Lance of Destiny

Phase I

1. Introduction

Lance of Destiny is an easy and competitive game to play. It combines fun and challenge. Two brave warriors are racing to obtain a unique item which is called the *Lance of Fate* that enables its holder to rule the world with its power. Its creator, Fistandantalus, the arch-magician, has created several barriers to protect the lance in a way that only the worthiest soul can reach it.

In this game, two players will contend representing a warrior, and try to reach the Lance of Power before the other. There are several types of barriers that they shall face. The warrior can obtain spells during their quest. Some of the spells can be used to enhance one's attacking power and status (*Benevolent or good Spells),* and others can be used to obstruct the other player from reaching the Lance of Power fast (*Malevolent or evil Spells, to be discussed in phase 2*). The warrior who finishes all the barriers first, is deemed the winner and the one worthy of the treasure.

Each warrior is represented by their Magical Staff and Fire Ball. A Magical Staff is a paddle-like object that is used to deflect the Fire Ball from falling to the ground. The Fire Ball is the object that is sent around to destroy barriers, but it is affected by gravity, therefore the Magical Staff is used to set its track towards the target barriers to destroy them. If the Fire Ball falls below the Magical Staff, the warrior loses a chance. Each warrior has 3 chances only. Once the warrior runs out of chances, they are considered

unworthy and therefore lose the game. If a player is deemed unworthy, then the other player automatically wins. In this phase, you shall focus on the single player case. In the next phase, the 2 player-mode shall be added by means of networking.

2. Gameplay

2.1. Player actions

The player has control over the Magical Staff (paddle), he/she should use the Magical Staff (paddle) to direct the Fire Ball to destroy as many barriers as possible and at the same time protect the Fire Ball from falling. The details about the Fire Ball and the Magical Staff movements will be provided in the following sections. The Magical Staff can basically be moved horizontally. To control the movement of the Magical Staff, the player needs to use arrow-left and arrow-right buttons. The Magical Staff (can also be rotated temporarily by up to 45- or 135-degrees using A and D keys respectively. This rotation might help to direct the Fire Ball (ball) to hit more important areas of the wall. On the game start, the Fire Ball will be on the top of that Magical Staff, to make the first shot the player can click the mouse left button or the letter W. During the game the player can gather some spells, some of these (Hex, Magical Staff Expansion, ...etc.) can be kept for later use. These spells will appear as icons on a specified place of the game view. The player might choose to activate a spell directly or keep them for the future. To activate the spell, the player can either click on its icon on the screen using the mouse left button or type the first letter of the name of spell.

3. Game Objects

3.1. Magical Staff

- Controlled by the player.
- Moves horizontally, can be rotated by up to 45 or 135 degrees.
    - The rotation angle is going to be changed by a rate of 20 degrees/second until reaching 45 degrees if the key A is pressed, or 135 if D is pressed.
    - Once the key is released the Magical Staff will go back to its horizontal state, and the rotation angle is going to be changed by a rate of 45 degrees/second.
- The Magical Staff length L is 10% of the screen width.
    - This L is going to be used as a basis to measure other variables in the rest of this document.
- The Magical Staff thickness T is 20px.
- Movement speed is:
    - If the left or right arrow is pressed and released: The Magical Staff should move by an offset equal to L/2 with a speed of L/second.
    - If the button is down, it should move with the speed of 2*L/second.

3.2. Barriers

- **Simple Barrier (Ancient Wall)**
  Can be broken in one hit. When broken, it disappears.

- **Reinforced Barrier (Triple Rashōmon)**

These barriers are more difficult to destroy. Each one contains a number written on it (*not necessarily just three as the name implies*), which corresponds to the number of hits it requires to be destroyed. After every hit it receives, the number decreases by 1, and the barrier disappears once the number reaches zero.

- **Explosive Barrier (Volatile Fence)**

This barrier has a circular shape and it explodes once it is hit. Once exploded, its remains fall downwards towards the Magical Staff. If the remains touch the Magical Staff, the player loses a chance.

- **Rewarding Barrier (Wish Endower)**

This barrier can be destroyed in one hit like the simple one. Once destroyed, it drops a box downwards towards the Magical Staff. If the Magical Staff touches the box, then the box opens and rewards the warrior with a spelly that can be either used to support the warrior, or to create more challenges and barriers for the other player.
    - The simple and firm barriers can be either stiff or moving horizontally (back and forth). Barrier positions are going to be specified in the building mode. Any barrier which has a free space around it in the x-axis might be moving back and forth with a probability of 0.2, or stiff with a probability 0.8. It will of course move in its free space, meaning that if it is about to collide with another barrier it will reverse its direction.
    - The explosive barrier can be either stiff or moving in circular fashion, if the space around it allows. The radius of the circle is 1.5*L and it is centered at (x1,y1) where x1 is the x coordinate of the center of the explosive barrier and y1 is the y coordinate of the barrier minus 1.5*L.
    - The movement speed of the moving barriers is L/4 per second.
    - All barriers except explosive barriers are rectangles with dimensions L/5 and 20px.
    - The circular barriers have a radius equal to 15px.
    - When destroying a barrier according to the previous rules (either by hitting directly or by some spell), the score of the player will be calculated using the following formula:

      newScore = oldScore + 300 / (currentTime - gameStartingTime)

    - Where CurrentTime is the time of the barrier destruction. The score is initially zero if we are in a new game. The times are measured in seconds.

3.3. Benevolent (Good) Spells

- **Felix Felicis**
This ability increases the player's chances by 1.

- **Magical Staff Expansion**
This ability doubles the length of the Magical Staff. It is not necessarily activated

once it is received. The player can choose to activate it whenever they want by either pressing the button T, or pressing its icon on the screen. Once activated, it lasts for only 30 seconds, after which the Magical Staff returns to its original state.

- **Hex**
  This ability equips the Magical Staff with two magical canons on both of its ends. The canons should point upwards and they rotate as the Magical Staff rotates. They can fire magical hexes that can hit the barriers. A hex hit has the same effect as the hit of a Fire Ball. It does not activate immediately, but can be activated by pressing H or pressing its icon on the screen. Once activated it remains active for only 30 seconds and then disappears afterwards.

- **Overwhelming Fire Ball**
  This ability upgrades the Fire Ball and makes it much more powerful, such that if it hits any barriers, it destroys it and passes through it regardless of its type (even for the firm barriers). This upgrade only lasts 30 seconds after it is activated.

3.4. Fire Ball

The Fire Ball has the dimensions of 16x16 pixels. The Fire Ball bounces between the barriers and the Magical Staff. If the Fire Ball hits a barrier it will have a certain effect depending on the type of the barrier or the currently activated spells. When the Fire Ball is going down, if the player does not move the Magical Staff to hit the Fire Ball, it will be lost and the player would lose a chance. The player normally has three chances at the beginning of a game. When losing the three chances, the game is over, and the player loses the game.

Fire Ball Movement

In the Lance of Destiny universe, the laws of physics are simple. The Fire Ball movement line is described in the following scenarios:

- Initially, the Magical Staff will fire the Fire Ball and it will move vertically relative to the Magical Staff. In other words, the Fire Ball movement line will angle 90 degrees with the Magical Staff surface. After this initial move, the Fire Ball's movement can be affected when hitting an object as described in the following scenarios.
- When the Fire Ball hits non-moving object:
  - If it hits a side of this object: it will bounce and move back in the same speed with the angle equal to and symmetric around the norm of the hit surface as explained in figure1.

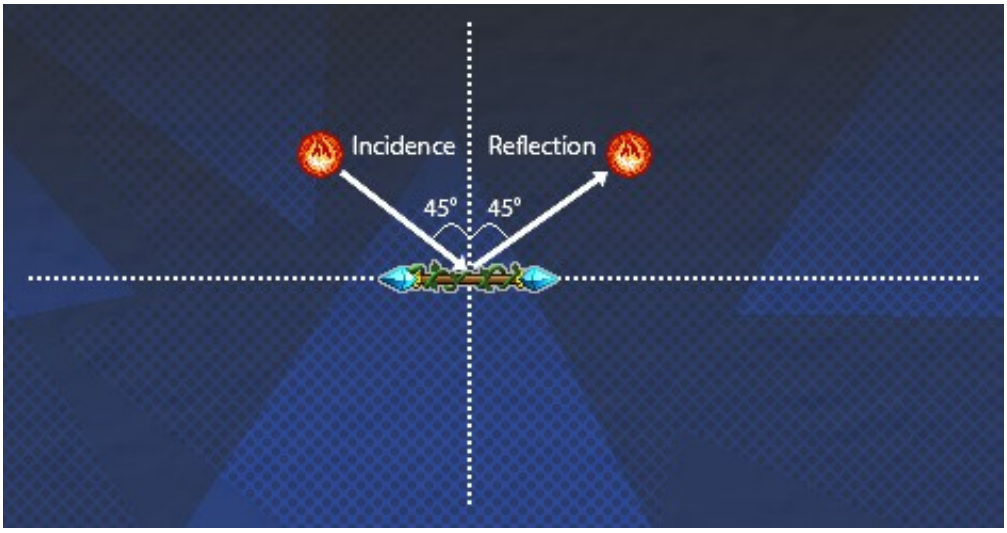


Figure 1
The reflection of the Fire Ball hitting the middle of a non-moving object. Here the original angle is 45, hence the Fire Ball will reflect with an angle of 45.

- If it hits a corner of an object, the same rule applies. But the reference here is an imaginary line making an angle of 45 degrees with the corner legs as described in figure2.

Figure 2.
The reflection of the Fire Ball hitting the corner of a non-moving object. Here the original angle is 45, hence the Fire Ball will reflect with an angle of 45.

- When the Fire Ball hits a moving object:

- If the direction of the movement of the object is the same as the direction of the component of the Fire Ball velocity that is parallel to that movement direction, the Fire Ball will reflect according to the roles described in the non-moving object case. However, the speed of the Fire Ball will increase by 5px/second.
- If the direction of the movement of the object is the opposite of the direction of the component of the Fire Ball velocity that is parallel to that movement direction, the Fire Ball will reflect with an angle of 180 degrees relative to the line of the original Fire Ball movement direction and the speed of the Fire Ball stays the same.
- If the direction of the movement of the object is perpendicular to the direction of the Fire Ball velocity, the Fire Ball will reflect with an angle of 45 degrees relative to the line of the moving object movement direction and the speed of the Fire Ball stays the sam

4. Game View Structure

4.1. Building Mode

Lance of Destiny consists of two modes: building mode and running mode. Above figure shows an example screen for the building mode.

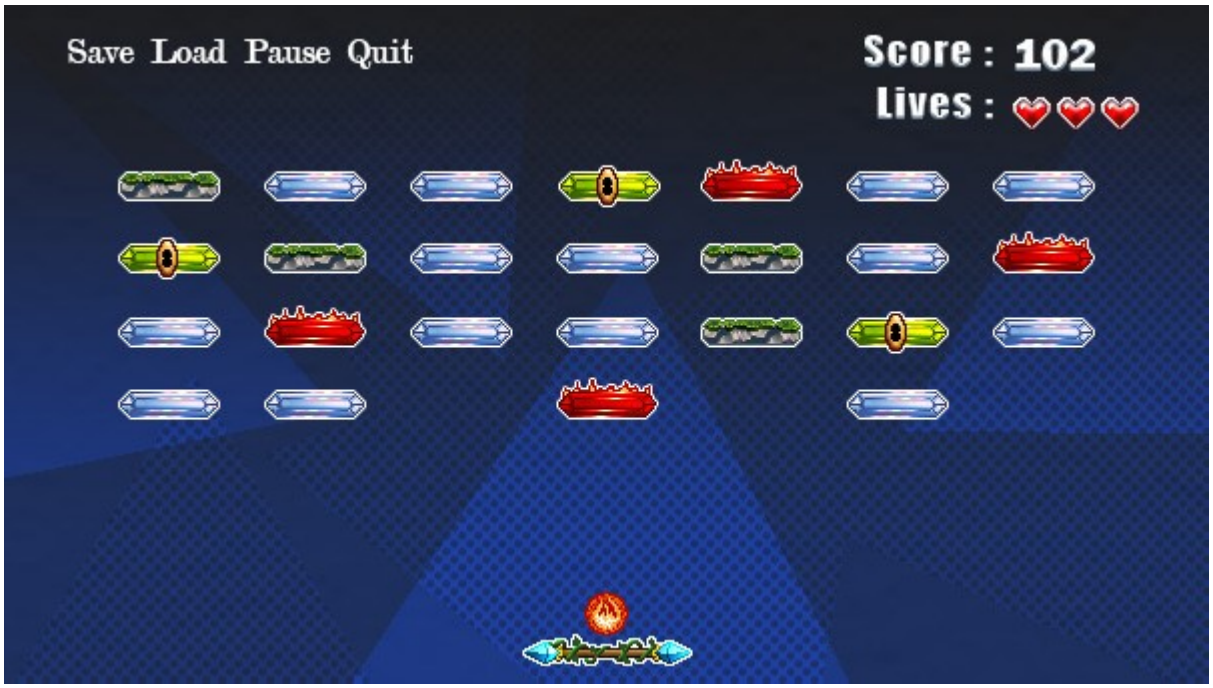
The game always starts with the building mode. In the building mode, users can load an already existing game layout or create a new one.

In order to create a game environment, the user interacts with the system to specify the number of each barrier type (top right box). When a user enters the number of barriers, the system puts these barriers in random places. Then, users can remove some of them and/or add more barriers by mouse clicks. System always places the barriers so that none of them overlaps with the others. Also, the system should reject the user's attempt if the user tries to place overlapping barriers. There are minimum criteria to be satisfied in the building mode:

- There has to be at least 75 simple barriers,
- At least 10 firm barriers,
- At least 5 explosive-barriers, and
- At least 10 gift barriers (we have in total 4 spells, so each spell should appear at least once in a gift barrier, the rest of the gift barriers are assigned spells randomly).

Once the minimum criteria have been satisfied, the user can save the game to play later or he/she can immediately play it.

4.2. Running Mode



In running mode, the user controls the Magical Staff to break the barriers, as explained above. In this mode, user-system interactions are handled according to game rules. The picture above is an example view from the running mode. The game enables the user to pause the game at any time and re-play it. When the game is paused, the user can save the current state of the game to continue to play it later. Additionally, the user can decide to change the game at any time, i.e. he/she can pause the game, and load another game. Also, the user can quit the game at any time. (See the top left part of the figure above.)

During the game, users can gain a score according to the game logic. Current score and the number of remaining chances of the player has to be shown on the game screen.

4.3. Game Features

The game should contain either menus or small buttons that provide the following features:

- Save/load a game: the user should be able to save the game whenever she/he decides to. The saved game can be loaded to continue playing. To save the game, you need to pause it first.
- Pause/resume: the user should be able to pause the game whenever she/he decides to. And resume it later.
- Help screen: there should be a help screen explaining the game objects hand features, and how to play.
- Login screen: appears when the game executable is run. Every player should have a unique login name. Players can load only the games saved by them.

4.4. Save/Load with Versioning

A database is an organized collection of structured information, or data, typically stored electronically in a computer system. For instance, all of our social media (*Facebook, Twitter, Instagram*) information such as pictures, posts, videos, and even our login information (*i.e., username and password*) is stored in a database. Similarly, KUSIS and Blackboard also operate in the same way. So, as a software engineer, it is very important to learn about the database.

In this project, you can use any database (*simple file, MySQL, MongoDB, PostgreSQL etc.*) to save and load the game. When the player clicks on the save button, you have to store the complete game into the database. As a hint, here are some of the variables which you have to store in the database:

- Username
- Types of barriers and their numbers
- Position (i.e., coordinate of the barriers) of the barriers
- Score.
- Number of chances remaining
- Number of Spells acquired (not activated yet)

So, now even if the player turns off the system and logs in again to play the game, the player should be able to play the game exactly from that point.

4.4.1. Versioning support for saved state

The persistence layer you implement to save the game state to the database must support extensibility. This means that the fixed schema of the database should not prevent the newer versions of the game to implement new features with savable state, and this new features (whatever they may be) should be implementable without changing the database schema.