[4# Analysis Model (2)]

[5] – [SoftProLab Team]

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4. Analysis model – version 2

4.1 Object catalog

4.1.1 Asteroids

Asteroid is one of the main entities in the game. They can be hollow and radioactive. In case the asteroid is hollow, it has the property to store mineral inside it or to hide settle/robot in it. Radioactive asteroid can exploade if its state is prehelion and it get drilled.

Interaction with Other Entities & Responsiblities:

These Asteroids objects are full of minreals/resource object which are located at the mantle/core of them. There are countless asteroid object spread throughout game. They are mapped at different location in game.

Beside that it mainly interacts with settler , robot and gate objects. Settler can travel to one of the Asteroid and drill through it to reach its core where all the material/resource is at. Gate object connects settler to one of the neighbour asteroid. It can be use to teleport to another asteroid. Robot can also travel to these asteroid and plunder them. While they can drill to core they can't really collect any resources.

Asteroids are responsible for managing different kind of other asteroids using the minerls object which will assign random mineral to it at start. They have 2 states i.e perihelion and aphelion. Which ultimately decide what kind of asteroid its going to be. For instance, In case the asteroid has water mineral inside and it has prehelion state assigned to it. It'll result in water melting and making the asteroid hollow. Or If Asteroid has uranium inside it then it becomes radioactive asteroid, which is a dangerous asteroid that can possibly be responsible for settler's death as it can exploade in case its near sun i.e prehelion state.
They also have to have random depth to their core. For some Asteroid more drilling is required while for some less is required.

4.1.2 Settler

Settler is the main entity that is controlled by player. It can perform various functions like moving to a nearby asteroid object using Travel method. It can drill on said asteroid using Drill method. It can mine out the material/resource object from the asteroid using mine method. Though Settler can only store 10 materials on them. If they collect all the different required material object, they can use build method to build a spaceship which will result in game ending.

Interaction with Other Entities & Responsiblities:

In case Settler have enough resource object they can use build method to build a robot which can perform some task similar to it. It can also make a Teleportation gate to an asteroid by consuming enough material object as price. In case Sunstrom Object hits the Settler object, it dies and game ends. But if Settler is on a hollow asteroid object it'll have an additional option hide by using that they can hide inside hollow asteroid and save themself. In case Settler is on Radioactive asteroid and its state is perihelion then if settler dig to its core, it'll result in asteroid exploding and killing settler.

Settler is responsible for collecting material object through drilling and mining which are its feature. It's also responsible for building other entities like robot, gate etc. throughout the game.

4.1.3 Place

Its other crucial element that plays important role in the game. It's used to place or map the different asteroids, gate etc throughout the game.

Interaction with Other Entities & Responsibility:

It interacts with majority of object present throughtout the game. It's responsible for placing the gate at certain place near the neighbouring asteroid. Same can be said for the Robot and settler. It set them to different asteroid and it also remove the robot in case it get hit by sunstrom resulting in it exploding. Vice Versa the radioactive asteroid that are near prehilion state result in asteroid exploding when it get drilled to its core, so place object remove the that specific asteroid. In case a robot was on the said asteroid then it will survive and it'll get passed to neighbouring asteroid which is also done by place class. Place object is vital for keeping track and placing these objects throughout the game.

4.1.4 Minerals

Minerals are the objects that are contained inside the asteroid. They consist of as a skeleton materials object for the other classes like Water, Ice, Iron, Carbon , Uranium. They play a major role in the game. They are releated to majority of the objects in the game.

Interaction with Other Entities & Responsibility:

Asteroids are the one that affect the state of the material objects most. Settler collect these materials through asteroids. When all kind of materials are collected by settler they are used to make spacestation object. If settler have collected certain material they can be used to make other object like robot and gate.

There could only be same type mineral that can be inside asteroids and mineral class make sure that it stays that way. Minerals are also responsible for creation of other object when certain certria is met.

4.1.5 Uranium, Water-Ice, Carbon, Iron

There are some of the material that settler have to collect in order to win. Beside that they have some important function that are in below paragraph.

Interaction with Other Entities & Responsibility

The biggest interaction these objects are going to have, will be with Asteroid. And these interaction affect the asteroid greatly. Depending on the kind of material that get assigned to asteroid, it impact different object as whole. For instance in case a uranium is inside a asteroid and that certain asteroid is in prehelion state, it'll result it exploding in case settler or robot drills in it. Similarly if a asteroid is in the prehelion state and it have water-Ice inisde it as material object then they will vaporized since being in prehelion state means they are near sun which will result in getting vaporized,. Beside that they also play important role in building of the object like robot, gate etc. If the Settler combine certain materials together it will result in creation of certain object. For instance:- some unit of uranium object, carbon object and Iron object will result in making of a A.I robot. Hence they play important part in the game.

4.1.6 Game

Game object is used to mange the start and ending of the game.

Interaction with Other Entities & Responsiblities

It doesn't interact with many other objects. But other objects interaction ends up triggring it. In case a settler dies it'll result in the game being over thus game object will be used. But in case the settler collected all the mineral objects and survived to build the space station, it will result in player winning the game and thus game object will be used to showcase that. At the start of the game, game object is the one that is used to start the game.
It's main purpose is to manage start and end the game. It contain main menu. Where we can start the game. Beside that it is responsible for adding the different entites in the game. Like SunStrom,Asteroid etc. It's also responsible for removing them in case they expload or robot get destroyed, sunstrom vanishes etc.

4.1.7 Robot
A Robot object can come into play in the game if settler have enough resources to build one.

Interaction with other entities & Responsibilities:

Robot can perform tasks similar to that of settler. It can travel to neighbouring asteroids at random and it can drill them to their core but it can't collect the resources within them. Also, during sunstrom it can hide inside a hollow asteroid to save itself but if sunstrom hits it, robot get destroyed. Robot can also dig on radioactive asteroid without worries as even if radioactive asteroid which is at perihelion state explodes it will not destroy robot but throw it

to neighbouring asteroid. Robot can also use gate object to travel from one asteroid to another.
Robot is also responsible for travelling to neighbouring asteroids and drilling them to their core. It makes easy for settler to come and collect material as robot can't collect material.

4.1.8 SunStrom

SunStrom is a phenomenon that occurs at random time during the game.

Interaction with other entities & Responsibilities:

As soon as a Sunstrom object is initialize to run through the game object which initiates making of it by adding it in game, settler gets informed about its action. SunStrom destroys everything in its path. If Settler is not hiding and it get struck by SunStrom object it'll die and that will make the game object to end the game. Same goes for Robot object i.e., it's also part of traveller entity. If it gets hit by the SunStrom it'll explode. Gate objects built throughout the asteroids also get destroyed in case they are hit with the SunStrom in the asteroid belt.

SunStrom is responsible for removing/destroying different entities throughout the asteroid belt. It occurs at random time and it vanishes after certain time.

4.1.9 Gate

Gate's most prominent feature is that it can be used to teleport the settler to one asteroid and to another asteroid which it has been interconnected with.

Interaction with other entities & Responsibilities:

Gate object can only be made when settler have enough resources and it use certain material object to build the Gate. The Iron material object, uranium object and water-ice objects different unit is combined together in order to make the Gate object. Gate object can also be used by the robot. It'll transfer it to neighbouring asteroid like settler can. Though, if a Gate gets hit by a SunStrom object it can get destroyed which will result in waste of the said materials.
Gate is responsible for teleporting the settler and the robot to one asteroid to the other one which is near by the said gate which is done by place object.

4.2 Static structure diagrams
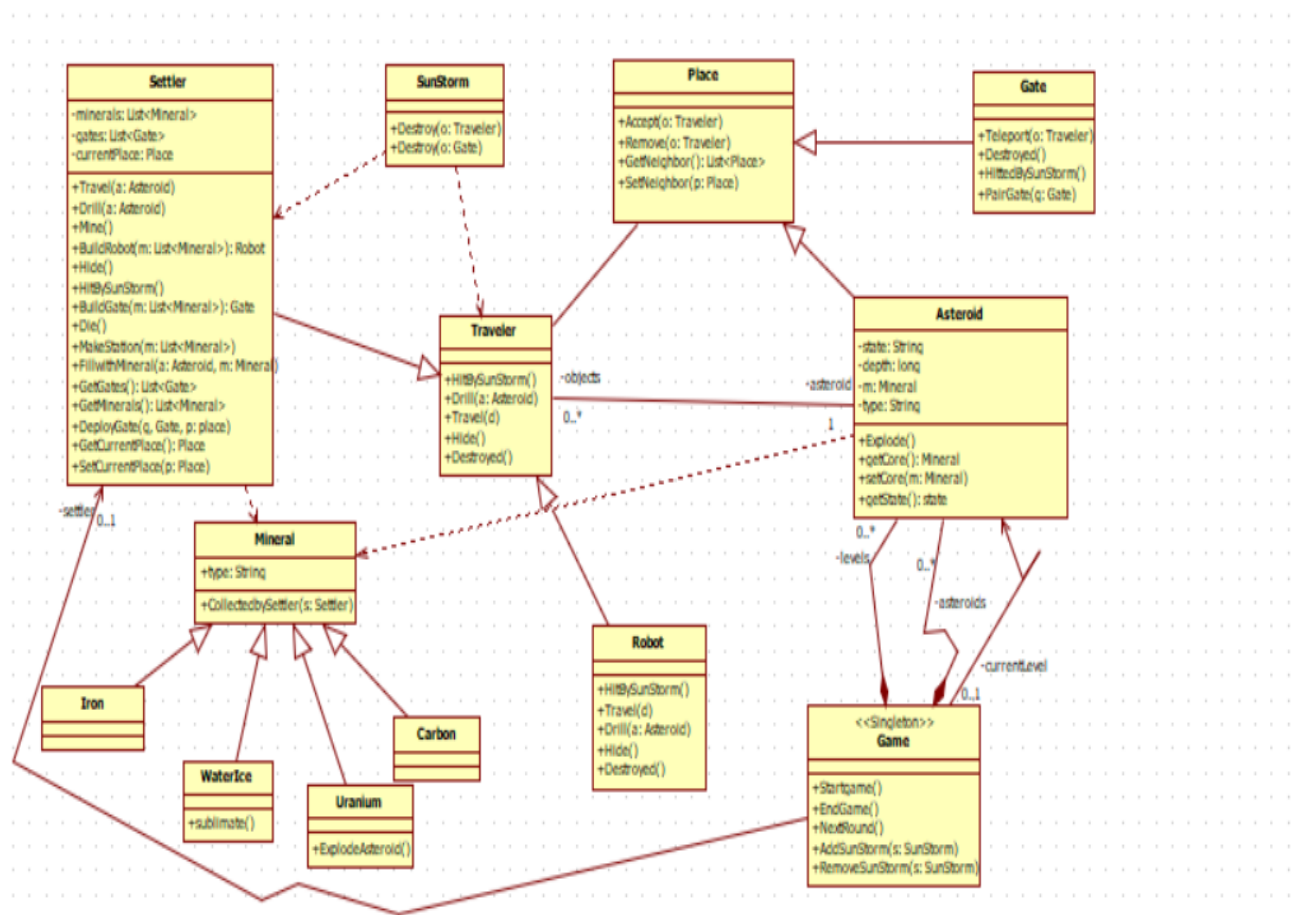
4.3 Class description

4.3.1 Settler

- **Responsibility**

  Settler is the actual person, the user who is actually in the game, playing the game. This class is very essential for the whole game as it contains the most important functions and methods which the settler is going to carry out/perform. Players of the game control the settlers that wander in the asteroid belt with single person spaceships looking for resources. Settler class can do functions like travelling, drilling etc. which I am going to explain in the next part.

- **Super classes**

  Traveller

- **Attributes**
  - **Minerals:List <mineral>** : This attribute is used to list all the minerals that settler is going to mine.
  - **Gates:List<Gate> :** This attribute is used to list all the gates that user and robot is going to built.
  - **currentPlace: Place :** This attribute is used to check the current place of the settler.

- **Methods**
  - **Travel(a: Asteroid)**: This is the method which defines in which direction the settler is going to travel. The settler can travel in left, right, up and down direction depending on which asteroid it wants to mine. The player can travel in whatever direction he wants by using his/her keyboard keys looking for resources to build a space station.

  - **Drill(a: Asteroid):** The settler is able to drill through the asteroid to reach its core where all the material/resource is at. Drilling method is used to access the minerals and resources that deeply seated in the asteroids. Settler can use this method to drill the hole in the asteroid by only one unit.

  - **Mine( ):** This method defines that the settler can mine i.e., he/she can extract valuable minerals from the core of the asteroid. This method is only possible if the asteroid has been complete drilled through.

  - **BuildRobot(m: List<Mineral>): Robot:** This method can be used if the settler wants to build the robots if settler has enough resources to build one. If the settler doesn't have enough resources/minerals to build the robots then this method won't work.

  - **Hide( ):** This method is going to be used by settler if he/she wants to hide in an asteroid but one condition for the settler to hide in asteroid is that the asteroid must be hollow otherwise, settler won't be able to perform this function.

- **HitBySunstorm( ):** This method defines that the settler can get hit by the sunstorm if it doesn't hide in the hollow asteroid.

- **BuildGate(m: List <Mineral>):Gate :** This function allows the settler to build teleportation gate and just like to bold robots, a settler need specific number of resources to bold these gates. This method is related to the both settlers and robots as they both are permitted to use these gates.

- **Die( ) :** This function can occur when the settler dies and the game ends. There could be multiple reason for this function occur which will be explained in the further classes.

- **MakeStation(m:List<Mineral>) :** This function indirectly means that the player has won the game and the condition which will be put in this method would be that if the settler has successfully built the space station.

- **FilledwithMineral(a:Asteroid, m: Mineral):** this method defines that when the asteroid is hollow, the settler can hide the minerals which are mined at other asteroids

- **GetGates():List<Gate>:** As the settler can take the gates with itself to any asteroid, this method returns the gates the settler have even if when the settler does not take them with itself

- **GetMineral():List<Mineral>:** Since the settler collects all the minerals after mining into the mantle, all the minerals collected can be obtained through this method

- **DeployGate(g, Gate, p: place):** This method defines that the settler can move the gates it have to a nearer location in order to teleport whenever necessary

- **GetCurrentPlace(): Place:** As the settler can travel between asteroids, this method returns which asteroid or gate the settler is in

- **SetCurrentPlace(p: place):** This method is to determine where the settler should travel now after getting done in one place

4.3.2 Gate

- **Responsibility**

    This class represents all the features and methods of the teleportation-gates. These gates are built by players if he/she has enough minerals to build these gates. These gates are used by settlers and robots. The main purpose of teleportation gates is to transport the settler and robot from one asteroid to another asteroid which is interconnected by the said gate.

- **Super classes**

    Place

- **Methods**
    - **Teleport (o:Traveler):** This method describes when and on which asteroid the settler or robot is going to be teleported. The settler can either be teleported to the radioactive active asteroid or otherwise. The type of asteroid is unknown to the player i.e., the player won't be able to know if the type of the asteroid is hollow or radioactive unless and until it does the drilling.

    - **Destroyed( ):** This method describes when the gate will be destroyed. If the settler or robot uses teleportation gates and gets teleported to a radioactive asteroid and if by chance the settler starts drilling the radioactive asteroid then this can cause destruction of the gate.

    - **HitBySunStorm( ):** This method will explain that the gates can be destroyed by sun storm also.

    - **PairGate(g: Gate):** It will pair the gates with the other one so the settler can only travel between paired ones.

4.3.3 Mineral

- **Responsibility**

    This class is responsible for all the resources and minerals present in a game. The minerals can be radioactive and non-radioactive. It depends on the settler which asteroid it wants to mine. The non-radioactive minerals can be used by settlers to build spaceship, robots or teleportation gates. This class will make sure that if the asteroid contains mineral such as water or ice and if that asteroid is at perihelion then the resources would melt/sublimates.

- **Attributes**
    - **Type: String** : This attribute is going to tell which type of minerals are we going to use in the game.

- **Methods**
    - **CollectedbySettler(s:Settler):** This method tells that which type of resources and how many units of that resources the settler has collected. This method will contain a

counter which will make sure about this. The result of this counter will be shown on the game screen which would be helpful for the player to keep in mind how many resources he still has to drill and mine. The more the resources, the more the counter, the more the score.

4.3.4 Iron

- **Responsibility**

    Iron class is a child class of the the mineral class. Iron is considered as a resource in this game which is necessary for the user to collect to build the spaceship.

- **Super classes**

    Mineral

- **Attributes**
    - **none**

- **Methods**
    - **None**

4.3.5 WaterIce

- **Responsibility**

    Similar to Iron class, this class is also child class of the mineral class. Waterice is considered as a resource in this game which is necessary for the user to collect to build the spaceship.

- **Super classes**

    Mineral

- **Attributes**
    - **None**

- **Methods**
    - **Sublimate()** : This method determines if an asteroid is in the prehelion state and it have water-Ice inisde it as material object then they will be vaporized since being in prehelion state means they are near sun which will result in getting vaporized

4.3.6 Uranium

- **Responsibility**

    Similar to Iron class, this class is also child class of the mineral class. Uranium is considered as a dangerous resource in this game. If by mistake the settler exploit the asteroid that contains uranium, it can even die.

- **Super classes**

    Mineral

- **Attributes**
    - **none**

- **Methods**
    - **ExplodeAsteroid():** This method determines if for instance in case a uranium is inside a asteroid and that certain asteroid is in prehelion state, it'll result it exploding

4.3.7 Carbon

- **Responsibility**

    Similar to Iron class, this class is also child class of the mineral class. Carbon is considered as a resource in this game which is necessary for the user to collect to build the spaceship.

- **Super classes**

    Mineral

- **Attributes**
    - **none**

- **Methods**
    - **None**

4.3.8 SunStorm

- **Responsibility**

    The responsibility of this class is to make sure that sun storm occurs during the course of the game at any moment. A settler can survive the sun storm if it hides in a hollow asteroid. The sun storm can occur at any random moment and can vanish after a certain time. Sun storm can be the cause of the death of the player if it is not hiding which can lead to the failure of the game. Sun storm can destroy settlers, robots and teleportation gates.

- **Interfaces**

- **Methods**
    - **Destroy(o: Travel)**: This method describes the functionality of the sun storm i.e., it is going to destroy every object that comes in its ways. The object can be settler or robot.
    - **Destroy(o:Gate):** This method is going to destroy all the gates built on a specific asteroid if the sun storm reaches the asteroid or gate.

4.3.9 Robot

- **Responsibility**

    The responsibility of this class is to perform the functionalities almost similar to that of the settler. The robots can be built by settler if it has enough resources to build one. The robot class can be considered helpful for the settler as it can help the settlers to perform different functions which can lead to the winning of the game. It can make the players job a little bit easy.

- **Super classes**

    Traveller

- **Interfaces**

- **Methods**

    - **HitBySunStorm( )**: The method defines that when the robot is going to get damages. It can get damaged when it gets hit by the sun storm

    - **Travel( )**: The robot can travel from asteroid to asteroid within the space in search for resources to help the player. Robots are controlled by the program internally and it will be defined in this method that where and when the robot is going to travel

    - **Drill(a: Asteroid) :** This class defines that a robot can drill the asteroid in searching for resources. If the robot finds any resource useful for the settler then it can send

signal/message to the settler so it can come and collect the resources as robots are unable to collect the resources.

- **Hide( ):** This method defines that the robot can hide inside the hollow asteroid to escape from the sun storm. This method is possible only if the asteroid is hollow. If the asteroid isn't hollow then the option for hiding won't appear.

- **Destroyed ( ):** The robot can get destroyed if it gets hit by the sun storm. This can cause serious damage to the robot and can often lead to its destruction.

4.3.10   Asteroid

- **Responsibility**

    Asteroid is like a planet containing several minerals/resources which are located at the mantle and are to be mined by the player. Asteroid is one of key classes in the game since it contains the attributes and functions which handle travelling and mining processes. There are unlimited asteroid objects which are freely distributed throughout the asteroid belt. Its interaction is mostly with settler, robot and gate objects. Asteroids can be drilled by Settler and Robot in order to collect the minerals/resources at the mantle. Asteroid can perform several functions which will be explained in the ongoing parts.

- **Super classes**

    Place

- **Interfaces**

    Timer

- **Attributes**
    - **state: string** - This attribute shows the type of asteroid which can be either perihelion or aphelion
    - **depth: long** – It shows the depth of the asteroid that should be drilled to reach the core
    - **m:Mineral**: It tell which mineral would be contained by asteroid. It can be radioactive mineral as well
    - **Type:String:** It determines the type of asteroid which of course would be unknown to the settler unless and until it digs it.

- **Methods**
    - **Explode** (): This method will determine conditions in which the asteroid can be exploded for example sun storm, radioactivity. Etc.
    - **Getcore:Mineral :** This will get the asteroid's core mineral.
    - **Setcore(m:mineral):** This method will set the core of the mineral.
    - **Getstate():state:** This method would define the state of an asteroid, perihelion or aphelion.

4.3.11   Traveller

- **Responsibility**

  Traveller is a superclass for Settler, Robot and Gate thus it contains common features like hiding, drilling etc. All interactions between the child classes and Asteroid are handled through Traveller class. All the features will be discussed in detail in the next part.

- **Super classes**

  None

- **Interfaces**

  None

- **Attributes**

  None

- **Methods**
  - **HitBySunStorm()**: This method defines that when the object is going to get damages. It can get damaged when it gets hit by the sun storm
  - **Drill(Asteroid a)**: This method defines that an object which can be either Settler or Robot, can drill the asteroid in order to find resources.
  - **Travel(d):** This method defines that the object can travel from one asteroid to another. It is carried out according to the chosen direction.
  - **Hide():** This method which is available only in the presence of hollow asteroid, defines that the object can hide inside the hollow asteroid to escape from the sun storm.
  - **Destroyed():** Once the settler or robot drill a radioactive asteroid and reach to its core, the object will be destroyed. Thus, this method determines when the destruction will happen.

4.3.12   Game

- **Responsibility**

  This is the most essential class as it controls all the game from the player side. However, Game class doesn't interact with all the objects. It can start the game, monitor whether the game ends and provide menu bar to the player to have a certain control over the game. At the start of the game, game class plays initializer role that is used to start the game.

- **Super classes**

  None

- **Interfaces**

  None

- **Attributes**

  None

- **Methods**
- **void StartGame():** this a method which starts the game by calling all necessary methods such as triggering tick() method.
- **void EndGame():** Once the settler dies by explosion or sun storm destruction, it results in the game being over which is handled by this method. It stops all the ongoing processes and release the data to ensure that the game is in start state.
- **void NextLevel():** This method defines that when the player succeeds to built the spaceship and wants to continue with the next level
- **void AddSunStorm (SunStrom s)**: This method creates a Sun Storm and add it to one of Asteroids which then will be able to destroy all objects there.
- **void RemoveSunStorm(SunStorm s)**: Once the sun storm happens in an asteroid, this methods removes the sun storm from both the asteroid and asteroid belt.
- **Step()**: It tell that at which step of the moment, the sun storm is going to occur .

4.3.13   Place

- **Responsibility**

    Place is like a planet containing several minerals/resources which are located at the mantle and are to be mined by the player. place is one of key classes in the game since it contains the attributes and functions which handle travelling and mining processes. There are unlimited asteroid objects which are freely distributed throughout the asteroid belt. Its interaction is mostly with settler, robot and gate objects. Asteroids can be drilled by Settler and Robot in order to collect the minerals/resources at the mantle. place can perform several functions which will be explained in the ongoing parts.

- **Super classes**
    None

- **Interfaces**
    Timer

- **Attributes**
    none

- **Methods**
    - **void Accept (o: traveller)**: this method accepts a new object such as settler, robot and gate to the asteroid
    - **void Remove(o: traveller)**: Once a traveller leaves the asteroid or explodes, this methods removes it from the asteroid belt
    - **Asteroid GetNeighbour():List<place>:** Player wants to know neighbours around while planning to move Settler from one asteroid to another. So, this method returns Asteroid according to a chosen direction
    - **void SetNeighbour(p: place):** When it comes to add a new asteroid to the game, this method sets it as neighbour according to its location in the asteroid belt

4.4 Sequence diagrams

Remark: it was not possible to draw „gate" messages due to error in software, so I draw them as self-message
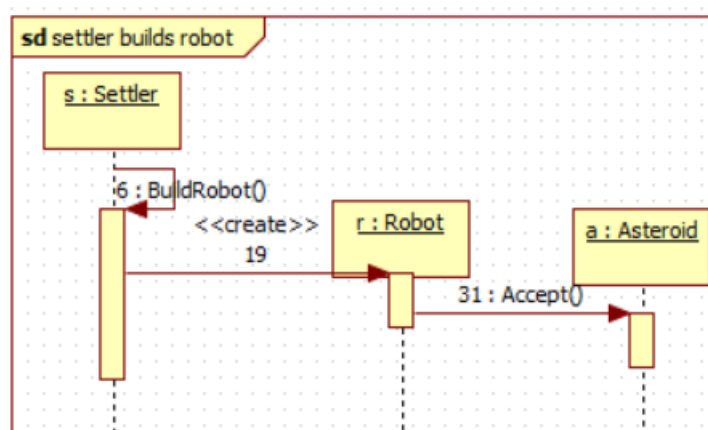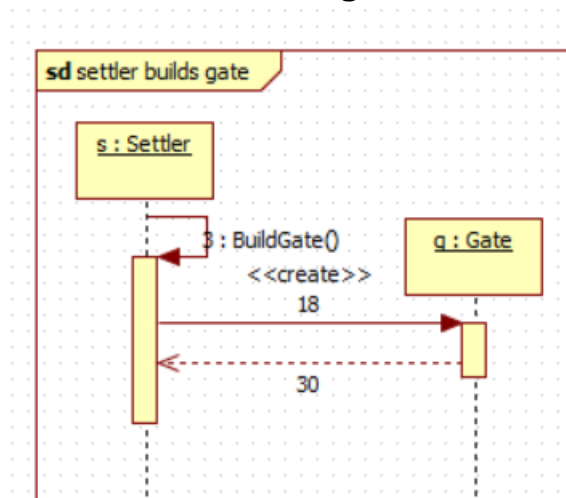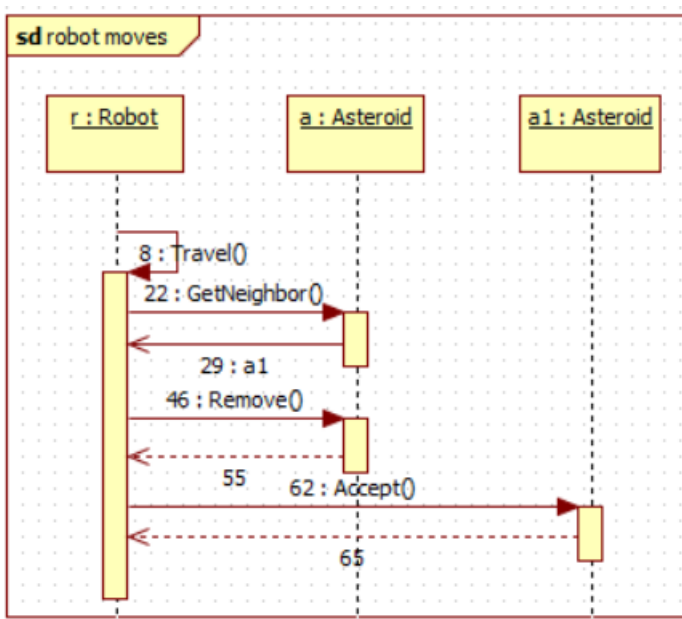
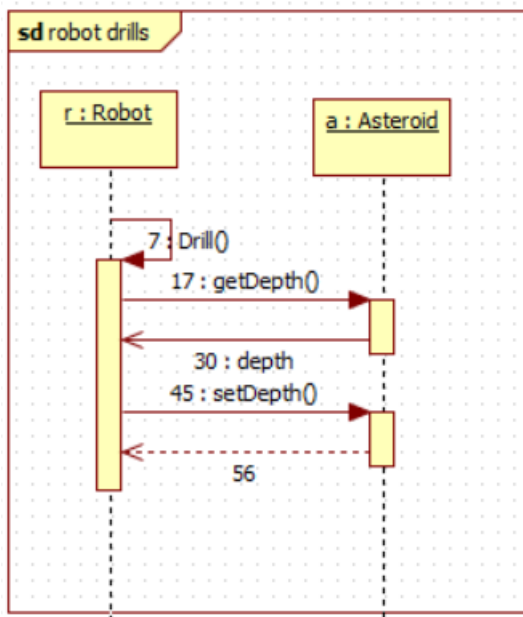### 4.4.1 Settler moves:
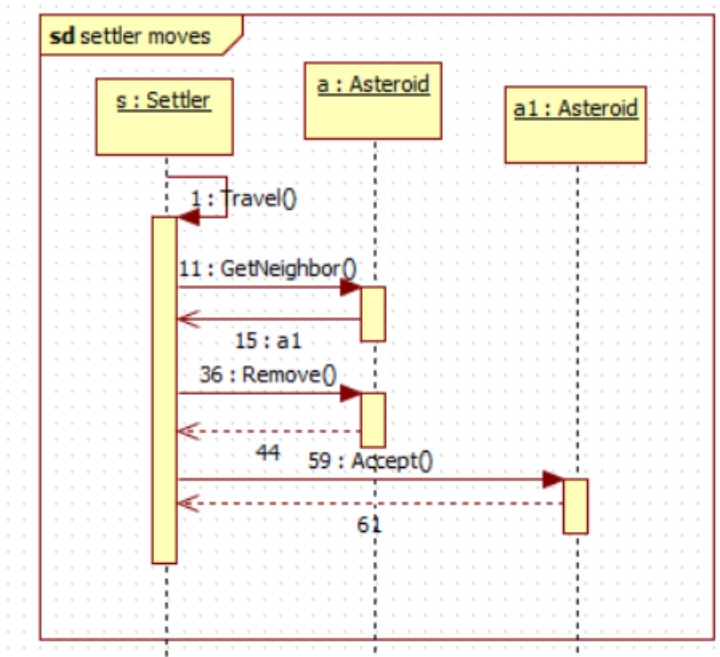
4.4.2 Settler mines:
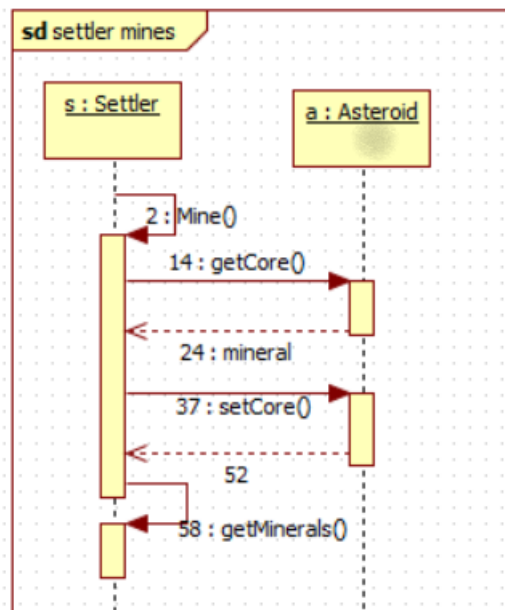
4.4.3 Settler drills:
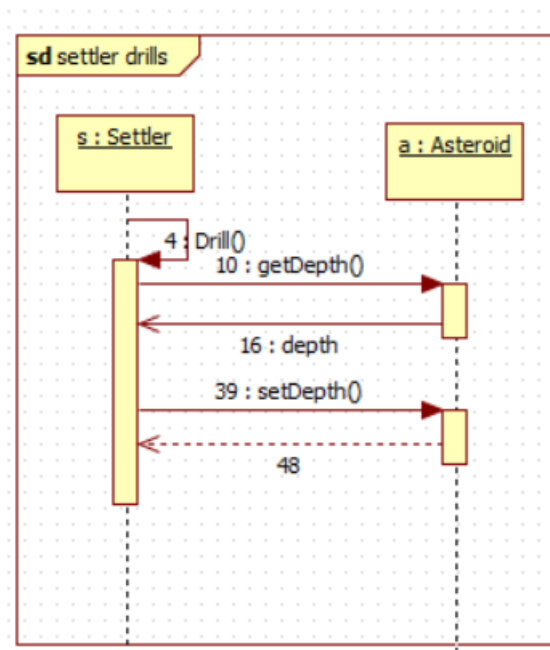
4.4.4 Settler hides:
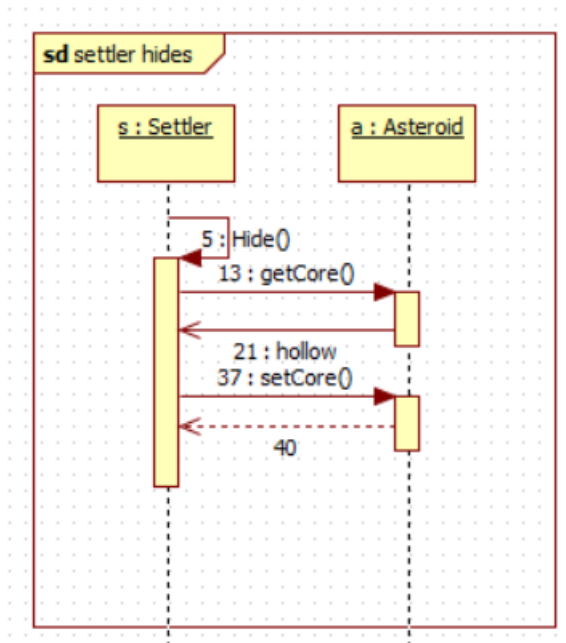
4.4.5 Settler builds robots:

4.4.6 Settler build gates:

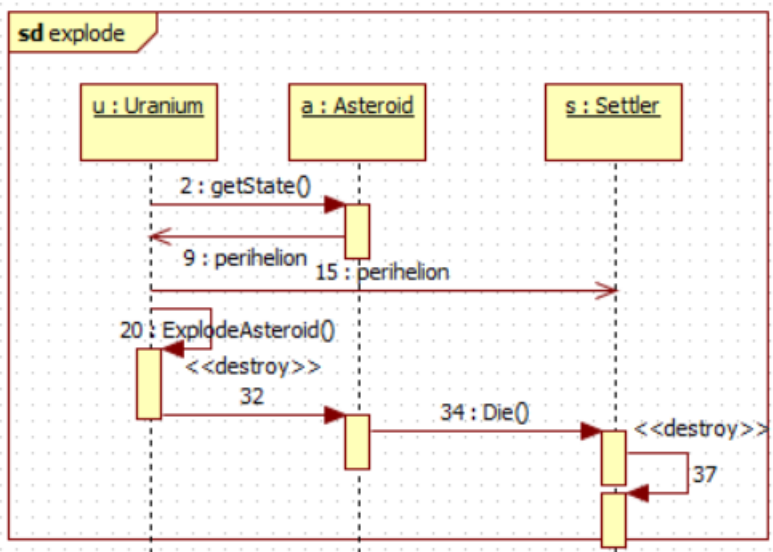### 4.4.7 Settler builds station:
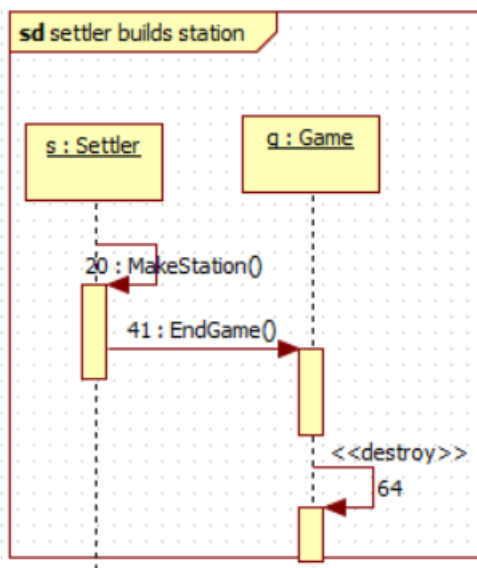
4.4.8 Robot moves:
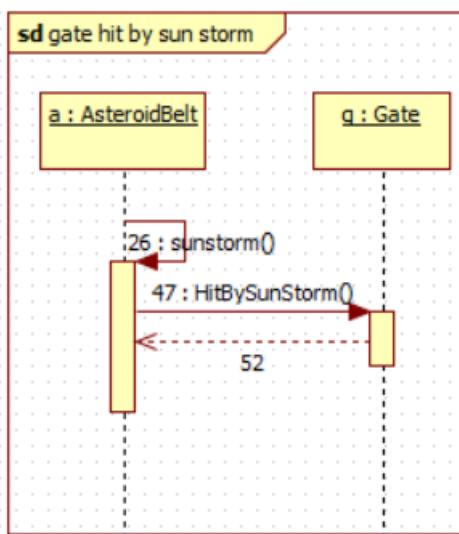
4.4.9 Robot drills:

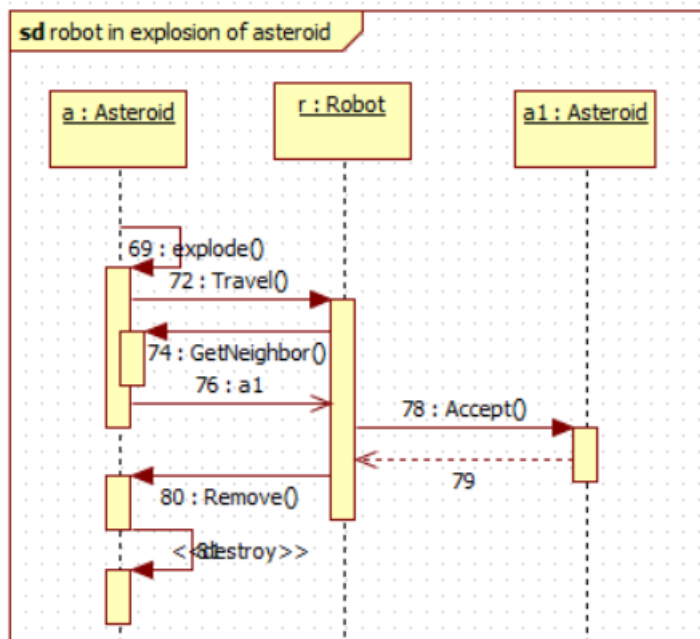

4.4.10   Robot hides:
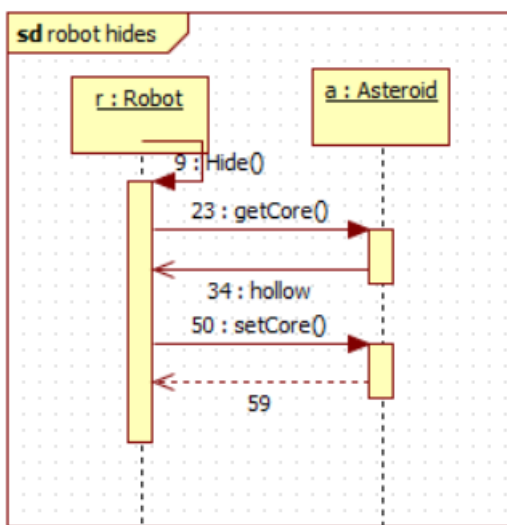
4.4.11 Asteroid explodes:
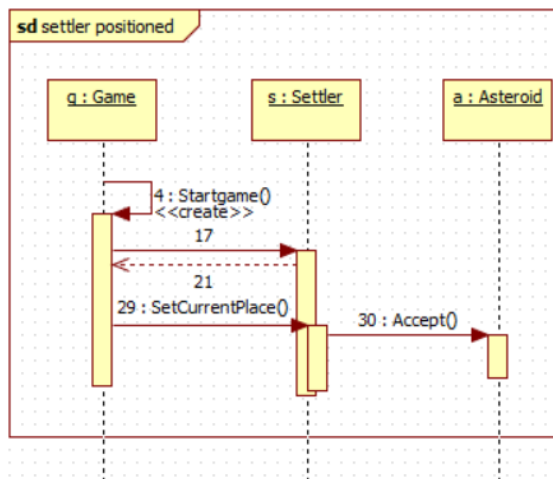

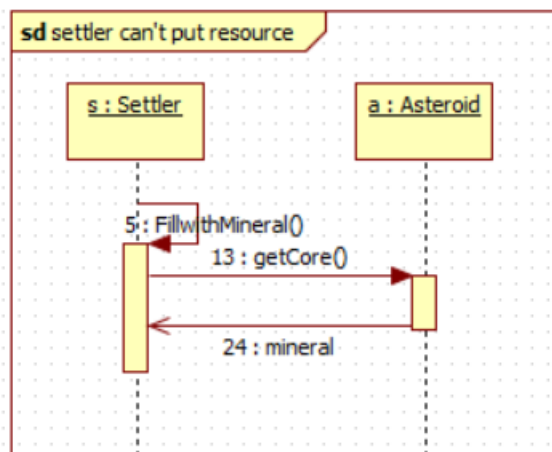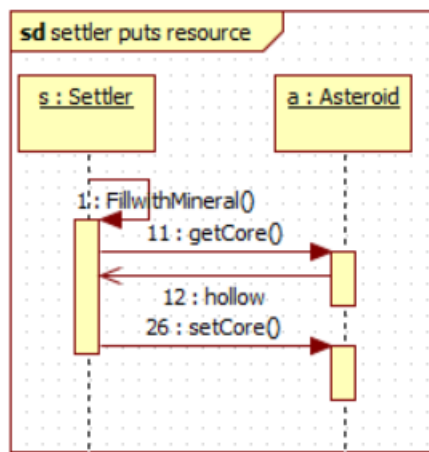### 4.4.12 Settler hit by sun storm:
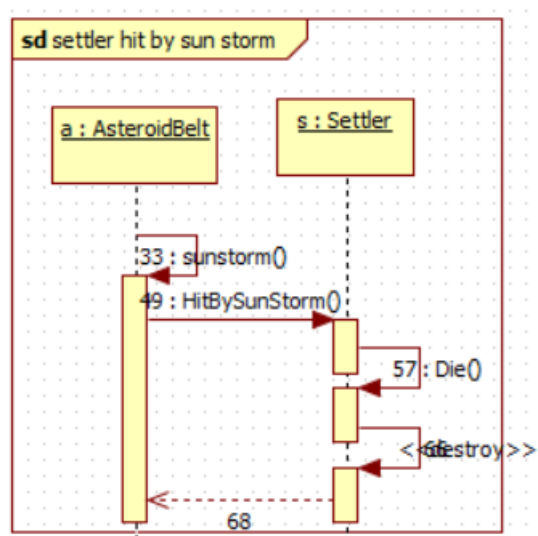
4.4.13   Gate hit by sun storm:

4.4.14   Robot hit by sun storm:
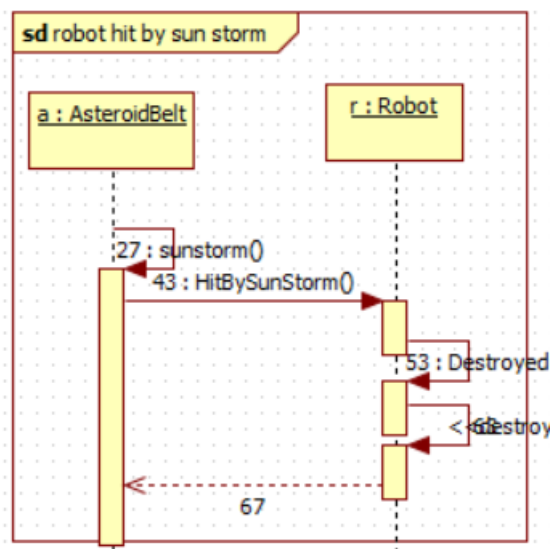
4.4.15   Robot in explosion of asteroid:
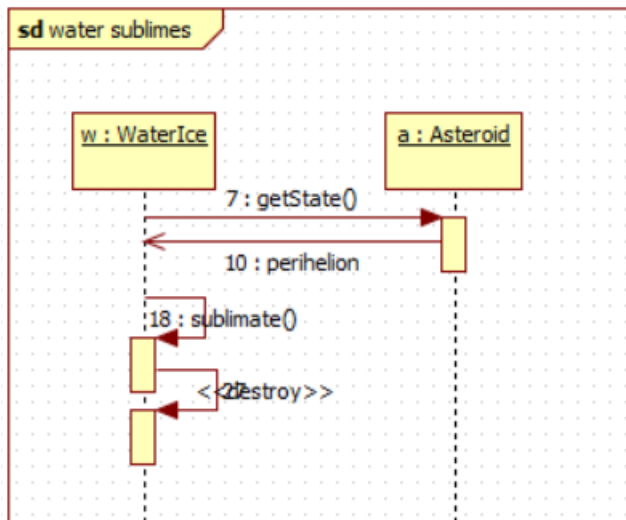

4.4.16   Last Settler dies:
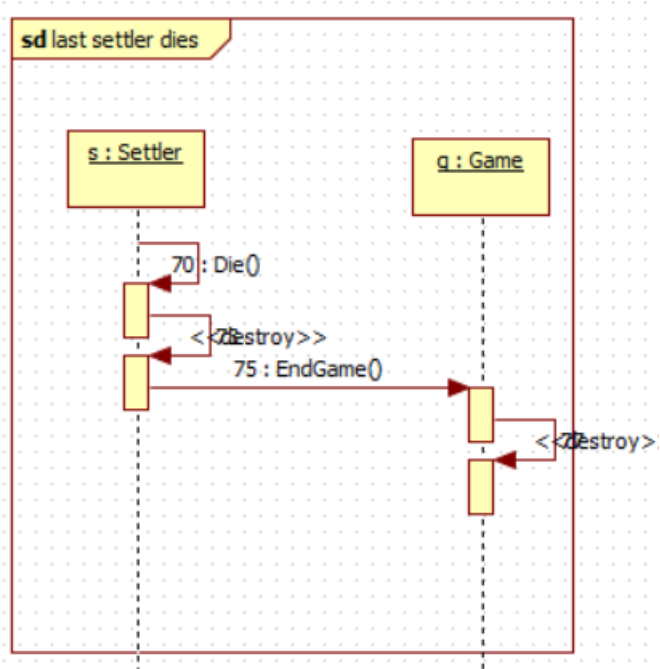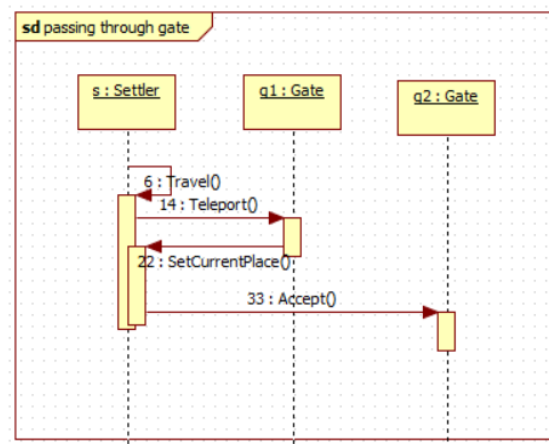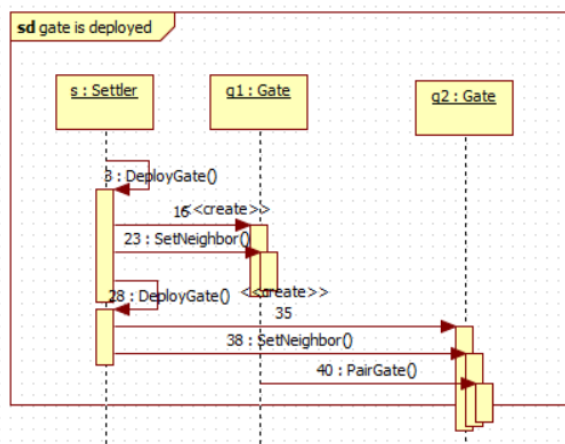
4.4.17   Next Round:
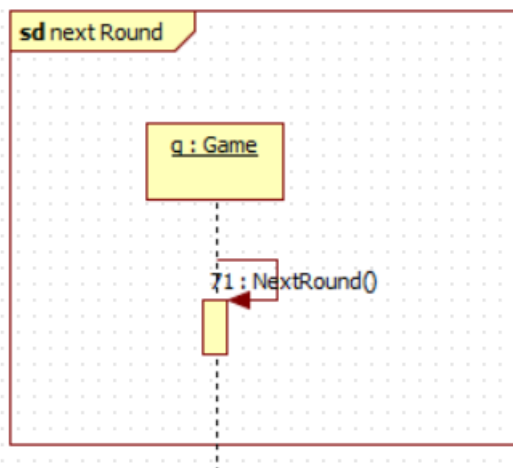
4.4.18   Initialization
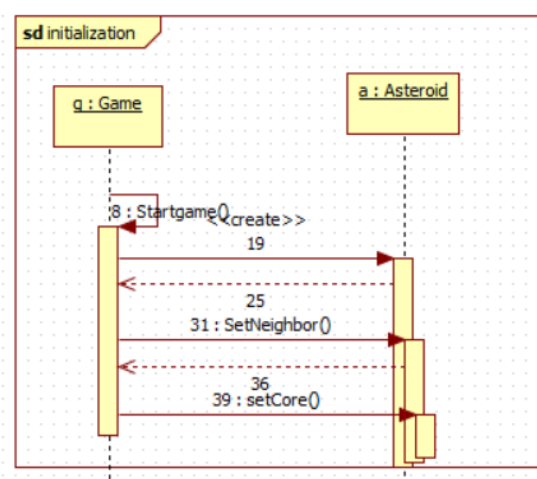
4.4.19   Settler hides resource / can't hide resource
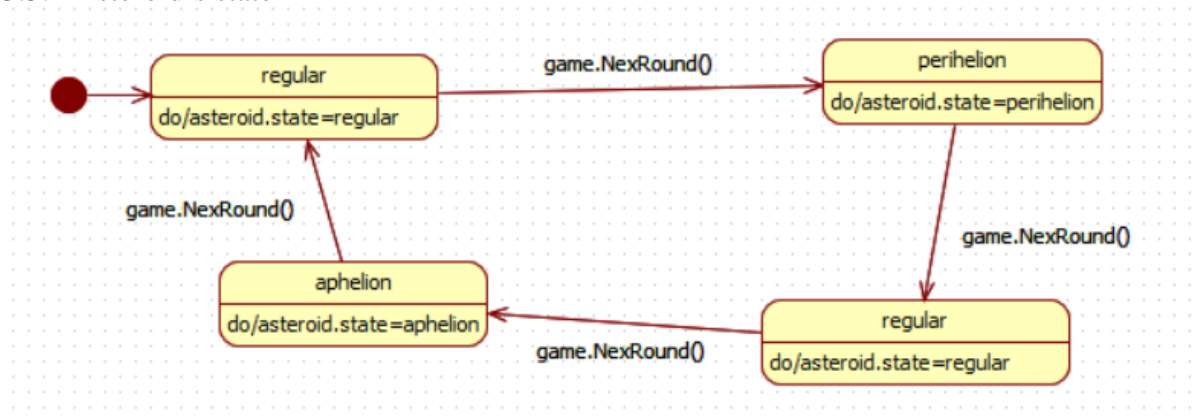
4.4.20   Water Sublimes

sd water sublimes

w : WaterIce   a : Asteroid

7 : getState()

10 : perihelion

18 : sublimate()

<<destroy>>

4.4.21   Deploying gate/ Passing through gate

sd gate is deployed

s : Settler   g1 : Gate   g2 : Gate

3 : DeployGate()

16 <create>>

23 : SetNeighbor()

28 : DeployGate()   <<create>>
35

38 : SetNeighbor()

40 : PairGate()

sd passing through gate

s : Settler   g1 : Gate   g2 : Gate

6 : Travel()

14 : Teleport()

22 : SetCurrentPlace()

33 : Accept()

4.5 State-charts

3.5.1 Asteroid's state

4.6 Protocol

Start (date & time)	Duration (hours)	Performer(s) name	Activity description
6.03.2021	1 hour 20 min	Gurdeep Singh, Salahov Kamal, Hakverdiyev Subhan, Ali Madatov, Areeba T. Shoaib	Discussing and Assigning Tasks, brainstorming methods : Microsoft Teams Reviewing and Changes to doc: Whatsapp
7.03.2021.13:00-15:00	2 hours	Gurdeep Singh	4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5, 4.1.6, 4.1.7, 4.1.8, 4.1.9
7.03.2021	2 hours	Salahov Kamal	4.4, 4.5
7.03.2021	2 hours	Hakverdiyev Subhan	4.2
7.03.2021	2 hours	Areeba T. Shoaib	4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.12, 4.3.13, editing
7.03.2021	2 hours	Ali Madatov	4.3.7, 4.3.8, 4.3.9,4.3.10, 4.3.11