Computer Games
Project Summary:
Freeciv AI city building process improvement
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1. What is Freeciv?

Freeciv is a clone of Civilization – very popular turn-based strategy game. Action takes place on a map resembling a part of the world and consists of various “tiles” representing different types of terrain. Players take control of different civilizations and try to conquer entire world by destroying other nations or focus on economy and work towards sending their people into spaces. Those are the win conditions. Players are divided into two groups – human and AI. The second one was our point of interest.

2. Goal

Our goal was to create an improved AI which would develop its cities way more smartly than the original AI. After some observations we decided to divide built cities into several groups – city types, to maximize the benefits the certain founding location offers. Original AI generally builds all cities based on the same scheme which isn't always the best choice. In our implementation there is a number of factors which have effect on the city type choice and effectively, types of building which are raised within its limits. We were aware from the beginning that this only a relative small part of Freeciv AI and there is no guarantee there will be any significant impact on the computer's gameplay, not to mention discernible changes in the win statistics.

3. City types

Implemented modification doesn't affect selection of city founding site – it's up to the original AI. We only assign carefully selected type to each existing city based on factors described in the next section.

List of city types:

- **Military** – focused primarily on military units production as well as supporting buildings which boost defense benefits. This type of city is built as close to enemy nations as possible, following the natural intuition that the attack is highly possible from these directions.
- **Food** – most of the food production takes place here. This type is vital to nation's growth because creating and upkeep of settlers require lots of food. Food city type is chosen if there are many food generating tiles nearby. Game provide number of structures designed specifically to boost food production and creating all of them in a such suitable city gives the best effect possible.
- **Production** – those cities are created nearby tiles having good shield output, like hills and mines. The city tries to maximize that output by creating improvements that boost it.
- **Economy** – gold is one of the most important resources in Freeciv, therefore there is need for a constant source of money. Stock exchange, marketplaces and other buildings in right combination can boost income several times while other buildings improves science output of the city significantly.
- **Coastal** – cities located on the coastline are treated specially, because of some specialized buildings that increase output from oceanic tiles and boost naval production and defense in the city, see list below.
Detailed list of buildings:

In order to better understand city types we present entire list of buildings included in each type's improvement plan:

Military:

Airport – allows to produce veteran air units, boosts repair rate for air units, enables airlift
Aqueduct – allows a city to grow larger then size of 8
Barracks(I, II, III) - gives Veteran status to every land unit produced in the city; boost repair rate for land units
City Walls – boosts city defense against land and helicopter units
Coastal Defense – boosts city defense against bombardments from enemy ships
Granary – sets food amount to half full when city grows
SAM Battery – doubles the defense against aircraft
SDI Defense – protects city from nuclear attacks
Sewer System – allow city to grow larger than size of 12

Food:

Aqueduct – allows a city to grow larger then size of 8
Cathedral – makes 3(+1 with Theology, -1 with Communism) unhappy citizens content(requires Temple)
Colosseum - makes 3(4 with Electricity) unhappy citizens content
Granary – sets food amount to half full when city grows
Harbor – gives one extra food from all oceanic tiles
Mass Transit – Neutralizes the pollution generated by the population
Sewer System – allow city to grow larger than size of 12
Supermarket – increases food production by 50% on each farmland
Temple – makes 1(2 with Mysticism) unhappy citizen content

Production:

Airport – allows to produce veteran air units, boosts repair rate for air units, enables airlift
Aqueduct – allows a city to grow larger then size of 8
Barracks(I, II, III) - gives Veteran status to every land unit produced in the city; boost repair rate for land units
Granary – sets food amount to half full when city grows
Hydro Plant – gives 25% extra production bonus to both Factory and Manufacturing Plant
Manufacturing Plant – increases shield production by 50%
Nuclear Plant - gives 25% extra production bonus to both Factory and Manufacturing Plant
Offshore platform – adds one extra shield to all oceanic tiles
Port Facility – allows to produce veteran sea units, boosts repair rate for sea units
Power Plant - gives 25% extra production bonus to both Factory and Manufacturing Plant
Recycling Center – reduces the pollution generated by production by 66%
Sewer System – allow city to grow larger than size of 12
Solar Plant - gives 25% extra production bonus to both Factory and Manufacturing Plant; eliminates all

**Economy:**

Aqueduct – allows a city to grow larger then size of 8
Bank – increases the luxury and tax production by 50% (needs Marketplace)
Courthouse – reduces the corruption in a city by 50%; under Democracy makes 1 unhappy citizen content
Granary – sets food amount to half full when city grows
Library – increases the science output of a city by 100%
Research Lab - increases science output by 200% (requires University)

**Coastal:**

Aqueduct – allows a city to grow larger then size of 8
Coastal Defense – boosts city defense against bombardments from enemy ships
Granary – sets food amount to half full when city grows
Harbor – gives one extra food from all oceanic tiles
Offshore platform – adds one extra shield to all oceanic tiles
Port Facility – allows to produce veteran sea units, boosts repair rate for sea units

4. **Results**

We run game couple of times with our improved AI vs. hard AI from game. One of the best results we have got is showed below.