity between stations, where players can exclude specific types of stations such as depots, stations or terminals and verify whether all remaining stations are connected. The second feature allows players to check the connectivity between two individual stations by selecting an origin and a destination from a list. The system then verifies whether a path exists between them, either directly or through intermediate stations. Finally, there is also an option to visualize the railway network, providing a graphical overview of how stations, either only those that support electrical trains or all types and the lines between them are connected.

4.3.2.4. Maintenance of Railway Lines

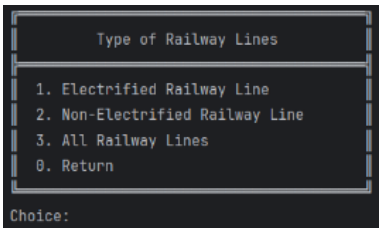


Figura 141 - Types os railway lines

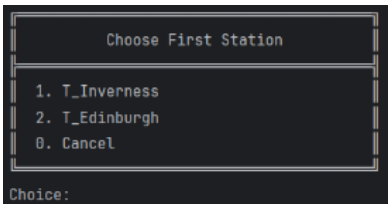


Figura 140 - Choose first station

4.3.2.4.1. T_Inverness

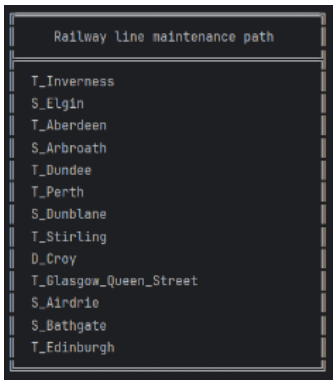


Figura 143 – T_Inverness - Railway line maintenance path

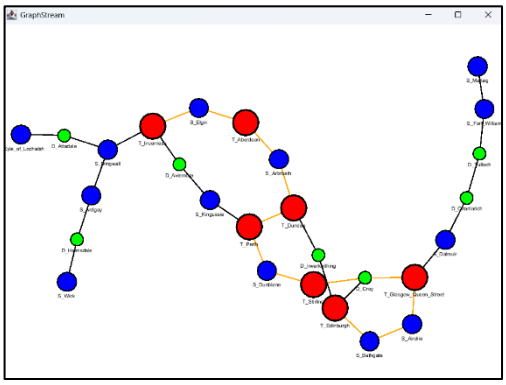


Figura 142 - T_Inverness - Railway line maintenance path - graphic

Figura 144 - T_Inverness - Railway line maintenance path - confirmation message

4.3.2.4.2. T_Edinburgh

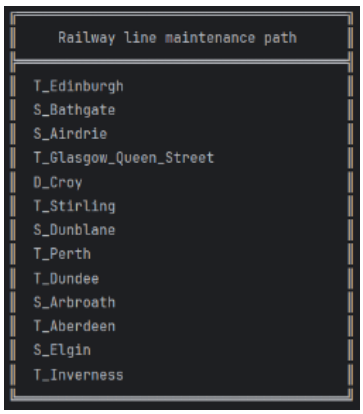


Figura 146 - T_Edinburgh - Railway line maintenance path

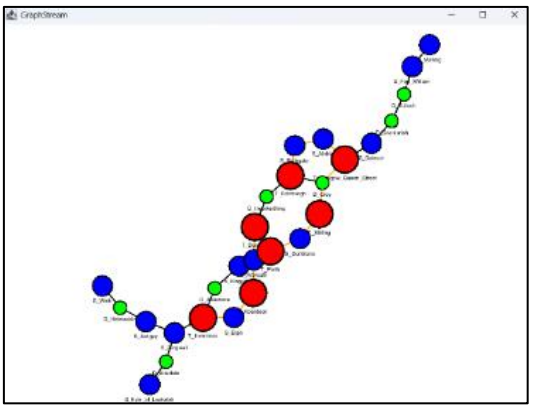


Figura 145 - T_Edinburgh - Railway line maintenance path - graphic

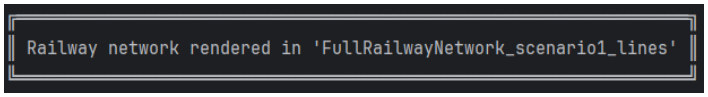
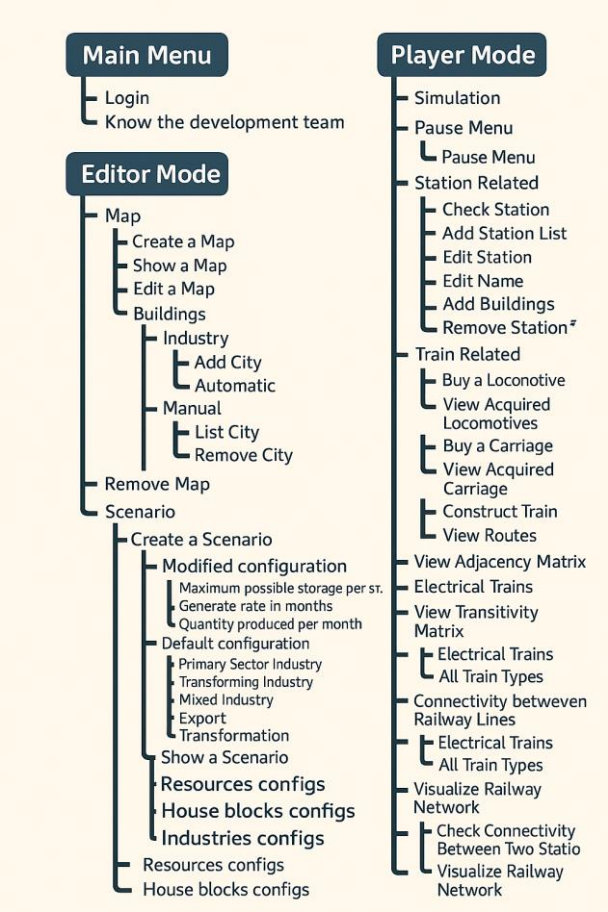


Figura 147 - T_Edinburgh - Railway line maintenance path - confirmation message

Simplified Version - Step by step



The program is organized into three main areas: the Main Menu, the Editor Mode and the Player Mode. When the user starts the application, they begin in the main menu, where they can log in and meet the development team.

From there, they enter Editor Mode, which is the phase where the simulation world is built. In this section, the user can create and edit maps, adding buildings like industries and cities (automatically or manually). It is also possible to remove maps, create scenarios and adjust the settings of these scenarios. The configuration options allow you to define, for example, the maximum storage per station, the generation rate and the amount of resource production. There are also specific settings for resources, residential blocks and industries, ensuring that all the elements are ready before simulating.

Once the environment has been set up, the user can switch to Player Mode, where the simulation itself takes place and where you can pause, reaload, increase speed and reduce speed. In the Pause Menu, you can manage stations - adding, editing, visualizing or removing - as well as construct buildings within the stations. You can also buy locomotives and carriages, assemble trains and visualize existing ones. Railway lines can be created, listed, deleted or updated according to the user's strategy. Finally, routes can be created based on existing infrastructure, and there are various tools for analyzing the connectivity of the rail network, such as adjacent matrices, transitivity and visualization of train routes.

5. Troubleshooting

Issue 1 - Application does not starts

- **Symptom:** Running the application doesn't open the application.
- **Possible Cause:** Java runtime environment is either missing or corrupted.
- **Solution:** Confirm that Java is correctly installed and configured. Try rebooting your system. If the issue remains, reinstall the application and Java.

Issue 2 – Simulation freezes or stops responding

- **Symptom:** No updates are displayed on the simulation interface, nor will the simulation react to any inputs.
- **Possible Cause:** High CPU/memory occupancy or infinite loops during event execution.
- **Solution:** Terminate other applications in order to improve system resource availability. Check that the simulation scripts do not contain errors or infinite loops in the simulation scripts. Restart the application.

Issue 3 – During simulation no resources are being generated

- **Symptom:** Time advancement does not translate to any changes in the inventory of stations.
- **Possible Cause:** Absence of resource generation in the station's area of influence.
- **Solution:** Ensure proper strategic placement of the stations so they can generate resources in their area of influence.

Issue 4 – Routes cannot be created

- **Symptom:** When attempting to create a new route, an error message appears stating that required elements are missing.
- **Possible Cause:** An error appears indicating that the necessary components have not been included when creating a new route.
- **Solution:**
  - Create at least one station on the map first.
  - Construct multiple railroad tracks that link all the relevant regions.
  - Build a minimum of one train which must include a locomotive and suitable carriages.

  Upon fulfilling these requirements, it will be possible to create a new route without any issues.

Need more help?

Contact our Support Service or Helpdesk Team at:

📧 Email: MABECDevelopments@gmail.com

📞 Phone: +351 968 692 446

6. Frequently Asked Questions (FAQs)

Q. 1: Is it possible for me to access the Railway Simulation app on my cellphone?
A. 1: Unfortunately, the app is only accessible via a desktop system running in a Java-based environment configuring now.

Q. 2: What is preventing me from designing a route in the simulation?
A. 2: For routes to work properly, there needs to be at least one station, a train, and a railway line. Additionally, the train's line must be suitable for the fuel type used by the train, so make sure these prerequisites are met.

Q. 3: Do the stations require geographical proximity to the city and/or industries?

A. 3: Yes, in order to generate or consume load, the stations must be located within the range of influence from cities or industries, but if a station is desired only as a complementary stop on a route and not for load generation or consumption, it can be placed far from any city or industry.

Q. 4: What do I do if I run out of money in the simulation?
A. 4: As a result of having no money, you will be unable to construct any new additions such as; stations, or railway lines. You are faced with the possibility of waiting for further profits or restarting the scenario.

Q. 5: Is it possible to upgrade a station with any building at any given time?
A. 5: No, there are certain requirements in terms of the current simulation year. Some structures supplant others and cannot coexist.

Q. 6: Is the simulation real-time, or is it turn-based?
A. 6: The simulation happens in months, which facilitates further subdivision. It can be paused, started, and sped up or slowed down during execution.

Q. 7: Where can I access the information for a train's route between two stations?
A. 7: From the control panel, make use of the specific train type selection path validation tool (steam, diesel, electric).

7. References

1. JETBRAINS. *Guia de instalação do IntelliJ IDEA*. Disponível em: https://www.jetbrains.com/help/idea/installation-guide.html#toolbox. Acesso em: 18 maio 2025.