**Specification Document**

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**1. Project Description**

“Risk” is a turn-based strategy board game for two to six players. Each player will have the fixed number of armies at the start of the game and will automatically receive additional army units in each turn [1]. Additionally, each player will be able to attack or ally with a territory controlled by opponent.

The project aim is to design, implement, test and evaluates a turn-based strategy game which is based on the rule of “Risk”, with the both intelligent agent players and the human players. The game will be delivered on time and shall be reliable. This project is prepared for the final year project supervisor and the players.

The “Unity3D”, the programming language “C++”, “Selection and Mini-Max Tree Algorithm” will be used to solve the project aims. The “Unity3D Game Engine” and “C++” will be used to implement the basic game rule following then, the “Unity3D UI System” will be used to implement the two-dimension graphic user interface. Additionally, the “Selection Algorithm” and the “Mini-Max Tree Algorithm” will be used to implement different layer of AI player.

**2. Statement of Deliverables**

**2.1 Anticipated Documentation**

The anticipated document will be the “specification and design document”, “interim report” and “user manual”;

**2.2 Anticipated Software (Functional and Non-function Requirement)**

* There will be two to six computer or human players in each game and the game will be turn-based and turn rotates among players.
* There will be zero to six human players in each game and the human players will be able to decide the number of the computer players at the start of the game. Therefore, the game type will be the “Player versus Player”, “Player versus Computer” and “Computer versus Computer”.
* The human player will be able to select the type of computer player by methods of different Artificial Intelligence algorithms at the start of the game.
* The game map will be shown on the screen and it will depict a political map of the earth, divided into forty-two territories, which are grouped into six continents.
* The action of each player, such as dispatching armies, invading territories and attacking enemies, will be shown on game map.
* The position of the player in relation to other player, such as the number of the armies in each territory, the additional army units in each turn will be shown on the screen.
* Each player will have the fixed number of armies and the player will either have complete control of where their armies start by clicking the map or by an algorithm to randomly distribute on equal size territories at the start of the game [1].
* Each player will automatically receive additional army units based on the number of territories they control at the start of each turn.
* In each turn, a player will be able to attack a territory controlled by an opponent. The system will randomly generate a number based on the size of each player’s army. The player with highest number wins and the losing player removes one army from the attacked territory.
* The player who loses all his territories will lose the game and the winner is the only one with territories left on the map. Additionally, the name of the winner will be shown on the screen.
* The user interface shall be user-friendly and shall make player easily comprehend game rule.
* The game map shall be well-design and will be shaping forward the different territories and the different continents. Additionally, it shall be visually well-designed too.
* The game-code shall be readable and self-documented. The programing language shall be Object-Oriented, and the software design pattern such as factory method, shall be used.

**2.3 Anticipated Experimentation**

The only anticipated experimentation should be the experiment in the evaluation phase. A series of “Computer versus Computer” game will be tested, and the results will be recorded following than, it will be used to evaluate the efficiency of the AI algorithm.

**2.4 Methods for Evaluation**

The game will have been evaluated by the programmer by means of identifying if the function and the non-function requirements are achieved or by comparing it with other online Risk game to estimate the game quality. The methodology in the software engineering, such as the “object point” and “function point” shall be similarly used to evaluate the game.

Furthermore, in order to analyze whether the game meets its aims, a group of volunteers will be used for game feedback. The project will strictly follow the requirements in the “Computer Science Student project 3rd party Evaluation Procedure” [2]

The game intelligent agent will be evaluated through analysis of the result of the “computer versus computer” game and also compared with the intelligent agent in other online Risk game. The “Evaluation Function”, such as the heuristic evaluation function or the static evaluation function, shall be used to evaluate.

**3. Conduct of the Project and Plan**

**3.1 Preparation**

According to the introduction in the website of “Hasbro”, Risk is a turn-based strategy board game which is designed in 1957 by Albert Lamorisse and the game emphasizes the diplomacy, conflict and conquest between players [1]. This project will transform the board game into a computer game.

The data, such as the game parameter from other online risk game and the player feedback, will be used in the project. However, the project will not require any “synthetic data”, “real non-human data” or “real human data” and it will not require the human participants except for 3rd party evaluation of the project.

In order to implement the project, a user guide of the risk game, other online Risk game, the game engine and the game assets will be required. The user guide of Risk from “Hasbro”, the publisher of the game, will be used in the project to elicit the function requirement. The “Warzone” and “Pogo Risk”, online Risk game, will be used to compare and evaluate the game quality. The Unity3D personal, the free cross-platform game engine and IDEA, and the assets in the “Unity asset store” will be used in the project.

Additionally, the software engineering methodologies, such as “Object-Oriented Programming”, “Automatic Testing”, “Project Management” and “Software Design Principle”, will be used in the project.

**3.2 Design stage**

The design of the project will be object-oriented, and the design phase shall strictly follow the software design process, namely architecture design, abstract specification, interface design, components design, data structure design, algorithm design. In addition, it will also include evaluation design. The method, such as the UML diagram (including, but not limited to limit class diagram, interaction diagram, user cause diagram) and the Pseudo-code, will be used in this stage.

**3.3 Implementation stage**

In the implementation stage, the developing environment will be hardware requirement, graphics card with DX10 (shader model 4.0) capabilities and SSE2 instruction set support CPU, and the software requirement, Windows 7 SP1+, 8, 10, 64-bit versions only; macOS 10.11+ and the development environment of the Unity3D [3].

The project will use the object-oriented testing to test the program and it shall strictly follow a top-down integrate testing process, namely, operation test, class test, cluster test, system test; The test method, “White Box Test”, “Equivalence Partitioning” and “Program Flow Graph”, and the test tools, “Unity Test Tools” and “Apache Ant”, will be used in the test phase;

**3.4 Risk Assessment**



The estimation risk, in which time required to develop the game is underestimated, will be caused by the overestimation of the programming efficiency and the underestimation of the project size. It will lead to the project delay or the low-quality documents and program. In this project, the estimation methods such as the “function point”, “EOF” and the Gantt Chart will be used to avoid this kind of risk.

The requirement risk, in which the project requirements are capricious, will be caused by the misunderstanding of the project. It will lead to the worthless function or nullification of the whole project. In this project, the software engineering methods such as, the “viewpoint”, “Ethnography and prototyping” will be used.

The people risk, in which the developer is unavailable at the critical time, due to the medical or family difficulty. It will lead to the project delay. In this project, the tasks shall be finished before at least one week to avoid the risk.

In the project, the artificial intelligent algorithm and the programming language C# are the required new skills. Therefore, the AI algorithm used in the project, “Selection” and “Max-Min Tree”, will be obtained from the “Artificial Intelligence - Search & Logic”, an online course. The programming language C# and the usage of the Unity Engineer will be obtained from the online course, “C# Programming for Unity Game Development Specialization”;

**4. Reference**

[1] A. Lamorisse, Risk, 6th ed. MA 01915. Printed in U.S.A: Hasbro, 1993, pp. 2,11-13.

[2] Computer Science Student project 3rd party Evaluation Procedure, 1st ed. Liverpool: University of Liverpool, pp. 2-3.

[3] "Unity - System Requirements", Unity, 2018. [Online]. Available: https://unity3d.com/unity/system-requirements. [Accessed: 02- Nov- 2018].