

Cos 214 Report: sudo-apt-get -marks

<https://docs.google.com/document/d/1ZHHgRcZDZM67LnuOBWLZ62E4VuhhpHCeZx697asKxBU/edit?usp=sharing>

Research Brief:

A major part of urban development is to plan and to do so strategically. This may include demarcating certain areas for infrastructural expansion, sector demarcation and the ease of transportation. We have used a city growth and city sector class to achieve this. The city sector class keeps track of all the buildings and citizens who interact with these buildings. This allows the city to be viewed as sectors, to determine which sectors may need more buildings, utilities, or transportation. (Sailus, 2024)

For a functional city to operate at a high capacity, service delivery and the collection of resources needs to be as efficient as possible. Within our city, powerplants, water supplies and waste management facilities are all used to maintain the citizens satisfaction. Supplying energy and water to the citizens whilst maintaining a clean city via the waste collection. (ETU, 2024)

A major challenge within most modern cities is the need for energy and how to produce such without major carbon emission. However, there are many ways modern societies have combatted pollution and the need for power generation. Renewable sources of energy such as wind, water and solar are being used worldwide in place of the traditional coal power plant. Therefore, users are given the choice to construct different power plants, such as hydro, wind, solar and coal. Creating power plants that produce clean energy increases citizen satisfaction, while creating coal power plants does the opposite. (United Nations, 2024)

The citizens are a vital part of any city and need a way to commute to and from work and home. In most countries the average commute time from home to work is around 25 minutes. Each sector of the city is populated with a citizen's workplace and residential stay, with different types of roads for the different types of citizens to reduce traffic congestion and average time it may take a person to get to work.

Design Pattern Applications:

Observer: To notify out citizens of any changes made in the city, the government acts as the subject and each specific type of citizen as the concrete observers. Our game is based on the satisfaction of the citizens which changes based on the governments(users) changes to the city. If the government performs an action, an update method is called which notifies the citizens. The citizens act accordingly by increasing or decreasing their satisfaction.

Prototype: Buildings have a clone function, which allows a building to be copied without repeating the complex implementation of creating a building. This is useful when the same type of building is constructed multiple times.

Adapter: There are two types of transport, namely the Road System and the Rail System, which have their own adapters that inherit from a unified interface that allows for the government to interact with the transport systems in the same way, whether it is to add a road or railway. The transport is seen as the same through the adapter design pattern. This addresses the ease of creation in a city for a government.

Singleton: The singleton pattern is used with relation to our resources such as the budget, wood, concrete, energy, water, etc. This allows for the same instance of each resource to be affected at different points in

our program and for there to be no discrepancies between for example the wood in the government class and the utilities class.

Command: The command pattern is used to create an object called Monthly Routines that is kept in the government class. This object has commands such as: Upgrade All Rails and Upgrade All Roads. These are commands that the government can call all at once. If there is insufficient transport for citizens to get to work, they become unhappy, and the different monthly routines can be executed to increase their satisfaction once again.

State: The state pattern is used to create utilities that are either functional or nonfunctional based on a repair and malfunction method. The design pattern allowa for the utilities to switch between the malfunctioned and functional state at run time by creating a new object of the relevant class. The utilities malfunction when a natural disaster occurs and can be repaired by the user.

Strategy: The strategy pattern is used to switch between tax strategies which are algorithms as to how the government collects tax from the citizens assigned to the workplace buildings. The tax strategies consist of flat tax strategy and a progressive tax strategy.

Composite: The composite design pattern is implemented as a CityGrowth object which then holds a vector of CitySector objects to act as the composites of the pattern. The sectors each hold a vector of buildings which act as the leaves of the pattern as the sectors and the buildings are treated the same by the component. This allows for the city to be seen as individual parts or as a whole.

Factory Method: The factory method is used in the creation of citizens. The citizen class is defined as an abstract class. Allowing for various types of citizens to inherit from this class. A citizen factory then defines the way that each concrete factory will produce their respective citizens. Each concrete factory then allows the creation of different types of citizens including, industrial, commercial and government workers as well as industrial, commercial and government residents.

Template: The template pattern is used in the retrieval and refinement of materials such as wood and concrete. The increase method is defined in the materials class as well as two pure virtual functions, obtain and refine. Each material that inherits from materials must define the obtain and refine method as these are both called in the increase function with materials. Therefore, calling increase in materials will call the subsequent methods.

References

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