

# Project Specification - Roguelike RPG

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## 1 Introduction

This project is a Rogue-like Role Playing Game implemented using the ncurses library for graphical output. It allows the user to control an adventurer to explore a dungeon. The dungeon should contain procedurally generated rooms which contain similarly procedurally generated entities of interest, such as monsters and items.

## 2 Design Description

### 2.1 Assessment Concepts

#### 2.1.1 Memory Allocation from the Stack and the Heap

- **Arrays:** The game map will be implemented using a two-dimensional array.
- **Strings:** Most objects such as monsters, items, and parts of the environment will have textual information associated with them, such as descriptions of enemies.
- **Objects:** The project will rely heavily on object-oriented design, so most functionality of the game will use objects, such as entities, items, levels, the renderer, etc.

#### 2.1.2 User Input and Output

- Input/output will be implemented in a blocking fashion (as the game is turn-based) to retrieve user input commands in the form of particular keypresses (or combinations thereof).
- This will be achieved using ncurses, which will parse user input per-character, and alter the game state based on a number of factors (such as menu contexts etc.).

#### 2.1.3 Object-oriented programming and design

- Objects will be used to model all aspects of the game environment, such as objects representing terrain tiles, and game entities.
- **Inheritance:** In order to implement various types of animated entities in the game, such as the player, as well as monsters that might oppose the player, a parent class to model a living creature will be used.
- **Inheritance:** Items in the game must all be able to do certain things, such as getting picked up by the player, or being dropped, or used. Thus, all items must inherit a base “item” class, while each individual item type may incorporate unique behaviours.
- **Polymorphism:** Items in the game will exist as one of multiple subtypes, such as equippable items, generic items, and comestible items, which will be implemented using another **abstract** class which will include a virtual function for the consumption of that item.

## 2.2 Testing

### 2.2.1 Unit Testing

Unit testing will be used to verify that individual class methods are functioning correctly through the calling of getters and setters in a separate c++ program. For example, the following code will test an entity's movement.

```
Entity entity(
    "Test Entity",
    "This is an entity instantiated for the purpose of testing the Move(int y, int x) function.",
    0,
    0,
    'T');
entity.move(0,1);
if (entity.GetX() == 1) {
    std::cout << "Entity::move(int y, int x)..... OK" << std::endl;
} else {
    std::cout << "Entity::move(int y, int x)..... FAILED! Entity::GetX() returned " <<
        entity.GetX() << std::endl;
}
```

See tests.cpp for comprehensive tests.

### 2.2.2 Integration Testing

Some of the game's processes will not be easily testable using unit testing, so integration testing will be used to verify that elements of the user experience are functioning correctly.

The following integration test will be used to exhaustively verify that orthogonal movement will be perceived to function correctly:

```
Key 6 pressed -> '@' moves right
Key 3 pressed -> '@' moves down and right
Key 2 pressed -> '@' moves down
Key 1 pressed -> '@' moves down and left
Key 4 pressed -> '@' moves left
Key 7 pressed -> '@' moves up and left
Key 8 pressed -> '@' moves up
Key 9 pressed -> '@' moves up and right
Key 5 pressed -> '@' remains stationary; other entities moves
```

Furthermore, a number of more general expectations were defined for particular scenarios.

Action:

Expected Outcome

The player moves in one direction constantly:

The player eventually reaches a wall and cannot move further

The player continuously passes their turn while being approached by an enemy ('s'):

The enemy attacks the player who eventually dies

The player dies:

The game prints a game over & high score message when the player next tries to move

The player presses 'i' then 'a' without having picked up any items:

The player's health increases by 10, and the item "Repair kit" is removed from the player's inventory

The player stands on a '>>' tile and presses '>>':

The map changes to the next level, which is unexplored if it has not yet been

visited. The level counter increases by one  
The player attacks (walks into) an enemy ('s') continuously:  
The enemy eventually dies unless the player does first, in which case the player  
can now walk over the enemy, which now has a red background

## 2.3 Class Descriptions

### 2.3.1 Entity

This will be a class describing a physical object within the game, excepting terrain. This object will be used to represent both animated entities, such as monsters and players, as well as inanimate objects, such as items. This object stores the health of the entity, as well as various properties including name and position.

**Base Class:** The base class will describe a generic entity, which will be used to create inanimate objects in the world such as boulders.

**Player:** The player is one of two types of animate entities in the game, of which this one will be controlled by the player. This class differs from the base entity in that it keeps track of inventory including weight.

**Enemy:** Similar to the player, this represents the other type of animate entity. This class differs from the base entity in that it keeps track of an inventory (loot), and contains methods to drop the loot and attack the player.

**ItemEntity:** A unique type of entity, this represents a physical item in space, able to be picked up by an animate being in the world. Thus, this object tracks the corresponding *Item* object, and contains methods to be picked up.

### 2.3.2 Item

This class represents an item as it exists within the storage some other entity, and thus includes information about the item's properties such as value and weight.

**Base Class:** The base class will simply contain the item's weight and value information, thus representing the most basic of items, such as money or rocks.

**ComestibleItem:** This subclass is an abstract class representing an item that can be consumed by an entity, and thus includes a virtual function for the effects upon consumption.

**HealingItem : ComestibleItem:** The *HealingItem* is an example of a *ComestibleItem* which would implement a *Consume* method that would heal the user.

### 2.3.3 Level

The *Level* object will represent a level of the game world. Thus, the class includes member variables for storing entities and environment information relevant to a particular level.

### 2.3.4 Room

The *Room* object contains the information relevant to a single room within the world, and includes methods for calculating useful information about the room, such as its area.

### 2.3.5 Tile

*Tile* is a struct that contains the information relevant to a single type of tile within the world, such as a floor or a wall.

## 2.4 Class Diagrams

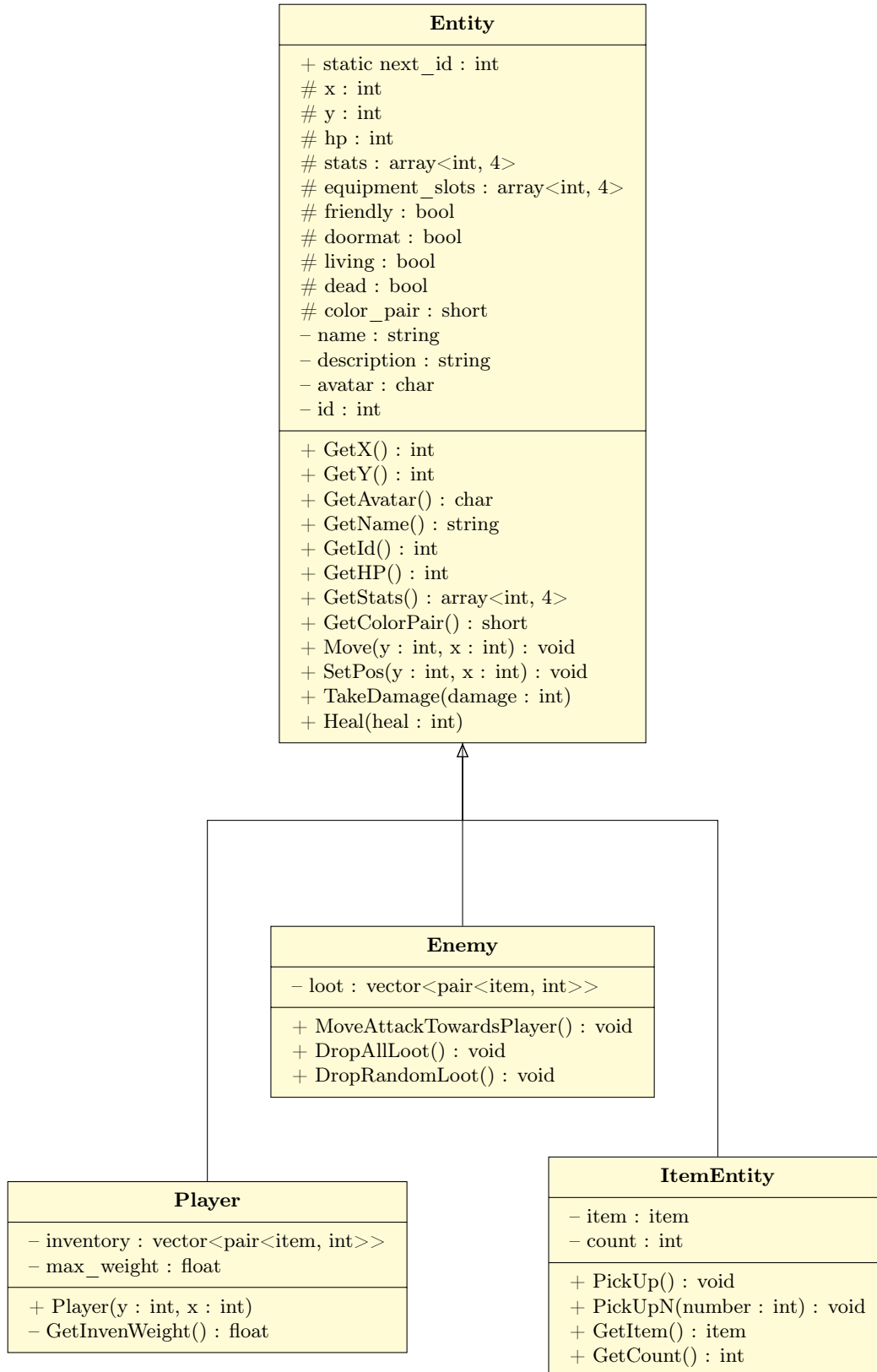


Figure 1: Entity Class Diagram

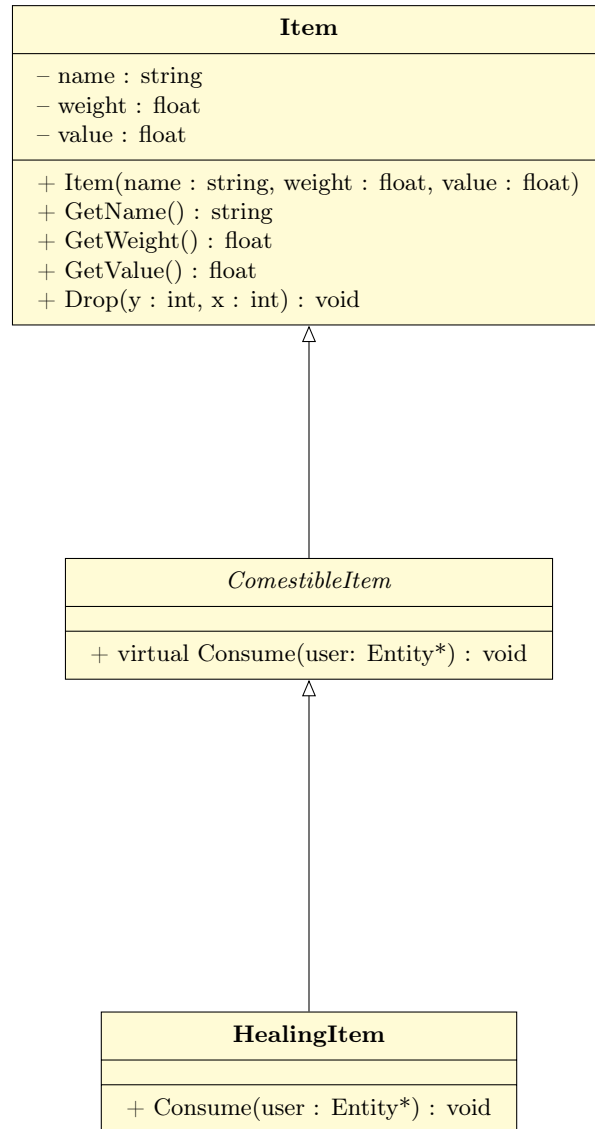


Figure 2: Item Class Diagram

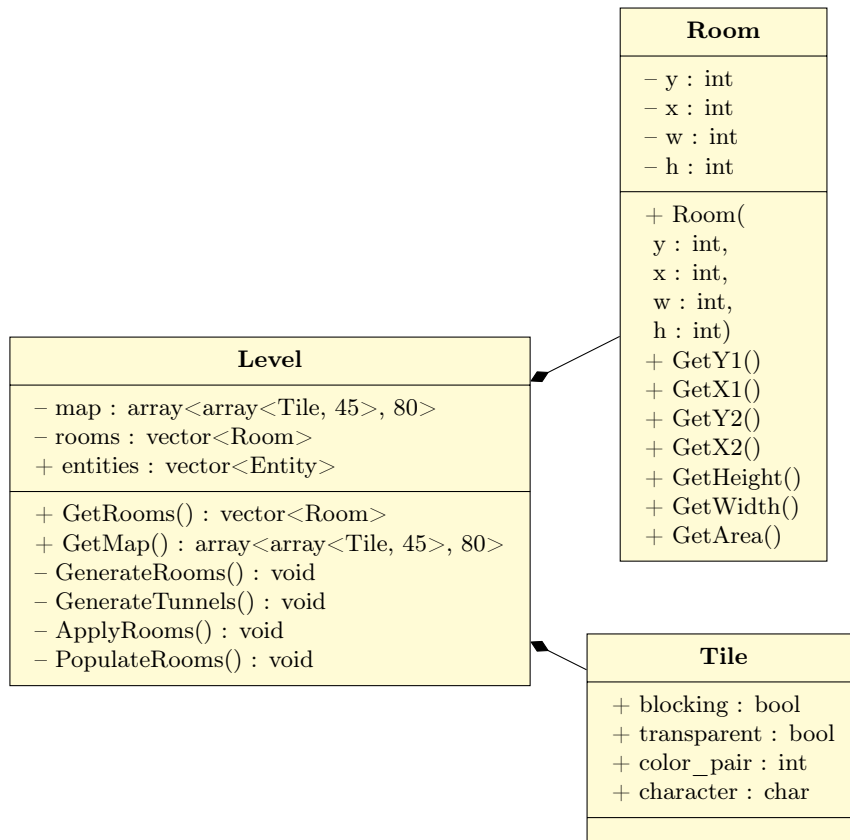


Figure 3: Level Class Diagram