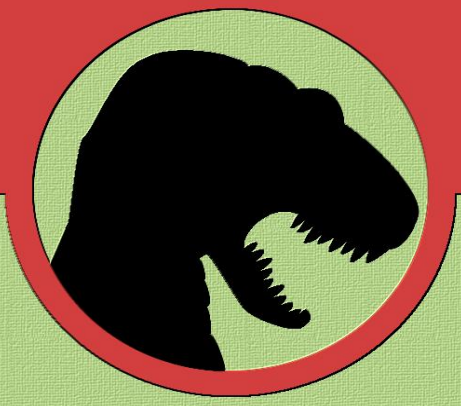
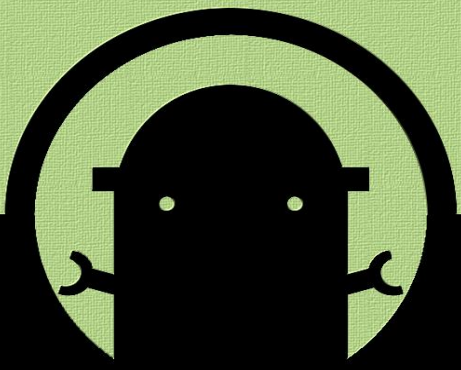
Nov. 7th 2009



MEGAMINER AI TIME TRAVEL HANDBOOK



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Background Story

It began innocently enough. You were in a lively discussion with colleagues: 'My dear sir, that is just where you are wrong. That is just where the whole world has gone wrong. We are always getting away from the present moment. Our mental existences, which are immaterial and have no dimensions, are passing along the Time-Dimension with a uniform velocity from the cradle to the grave. Just as we should travel _down_ if we began our existence fifty miles above the earth's surface.'*, you said! They laughed, and in your heart you vowed to prove them wrong. No sooner did you leave the room than did a man wearing chrome clothing and sunglasses come to you. He handed you a thick pile of papers in your own hand writing. 'These are the designs for the time machine you will invent by studying these designs.' he told you. This having been your plan for inventing the time machine, you smugly smile as he continues. 'Now, you must take command of your trans-temporal army (which you will found in 20 years) and win the great time war! Be prepared! If you cannot win then you will never invent the time machine or found your army, and the implications will be so confusing that the universe will be destroyed!' The metaphorical gravity of the situation weighed heavily on your heart, and you stepped onward to your TIME-DESTINY!

*H.G. Wells, The Time Machine

Rules

- Teams consist of no more than 3 players
- There are 24 hours to complete your AI
    - Competitors may begin working at 12:00 (noon) on Saturday, November 7, 2009
    - **Code must be submitted by Sunday November 8, 2009**
- Competitors are free to come and go as they please.
- All code must be completed in Centennial Hall room 105
- Only the machines in Centennial 105 may be used for programming
    - Each machine is equipped with Windows XP and PuTTY for access to Linux machines
    - PCs in Centennial 105 are grouped into pods of 4 computers. One or two teams may be assigned to each pod.
- *No Cheating.* Competitors may use the internet for research, but all code must be written by team members during the aforementioned 24 hour period in Centennial 105.

Game Brief

- Two players play during each game
- There are three time period in which action takes place: "Far Past", "Past", "Present" Units may traverse time periods by using portals which exist in fixed locations on the map.
- The Tournament is a McMahon style tournament. Initial rankings are based on wins in the arena.
- How to win:
    - Destroy all of your opponent's buildings and end your turn
    - Have a greater net worth than your opponent at the end of turn 499.
        - The first turn is numbered 0. Each player will get 250 turns.
        - Net worth is the sum of the price you paid for each of your remaining buildings and units (regardless of their remaining HP).
    - Wait approximately 5 seconds for your opponent to take their turn. The server will assume they are stuck or disconnected.
    - There are no ties. The player that moved second wins in any such cases.

Game Details

- Map Details
  - Each time period is a 21 by 21 map.
  - Coordinates run from -10 to 10 in both the X and Y direction.
  - Object time period location is denoted by a Z coordinate
  - Players start at opposite ends of the map.
  - Maps are randomly generated, but constructed symmetrically such that each player's half is a mirror image of the other player's half
- Time Travel Details
  - Portals might not appear in the same spot on every map. However, once placed, a portal cannot move.
  - Units may traverse Far Past <-> Past <-> Present, but may NOT travel from Far Past to Present directly, or vice versa.
- Armor
  - When a unit takes combat damage, it will subtract its armor rating from the damage received, for a minimum of 1 damage.
- Portals
  - Portals allow units to travel between time periods at the cost of gold.
  - To a use a portal, a unit must be standing on a portal and use its warp ability. The direction of the portal, 1 or -1, is added to that unit's z coordinate.
  - For every portal, there will be another portal on the other side that can be used to return.
  - Blocking terrain will be placed such that portals can not be destroyed by cascading buildings.
  - Initial fee to use a portal is 25 gold.
  - Each use of the portal increments the fee by 10 gold.
  - At the end of each turn, the fee to use a portal is multiplied by .8 (NOTE: 25 is not a minimum, price will decrement to zero)
  - Upon warping, all enemies on the target coordinate are destroyed so that the rules of stacking are never violated.

Backward

Forward

- Food
  - Farms generate food, and each unit requires some amount of food based on its type.
  - Food can neither be stored nor transferred between time periods.
  - At the end of each turn, the current player must feed all of its units in each time period. If a player has N less food production in a time period than it has hunger in that time period, all units that belong to that player in that time period take 10*N damage.
- Terrain Effects
  - Terrain objects are scattered across the three time periods. These objects may prevent building on this square, moving on this square, or both.

~~Move~~/~~Build~~

~~Move~~/Build

Move/~~Build~~

- Buildings
    - All buildings are built by Engineer units
    - Engineers can start a new building in an adjacent square with non-blocking terrain, paying the building's cost up front.
    - Let T equal the build time for this building in this time period and M equal the max HP for this building. Each build action, including the act of starting a new building, adds M/T units of health to this building. This can be used to repair completed buildings as well.
    - When a build action restores the building to full HP, it is complete. It ripples through time, completing a building of the same type and 1 level higher in the next time period at the same location. This new building also ripples to the next time period. Buildings can not ripple to blocking terrain. Enemy units and all buildings in the way are destroyed.
    - Before a building is complete, it can be canceled for a full refund. Incomplete buildings have no abilities, actions, or benefits other than being in the opponent's way.
    - Buildings have a width and a height, so a single building may cover multiple squares.
    - A building's (x, y) coordinate marks the corner of the building closest to (-inf, -inf).
    - A building will cover all the coordinates within the rectangle (x,y) to (x+width-1, y+height-1).
- Stacking
    - All of your units can stack with each other.
    - All of your units can stack with your buildings.
    - No buildings may overlap.
    - None of your units or buildings can stack with your opponent's units or buildings.
    - None of your units or buildings can stack with portals or blocking terrain.
    - If an attack is made on a square containing a stack of units and a completed building, the damage is dealt to the building. No damage is dealt to the units.
    - If an attack is made on a square containing only units and/or an incomplete building, all of these objects take the full amount of the damage.

Unit Types

- *Any unit that has not finished being created can be canceled for a full refund. A building will not auto cancel any units in progress if the building is destroyed.*

- ***Joe Miner (Example)***
    - Cost: *Price of a unit in gold, where LVL means Level*
    - HP: *Health points, depends on Level*
    - Armor: *Depends on Level*
    - Build Time: *Necessary time to train in **turns***
    - Moves: **Available steps per turn**
    - Actions: **Maximum number of actions to perform per turn**
    - Mine: costs 1 action, 1 move
        - *Description of unit's action*

- Pig
    - Cost: 80 * 1.05^{LVL} (rounded down)
    - HP: 1400 * 1.15^{LVL} (rounded down)
    - Armor: 100 * 1.15^{LVL} (rounded down)
    - Build Time: 1
    - Moves: 3
    - Actions: 0
    - Hunger: 1

- Engineer
    - Cost: 75 * 1.05^{LVL} (rounded down)
    - HP: 500 * 1.15^{LVL} (rounded down)
    - Armor: 20 * 1.15^{LVL} (rounded down)
    - Build Time: 3
    - Moves: 2
    - Actions: 1
    - Build: costs 1 action, 1 move
        - Start a new building of any type, paying its cost up front
        - Work on an existing incomplete building
        - Repair a completed building
    - Hunger: 3

- Artist
    - Cost: 75 * 1.05^{LVL} (rounded down)
    - HP: 500 * 1.15^{LVL} (rounded down)
    - Armor: 20 * 1.15^{LVL} (rounded down)
    - Build Time: 3
    - Moves: 2
    - Actions: 1
    - Paint: costs 1 action, 0 moves
        - Must target an adjacent art gallery. Gold is generated in each time period this gallery exists. Let A be the artist's level and G be the gallery's level in a given time period. The gold gained in that time period is 5 + 5*abs(G – A)
    - Hunger: 3

- Spearman
  - Cost: 181 * 1.05^{LVL} (rounded down)
  - HP: 2000 * 1.15^{LVL} (rounded down)
  - Armor: 160 * 1.15^{LVL} (rounded down)
  - Build Time: 3
  - Moves: 4
  - Actions: 1
  - Attack: costs 1 action, 1 move

    - Damage: 450 * 1.15^{LVL} (rounded down)
    - Range: 0 - 2
  - Hunger: 5
- Artillery
  - Cost: 177 * 1.05^{LVL} (rounded down)
  - HP 1800 * 1.15^{LVL} (rounded down)
  - Armor: 25 * 1.15^{LVL} (rounded down)
  - Build Time: 5
  - Moves: 3
  - Actions: 1
  - Attack: costs 1 action, 2 moves

    - Damage: 750 * 1.15^{LVL} (rounded down)
    - Range: 3 - 4
  - Hunger: 5
- Cavalry
  - Cost: 120 * 1.05^{LVL} (rounded down)
  - HP: 1500 * 1.15^{LVL} (rounded down)
  - Armor: 50 * 1.15^{LVL} (rounded down)
  - Build Time: 4
  - Moves: 5
  - Actions: 2
  - Attack: costs 1 action, 0 moves

    - Damage: 280 * 1.15^{LVL} (rounded down)
    - Range: 0 - 1
  - Hunger: 5

Building Types

- ***Centennial Hall (example)***
  - Cost: *Price of a unit in gold, where LVL means Level*
  - HP: *Health points, depends on Level*
  - Armor: *Depends on Level*
  - Build time (far past, past, present): 12, 8, 5 *turns*
  - Width, Height : 2, 2
  - Can hold super awesome AI tournaments (*purpose*)

- School
  - Cost: 400 * 1.05^{LVL} (rounded down)
  - HP: 3500 * 1.15^{LVL} (rounded down)
  - Armor: 100 * 1.15^{LVL} (rounded down)
  - Build time (far past, past, present): 12, 8, 5
  - Width, Height : 2, 2
  - Can build Civil Engineer units

- Gallery
  - Cost: 400 * 1.05^{LVL} (rounded down)
  - HP: 3500 * 1.15^{LVL} (rounded down)
  - Armor: 100 * 1.15^{LVL} (rounded down)
  - Build time (far past, past, present): 8, 5, 3
  - Width, Height : 2, 2
  - Can build Artist units
  - Allows artists to use Paint ability when adjacent

- Farm
  - Cost: 300 * 1.05^{LVL} (rounded down)
  - HP: 3000 * 1.15^{LVL} (rounded down)
  - Armor: 100 * 1.15^{LVL} (rounded down)
  - Build time (far past, past, present): 7, 4, 2
  - Width, Height : 2, 2
  - Generates (20 * 1.15^{LVL}) units of food (rounded down)
  - Can build Pigs

- Barracks
  - Cost: 400 * 1.05^{LVL} (rounded down)
  - HP: 3500 * 1.15^{LVL} (rounded down)
  - Armor: 100 * 1.15^{LVL} (rounded down)
  - Build time (far past, past, present): 12, 8, 5
  - Width, Height : 2, 2
  - Can build Spearmen, Calvary, and Artillery units

- Bunker
  - Cost: 300 * 1.05^{LVL} (rounded down)
  - HP: 5000 * 1.15^{LVL} (rounded down)
  - Armor: 100 * 1.15^{LVL} (rounded down)
  - Build time (far past, past, present): 14, 8, 4
  - Width, Height : 2, 2

Coding

- Edit only AI.*
- BaseAI.*
    - Various accessor functions to get values that don't apply to a particular game object
        - getPlayer0Gold0() returns player0's gold.
        - getPlayerID() returns the caller's playerID
- wrappers.* (C++) or GameObject.* (Java/Python)
    - Accessors for specific objects
    - Unit/building actions
        - Unit.level() returns a units level
        - Unit. *attack(int x, int y)* causes unit to attack (x,y)
- NOTE: Game state is not updated during your turn *unless…*
    - If your run function returns false, your turn will not end, and will request an updated game state. At this point, run() will be called again.