# Structure Chart

# Diagram Description automatically generated

# Diagram Description automatically generated

# Data Flow Diagram:

# Diagram Description automatically generated

# Class Diagrams:

Ground

Star

-ground : Real [ ]

-iLZ : Integer

-width: Real

-height: Real

-minHeight : INT

-maxHeight: INT

-position: Point

-phase: unsigned char

+Ground(width: Real, height: Real)

+reset()

+draw()

+getElevation(): double

+hitGround(): bool

+onPlatform(): bool

-Star()

-Twinkle()

+drawStar()

+Demo(width: Real, height: Height)

- lander : Lunar Lander

- angle: Real

+ ptStar: Star

+ phase: char

+ width : Real

+ height: Real

+ ground: Ground

Demo

A picture containing text, document, receipt

Description automatically generated

# Pseudocode:

A picture containing timeline

Description automatically generated

# Test Cases:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Pre-condition** | **Input** | **Output** | **Reasoning** |
| No Inputs | Lander has some horizontal and vertical velocity and is above the ground. | NONE | Lander maintains horizontal velocity and begins falling to the ground. No thruster flame is shown. | When there is no input, there is no thrust, and the only force acting on the lander is gravity. |
| Main Thruster Up | Lander has some fuel, angle is zero. | Down Arrow | Lander gains altitude and main flames are drawn | Make sure the main thruster works |
| Right Thruster | Lander has some fuel | Right Arrow | Lander angle moves counterclockwise, lander's fuel decreases, and right flames are drawn | If the right arrow is pressed, then the lander changes angle. |
| Left Thruster | Lander has some fuel | Left Arrow | Lander angle moves clockwise, lander’s fuel decreases, and left flames are drawn | If the left arrow is pressed, then the lander rotates clockwise. |
| Left Right Thrusters | Lander has fuel | Left & Right Arrow | Lander Fuel goes down, left and right flames are drawn, lander angle stays the same | Having both left and right thrusters on should cancel out any angle movement. |
| Left Right and Main Thrusters | Lander has fuel, lander angle is zero | Left, Right, & Down arrow | Lander fuel goes down; left, right, and main flames are drawn, lander accelerates upward and does not rotate. | Having all thrusters on maintains angle, but does cause acceleration in the direction the lander is facing. |
| 1st Quadrant Angle | Lander is at an angle between 0 and 90 degrees | Down Arrow | Lander accelerates up and to the right. | If the lander is at an angle and the main thruster is engaged, the lander should accelerate in that direction |
| 4th Quadrant Angle | Lander angle is between 270 and 360 degrees. | Down Arrow | Lander accelerates up and to the left | If the lander is at an angle and the main thruster is engaged, the lander should accelerate in that direction. |
| 2nd Quadrant Angle | Lander is at an angle between 90 and 180 degrees | Down Arrow | Lander accelerates down and to the right | If the lander is pointed down and the main thruster is engaged, the lander should accelerate in that direction. |
| 3rd Quadrant Angle | Lander angle is between 180 and 270 degrees. | Down Arrow | Lander accelerates down and to the left. | If the lander is at an angle and the main thruster is engaged, the lander should accelerate in that direction. |
| 4th Quadrant Negative Angle | Lander angle is between 0 and –90 degrees. | Down Arrow | Lander accelerates up and to the left. | The lander angle should handle negatives. |
| Left Edge Collision | Lander is near the left edge of the screen with a negative horizontal velocity. | None | Lander moves to the left edge of the screen, and then stops moving horizontally. | The lander is not allowed to go off the screen. |
| Right edge collision | Lander is near the right edge of the screen with a positive horizontal velocity | None | Lander moves to the right edge of the screen and then stops moving horizontally | The lander is not allowed to go off screen |
| Top Edge Collision | Lander is near the top edge of the screen with a positive vertical velocity | None | Lander moves to the top edge of the screen, then stops moving vertically until its vertical velocity decays due to gravity. | The lander is not allowed to go off the screen. |
| Ground Collision: Right base of lander | Lander is approaching ground where ground is at a positive slope. Lander has a negative vertical velocity. | None | Right base touches the ground first and lander crashes | The lander cannot land at a slope |
| Ground Collision: Left Base of Lander | Lander is approaching ground where ground is at a negative slope. Lander has a negative vertical velocity. | None | Left base of the lander touches the ground first, and the lander crashes. | The lander cannot land at a slope. |
| Landing Zone Collision: Too fast | Lander is approaching landing zone with too much speed | None | Lander crashes when it collides with the landing zone | The lander will crash if it picks up too much speed |
| Landing Zone Collision: Wrong Angle | Lander is approaching landing zone in excess of the max angle. | None | Lander crashes when it collides with the landing zone. | The lander must be mostly upright to land. |
| Landing Zone Collision: Safe Landing | Lander is approaching landing zone with zero speed and zero angle | None | Lander lands safely and the simulation ends. | The lander *can* land, it just needs the right situation. |
| Landing Zone: Partial Landing | Lander is approaching landing zone where half the lander will land on the landing zone and half will land on the ground | None | Lander crashes when it collides with the ground and landing zone | The lander cannot partially land on the landing zone |
| Lander Runs out of Fuel | All thrusters are on, and the lander has little fuel. | Down, Left, and Right Arrows | Lander runs out of fuel, and all thrusters shut off. The only acceleration comes from gravity, and there is no change in angle. | If the user runs out of fuel while engaged in a maneuver, they can’t maneuver any more. |
| Lander Does not have fuel | Lander has no fuel and no thrusters are on | Any arrow key | Thrusters will not turn on and lander will fall towards the ground | If there is no fuel the lander cannot turn on the thrusters |