AI for Games – Group ICA 2

This document describes the second group assessment for AI for Games. The game that you must create will be described, followed by three defined team roles.

# The Problem: Real-Time Strategy Game

In your teams, you will create a real-time strategy game, which requires the gathering of resources, motion planning, strategic planning and combat. You will use the benchmark maps from the movingai website:

<http://movingai.com/benchmarks/>

Each free grid square can be built on, and can contain exactly one building. Each building takes a certain amount of time and resources to build, each action takes a certain amount of time to perform, has a resource requirement, and produces a resource output. There is exactly one type of unit, which can be trained to perform various tasks. These are listed below.

## Resources

There is a range of raw resources, derivative and human resources. The raw resources are coal, ore, timber and stone. The derivative resources are iron and wood. Human resources start with limited abilities, to gather resource and work as labourer, but can be trained to be lumberjacks, miners, blacksmiths, carpenters, teachers, riflemen and traders.

Resources are to be placed within open spaces. A resource square can be exploited to extract 5 units of whatever it provides. In addition, if a mine is placed on a resource tile (coal / ore), it can produce limitless resource. Timber replenishes at a rate of one unit of timber per 10 time units.

Without a cart a person can transport a unit of resource. With a cart, they can transport up to five units.

Trade allows you to buy and sell resource between you and other players. Trade is optional, no player is compelled to buy or sell.

Combat can occur at any time, and when attacking an untrained person, has a 100% chance of success. When attacking another rifleman, there is a 70% chance of success (killing the opponent rifleman), 30% chance of being killed. When a rifleman occupies an opponent’s building, it becomes within the player’s control. You must be within 5 units to engage in combat, and fight riflemen before other units.

## Buildings

There are the following building types, along with the time required to build, dimensions to place and requirements:

|  |  |  |  |
| --- | --- | --- | --- |
| Building | Time | Dim | Requirements |
| Turf Hut | 10 | 2x2 | Labourer |
| House | 15 | 2x3 | Stone, Wood, Carpenter, Labourer |
| School | 30 | 5x5 | Stone, Wood, Iron, Carpenter, Labourer |
| Barracks | 30 | 5x5 | Stone, Wood, Carpenter, Labourer |
| Storage | 20 | 5x5 | Stone, Wood, Carpenter, Labourer |
| Mine | 50 | 1x1 | Wood, Iron, Labourer, Carpenter, Blacksmith |
| Smelter | 20 | 2x2 | Stone, Labourer |
| Quarry | 10 | 1x1 | Labourer |
| Sawmill | 30 | 30 | Iron, Stone, Timber, Labourer |
| Blacksmith | 30 | 30 | Iron, Stone, Timber, Labourer |
| Market Stall | 5 | 1x1 | Wood, Carpenter |

## Actions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Action | Time | Building | Requires | Produces |
| Family | 20 | Turf Hut | 2xPeople | 1xPerson |
| Family | 20 | House | 2xPeople | 2xPerson |
| Educate | 100 |  | Person, Student | 1xSkill for Students |
| Educate | 30 | Barracks | Teacher, Student | Rifleman Skill |
| Train | 50 | School | Teacher, Students | 1xSkill for Students |
| Cut Tree | 5 |  | Forest, Lumberjack | Timber |
| Mine | 5 | Mine | Miner | Mined Resource |
| Store | 1 | Storage | Resource | Money |
| Move | dist. |  |  |  |
| Smelt | 5 | Smelter | Labourer, Ore, Coal | Iron |
| Quarry | 5 | Quarry | Labourer | Stone |
| Saw Wood | 10 | Sawmill | Labourer, Timber | Wood |
| Make Tool | 10 | Blacksmith | Blacksmith | Axe, Cart or Rifle |
| Buy/Sell | 1 | Market | Trader, Money/Goods | Money / Goods |
| Combat | 1 |  | Rifleman | Dead Person |

# The Roles

## Role 1: Motion Planning

You will be responsible for creating the path planner. The executive will request plans from points to points on the map – it is your responsibility to return these as quickly as possible. Things to consider are: will you return an entire plan, or a partial plan? Will your plans be optimal? Will you plan for multiple agents? For examples of the algorithms that you can implement, look at the Grid-Based Path Planning Competition:

<http://movingai.com/GPPC/>

## Role 2: Task Planning

You will be responsible for creating the PDDL models for performing the task planning. The executive will provide goals for the task planner to achieve – it is your responsibility to return plans to achieve these goals as quickly as possible. This should be dome using an external planner – MetricFF if you intend to use numeric fluents or FastDownward / LAMA if not. Again, questions of optimality are relevant, alongside the questions of whether a plan that achieves all goals should be returned, or just a partial set.

## Role 3: Plan Executive

It is the role of the plan executive to take a strategic view of the game and interact with the motion and task planners in order to achieve the global objectives. It is your responsibility to make requests from the planners in a timely fashion, so the game doesn’t hang and also that the plans look intelligent. It is also your responsibility to execute the plans in the game. This might include real-time plan modifications based on the dynamism of the game, etc. In addition, you will be required to request updates to any data structures that the different planning systems use when the map changes due to buildings being placed, etc.

# The Report

You will produce a report of 7000 words, detailing how each of the components is implemented, how they are integrated and how much of the game specification is completed. Construct different scenarios in order to demonstrate the effectiveness of each of the components.