Functional Requirements

BUILDINGS:

- Design Pattern: Abstract factory to create the buildings which each belong in a family
- Starting point: a few of each building I guess
- User ability:
    - Buy buildings: will diminish city budget and use resources
    - Destroy buildings: will add to materials resource
- Effect of buildings:
    - **Residential**: decide the maximum population capacity
    - **Commercial**: will affect future city budget
        - More commercial buildings -> generate income over years for city budget obtained from tax
    - **Industrial:** decide maximum resource capacity
    - **Landmarks:** will affect citizen satisfaction
        - More the better
- General: Each building will have a certain cost (which will be subtracted from city budget) and resources required (which will subtract from resources) when built.

UTILITIES:

- Design Pattern: Command and Adapter
- Starting point: one of each plant I guess
- User Ability:
    - Buy utilities: will diminish city budget and use resources
    - Destroy utilities: will add to materials resource
- Effect of buildings:
    - **Power plants:** generate electricity
        - More buildings = higher energy consumption
        - Create jobs for `energyWorkers`
    - **Water supply:** generate water
        - More residential houses and landmarks = higher water consumption
        - Create jobs for `waterWorkers`
    - **Waste management:** decide level of hygiene
        - More citizens = more waste management required
        - More industrial buildings = more waste management required
        - Create jobs for `wasteWorkers`
    - **Sewage systems:** decide level of hygiene
        - More citizens = more sewage systems required
        - Create jobs for `sewageWorkers`
- General:
    - Essential for functioning of the city -> if not looked after will be end of city
    - Power:
        - More buildings -> more power consumption
        - When power drops too low -> citizen satisfaction diminished
        - Option to change over to nuclear -> if that drops too low then city explodes
    - Water:
        - More Resident & Landmarks buildings -> more water consumption
        - Water drops too low -> citizen satisfaction diminished -> maybe they drought and they all die
        - Have option to open damn wall to restock water (only get one)
    - Waste & sewage:
        - If drops too low -> change of outbreak and then chance everyone die

TRANSPORTATION:

- Design Patterns: strategy, state, observer
    - State -> state of roads
        - Not Operational:
            - Work comes to a halt (no power generation, etc.)
            - Decrease citizen satisfaction severely
        - Bad:
            - 25% reduced productivity (power generation)
            - Decrease citizen satisfaction slightly
        - Okay:
            - No pros or cons
        - Good:
            - 25% increased productivity
            - Increase citizen satisfaction slightly
        - Exceptional
            - 40% increased productivity
            - Increase citizen satisfaction severely
    - Observer -> when roads change states, make calls to productivity and citizen satisfaction
    - Strategy -> IDK
- Starting Point: IDK, maybe start with basic roads and public transit
- User ability:
    - Users can opt to invest in trains, airports, upgrade roads, and upgrade public transit
    - Will cost resources and budget
- Effect of buildings:
    - **Roads**:
        - can contribute to citizen satisfaction (amenities)
        - Increase employer efficiency
    - **Public Transit:**
        - Same as above
    - **Trains:**
        - Same as above
    - **Airports:**
        - Can serve as a means of passive income from foreigners which contribute to the city budget. Will be expensive to build
- General:
    - Basically just options for the user to upgrade to help improve efficiency and satisfaction of citizens

CITIZENS:

- Design Patterns: Prototype, template
  - Template: Different types of citizens based on their job
    - energyWorker: will work for power supply
    - waterWorker: ditto
    - wasteWorker: ditto
    - sewageWorker: ditto
    - unemployed: when no jobs are available and population continues to grow
      - essentially provide nothing to city but increases citizen consumption and needs
    - homeless: basically like unemployed but occurs when no more resident buildings are available
  - Prototype: used to create instances of citizens
- Starting point: will have a pop of like 50 or something
- User Ability: No direct control of the citizens, they just have to model the city in such a way that they are satisfied and happy -> will basically be a measure of success
  - Do have control over the purchases of services (healthcare, security, entertainment)
  - Like before these will cost from budget and resources
- Effect of parameters:
  - **Population Growth:**
    - Will use a population growth formula which is applied every year
    - Factors:
      - Birth Rate
        - Healthcare
        - Bad education
      - Death Rate
        - Lack of health care
        - Bad hygiene
        - Bad security
        - Lack of water
        - Bad satisfaction
  - **Employment:**
    - Will be decided by utilities
    - There will be available jobs and when this is exceeded, they become unemployed
  - **Services:**
    - Healthcare -> better healthcare = decrease death rate and increase birth rate. Can also be used in the deciding factor if the city succumbs to an outbreak
    - Education -> decrease birthrate – prevent population boom
    - Security -> decrease deathrate and increase satisfaction
    - Entertainment -> increase satisfaction
  - **Satisfaction:**
    - Calculated from all the factors which have been mentioned (I will make a specification which specifies everything which affects citizens' satisfaction)
    - This is basically the score of the game, the user should aim to score for highest possible satisfaction

GOVERNMENT: (Ronan had some interesting ideas he could add here)

- Design Patterns: Mediator, Singleton
- Starting Point: A city budget of $1 000 000 or alike can be the starting point
- User Ability:
    - Control of budget
        - Use of budget (mainly for building)
        - Increase of budget (decided by tax rates, foreign income, etc.)
- Effect of parameters:
    - **Taxation:** will be elaborated on in taxes class
    - **City Budget**: Will be the pool of money in which the user uses to upgrade the city
        - It will be their responsibility to manage their budget efficiently and will be the main goal of the game, along with citizen satisfaction
    - **Policies:** Not too sure what we can add here which affects city dynamics
    - **Public Services:** Same as services for citizens, maybe we have some worker as follows:
        - healthcareWorker
        - lawEnforcement
        - teacher
        - etc
        - These will function similar to the other workers and will have to be implemented in the template design pattern for citizen
        - Will also need power and roads to remain functional

RESOURCES:

- Design patterns: Observer
  - When the resources drop below a certain threshold, observer makes calls to the utilities to enforce alternative strategies
  - E.g., when power drops below 10% -> activate nuclear & decrease satisfaction
    - When nuclear drops below 10% -> boom
  - E.g., When hygiene drops below 40% -> increase random chance of disease outbreak -> decrease satisfaction
  - Etc.
- Starting Point: predefined amount of starting resources including:
  - 10 000 steel
    - Needed to build power plant and other buildings
  - 15 000 concrete
    - Needed to build hospitals and other facilities
  - 5000 tar
    - Used to construct and upgrade roads
  - etc
- User Ability:
  - User's goal is to efficiently manage their resources to effectively build necessary requirements in a city
- Effect of parameters:
  - **Materials:**
    - Same as mentioned above, there will be different resources that the user makes use of
    - Depending on the city's satisfaction at the end of each year, they are rewarded with an amount of resources directly proportional to their citizen's satisfaction
  - **Energy:**
    - Will be produced by the power plant
    - Necessary for running of buildings and a lack of causes dissatisfaction along with potential boom
  - **Water:**
    - Will be produced by water supply
    - Necessary for citizens to live, lack of water will increase death rate
    - Can also cause drought if water runs out
  - **Budget:**
    - Same thing as city budget

TAXES

- Design patterns: Strategy & memento
  - Strategy
    - Different ways to calculate taxation strategies
      - Progressive
      - Flat
      - Regressive
  - Memento
    - Previous years tax will be used to calculate current tax
- Starting point: User chooses their beginning tax rates and the strategy
- User ability:
  - Will have the option to change their tax rates each year
  - A high tax rate will yield in an increase in budget, however, will decrease citizen satisfaction
- Effect of parameters:
  - **Tax Rates**
    - Adjustable rates
    - Different types of tax
  - **Collection**
    - Will be collected from workers – more workers more income tax for city budget
  - **Allocation**
    - Not much to say here
  - **Impact**
    - More tax – increase in city budget but decrease in satisfaction which leads to a decrease of material rewards

CITY GROWTH

- Design patterns: Memento
    - Memento used to store each years stats
    - Can then be used to calculate improvements or deterioration of current year compared to previous years
    - Basically users can check their stats from previous years
- Starting point:
    - Display the starting points stats
- User ability:
    - Not much user ability, just a summary of the year's progression
- Effect of parameters:
    - **Population growth:** obtained from citizens population growth
    - **Housing needs:** comparison of citizens and residential buildings
    - **Economic Development:** Commercial and Industrial stats
    - **Infrastructure expansion:** road and utilities stats