

# Case Study for CIS 683

## Santa Paravia and Fiumaccio

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## Introduction

This case study consists of the requirements for a computer game. It is to be used as a requirements document to develop analysis and design models for practice in Object Oriented Analysis and Design.

Santa Paravia and Fiumaccio has an interesting place in computer history. Based initially on the computer program Hammurabi, which allowed the player to allocate economic resources between guns and butter and displayed the results in text format, it was the first graphical “God Game” for computers, the ancestor of programs like Sim City™, Caesar 3™, Age of Empires™ and Civilization™. It was also the first computer game based on character development, one of the ancestors of games like Wizardry™, the Might and Magic™ series, and Baldur’s Gate™. It was the first computer game designed to be played by family groups including parents and children. It was one of the most popular computer games of the early days of the microcomputer, and was quickly ported to all of the popular systems of its time, including the Radio Shack TRS-80™, the Apple II™, the Commodore Pet™, and the Texas Instruments 99/4™.

The town names for Santa Paravia and the Italian setting were inspired by Giovanni Guareschi. Guareschi wrote a series of stories for anti-Communist newspapers in Italy during the 1950’s about conflicts between parish priest Don Camillo and the communist mayor of his town, Peppone. Those stories were translated into English by L. K. Conrad, and published by Farrar, Straus and Giroux as a series of books, including *The Little World of Don Camillo* (1951), *Don Camillo and His Flock* (1952), *Don Camillo’s Dilemma* (1954), *Don Camillo Takes the Devil By the Tail* (1957), *Comrade Don Camillo* (1964), and *Don Camillo Meets the Flower Children* (1969). The game enjoyed popularity in Italy, and I received fan mail from a student who lived in the region in which the game was set. I had not known that there were real towns with those names.

I moved the setting back to the middle ages to simplify the economy. The game was designed to be fun for mixed ages, so I tried to make the outcome depend significantly on chance. At the time, I had two young sons. One of the weaknesses of the original game was that you could get rich speculating in Grain and Land, so that skill in speculation could overcome other decisions.

A crude translation of the original game can be downloaded from the web at <http://jeffrey.henning.com/app/paravia/default.htm>, which is also a fan site for the program.

The requirements given here are for an updated version, mostly true to the original and much too simple for a commercial game today, but a good class exercise. I have chosen this for a case study because I am the original author and kept all the copyrights. The game was originally printed as a program listing in SoftSide™ magazine of Milford, New Hampshire in December, 1978, and was marketed as a finished product by Instant Software™ of Peterborough, New Hampshire in 1979 and 1980. As recently as this year, two people purchased original, unopened copies of the Commodore version through a computer auction.

## Requirements Specification

Santa Paravia and Fiumaccio is a computer game, simulating managing the economy of imaginary and oversimplified Italian city states in the 15<sup>th</sup> Century. The object of the game is to be promoted to higher noble titles by building the economy, size, and population of your state. The first person to become a King or Queen wins. Each person gets a random life expectancy of 20 to 55 years, so there is an urgency and time limit to the game.

Players alternate play, and each cycle of player turns represents one year in the history of each city state. Each turn as three possible sets of decisions to be made, under the category of Harvest, Taxes, and Public Works. A visual display of the city state reveals clues about decisions to be made.

In the Harvest decisions, each player may buy grain, sell grain, buy land, and sell land, and must decide how much grain to release for consumption, and how much to store for the following year, including seed for the following year's crops and production against a bad harvest.

In the Tax decisions, each player may set tax levels for Customs Duty, Sales Tax, and Income Tax, and also sets Justice Policy.

In the Public Works decisions, players may purchase weapons and armor to equip some of their serfs as soldiers, and build markets, woolen mills, palaces, and cathedrals.

After all decisions have been made, the computer makes a few random decisions, then calculates the consequences to start the next turn.

## Requirements Part I: Initialization

**R001 Players** The game may be played by 1 to 6 persons. There are always six players, with the computer taking any places left over after human players have entered their names and sex.

**R002 Name, Sex and Title** The game must keep track of the name and sex of each player, and assign the following titles as they are earned. Each city state should be identified on the screen with it's name, a graphical shield, and the title and name of its ruler.

Men	Women
Sir	Lady
Baron	Baroness
Count	Countess
Marquis	Marquise
Duke	Duchess
Grand Duke	Grand Duchess
Prince	Princess
King	Queen

**R003 Toggle Map** When each player is making their decisions, the screen should use a hot key to toggle between a full screen display of all six states and an enlarged map of the current state with icons and information for decision making.

**R004 Initialization.** At the beginning of the game, the computer must accept the names and sex of the players, set the year to 1400, calculate a random date of death for each player between 1421 and 1455, and initialize the following variables for each player, including the computer players:

Variable	Initial Value
Markets	5
Palace Level	0
Cathedral Level	0
Woolen Mills	0
Customs Tax Rate	25%
Sales Tax Rate	10%
Income Tax Rate	5%
Justice Level	Fair
Treasury	1000 Florins
Land	10000 Hectares
Merchants	25
Nobles	4
Year of Death	1420 plus Random(35)
Soldiers	25
Clergy	5
Grain Reserves	5000 Steres
Serfs	2000
Title	Sir (Male) Lady (Female)
Economy Index	0
Sex	As input for human, default for computer
Player Name	As input for human, default for computer
City Name	Default

Here are the default values for Cities, Players, and Sex:

City	Computer Player	Computer Sex
Santa Paravia	(not applicable)	(not applicable)
Fiumaccio	Peppone	Male
Torricello	Camillo	Male
Molinetto	Anselma	Female
Fontanile	Flora	Female
Romagna	Brusco	Male

## Requirements Part II: Annual Calculations

### R005 Annual Global Value Calculation.

The following variables are calculated at the beginning of each year.

Variables that are the same for all players:

Add 1 to the previous year

1 chance in 50 of a universal plague (See R010)

Weather:

Description	Probability	Base price for grain	Grain Produced per planted Hectare
Drought	5%	5 Florins/Stere	½ stere
Poor	10%	4 Florins/Stere	1 steres
Fair	10%	3.5 Florins/Stere	2
Average	50%	3 Florins/Stere	3
Good	20%	2 Florins/Stere	4
Excellent	5%	1.5 Florins/Stere	4 ½

Annual variables that are different for each player:

**R006 Obituary** Compare the year to the players year of death, and print an obituary if equal. In the obituary, give name, title, state and cause of death,  
 If over 50 (Year > 1450) of old age after a long and successful reign  
 otherwise randomly from the following causes:  
 of Consumption after a cold winter in a drafty castle  
 in a smallpox epidemic  
 of typhoid after drinking bad water  
 of food poisoning  
 murdered by the crown prince  
 in glorious battle

**R007 Rats** eat from 1 to 50 percent of the stored grain

### **R008 Markets and Mills**

Calculate rents at (70 plus the number of Nobles) Florins per market. If justice is Very Fair, add 10 Florins per Merchant (not Market). If Justice is Harsh, subtract 15 florins per market. If justice is outrageous, subtract 30 Florins per market.

Calculate profits for the Woolen Mills as follows

Add the Palace Level, Cathedral Level, Number of Markets, and Number of Nobles

Multiply this value by 25

Calculate a random value between 1 and this number

If Justice is very fair, add ten. Multiply by the number of mills

### **R009 Grain**

Subtract Grain eaten by Rats from reserves

Add Harvest = Planted Hectares times Grain Produced per Hectare (See R0005)

Calculate Grain Demand as follows: 100 steres per noble, 40 per clergy, 25 per merchant, 10 per soldier, and 5 per serf.

Divide the amount of Grain released for consumption on the previous turn by the demand to get the Percent of grain demand Met. (Exception: In the first year, 1400, set Percent Met = 100)

Calculate **Grain Price** as follows

Take Base Price (See R005)

If the Percent Met is less than 100%, multiply the price by One plus the difference.

Example

Base Price is 3, Percent Met is 70%, (Difference is 100%-70% = 30%)

3 florins times 130% = 3.9 Florins per stere.

If Grain Reserves (after Rats) are less than 20% of demand, add 1 Florin per stere.

Random adjustment to local price:

Add number of promotions received (i.e. 1 for Baron, 6 for Prince) to 10.

Calculate a Random number up to this value

Subtract 6 and divide by 10

Add to previous price

Examples: (Using 3.9 value from above)

Lady (0 promotions)

0 plus 10 is 10.

Calculate random(10) = 3

(3-6)/10 = -0.3

3.9 plus -0.3 = 3.6 Florins per stere

Duke (4 promotions)

4 plus 10 is 14

Calculate random(14) = 9

(9-6)/10 = 0.3

3.9 plus 0.3 = 4.2 Florins per stere

**R010 Plague**

If no universal plague (see R005) then

If grain supply is less than 60% of demand, 1 chance in 5 of plague

If grain supply is less than 30% of demand, 1 chance in 2 of plague

Any kingdom hit by plague loses from 10% to 50% nobles, clergy, merchants, soldiers and serfs.

Calculate and display the results for each category of population separately, in this format.

**Fiumaccio lost 2 nobles, 5 clergy, 20 merchants, 43 soldiers and 1574 serfs to the plague.**

**Population**

Calculate changes in population as follows

**R011 Births**

Calculate Serf growth factor as follows

If percent of Grain Demand Met (See R009) is	Base value
Greater than 125%	5.0%
100% to 125%	4.0%
75% to 99.9%	2.5%
Less than 75%	1%

If Justice is Very Fair, add 0.1%

If the total of the Sales Tax and Customs Tax is less than 30%, add 0.1%

If the Weather was Good add 0.1%, if excellent add 0.2%

Add a random adjustment of -0.5% to .5%  $\{(Random[10] - 5)/10\}$

Multiply by the number of serfs to get the births.

There is one chance in 4 of a birth in the nobility each year.

There are no births in the Clergy, Merchants, or Soldiers. Serfs move into these positions based on the economy.

**R012 Deaths**

If plague, use values from R010

Otherwise, calculate mortality factor as follows

If percent of Grain Demand Met (See R009) is	Base value
Greater than 120%	2.0%
100% to 120%	2.4%
80% to 99.9%	2.7%
60% to 79.9%	4.5%
Less than 60%	10%

For each category (nobles, clergy, merchants, soldiers, serfs)

Add a random adjustment of -0.5% to .5%  $\{(Random[10] - 5)/10\}$

Multiply by the number of persons in each category to get the number of deaths in that category.

Exception: If the number of deaths in a category is less than one, divide 100% by the base value to get the probability of a death.

Example

There are 4 nobles, and the base value is 2.4% with a random adjustment of +0.1% (2.5%)

$100 / 2.5 = 40$  (One chance in 40 of a death)

If  $Random(40) = 1$ , 1 noble dies.

**R013 Migration**

If Justice is Very Fair, there is an in-migration of  $\text{Random}(0.03 * \text{number of serfs})$

If Justice is Harsh, there is an out-migration of  $\text{Random}(0.01 * \text{number of serfs})$

If Justice is Outrageous, there is an out-migration of  $\text{Random}(0.1 * \text{number of serfs})$

If percent of grain demand met is:

> 150%, there is an in-migration of  $\text{Random}(0.2 * \text{number of serfs})$

> 130%, there is an in-migration of  $\text{Random}(0.1 * \text{number of serfs})$

> 100%, there is an in-migration of  $\text{Random}(0.05 * \text{number of serfs})$

< 90%, there is an out-migration of  $\text{Random}(0.1 * \text{number of serfs})$

< 60%, there is an out-migration of  $\text{Random}(0.2 * \text{number of serfs})$

If Justice is better than harsh, and grain demand is greater than 100% and there is more than 500 hectares of land that was not planted due to a labor shortage, there is an in-migration of  $\text{Random}(0.1 * \text{number of hectares of land not planted})$

Add the values and report in this format:

**232 Serfs moved to Santa Paravia**

**112 Serfs fled to other lands**

**R014 Human progress**

If the number of Merchants is less than 5 times the number of Markets, increase merchants by  $\text{Random}(\text{Number of Markets})$  and subtract the same number from the serfs.

If total taxes are less than 30%, increase merchants by  $\text{Random}(\text{Number of Markets})$  and subtract the same number from the serfs.

If profits from the Woolen Mills are greater than 100 Florins times the number of Markets, increase merchants by  $\text{Random}(\text{Number of Markets})$  and subtract the same number from the serfs.

If the number of Clergy is less than 5 times the level of Church, increase clergy by  $\text{Random}(\text{Level of Church})$  and subtract the same number from the serfs.

**R015 Land in Production**

Subtract 100 times the number of Woolen Mills from the number of serfs (Mill Workers)

It takes 1 serf and 2.5 steres of seed grain to plant 5 hectares.

Multiply the remaining number of serfs by 5. Divide the amount of Grain in the warehouse not distributed for consumption by 2. The smaller of the two numbers is the number of Hectares of land that can be farmed.

If it is less than total land, all land is in production. Otherwise, some land is idle, and will not produce grain that year. The Map should display a pasture that graphically represents all the land. This pasture does not increase in size as more land is purchased. Instead, it is a bar graph of the percentage of land in production. If all land is in production, it is covered with green plants, and a farmer plowing with an ox is shown at the top of the graph. If there is idle land, the relevant percentage of the land is shown as bare dirt, and farmer is plowing at the top of the green section. If there are any idle serfs, either because there is not enough land or not enough seed grain, display a tree at the top of the pasture. Alongside the tree, display one serf for every 10% or fraction of the serfs who are idle. (1 serf to 10% = 1 unemployed serf, 11% to 20% = 2, etc.) This graphic is a key part of the game, because managing unemployment is key to the game economy. When there are idle serfs, players should buy seed grain or land, reduce the grain released for consumption, or build woolen mills to relieve unemployment. Note that this must be recalculated and redrawn every time the number of mills, serfs, or amount of land or grain in reserve changes.

**R016 Taxes**

Tax Rates are as follows

Tax	Minimum Value	Maximum Value
Customs Duty	0%	100%
Sales Tax	0%	50%
Income Tax	0%	25%

In addition, you can raise money from fines by setting your level of Justice:

Level of Justice	Revenue Effect	Other Effects
Very Fair	Costs money	Immigration, Flourishing markets, Improves economy
Moderate	Some Income	Neutral
Harsh	Good Income	Emigration, hurts markets, damages economy
Outrageous	Lots of Money	Same effects as Harsh Justice, but more damage

To identify the yield from taxes, you first calculate the economic potential (Economy Index) for each state:

Multiply the number of Markets by 100, the number of mills by 200, the Palace Level by 300, and the cathedral level by 500. Add these values together. Multiply the number of Nobles by 100, the number of clergy by 50, the number of merchants by 25, the number of soldiers by 3, and add these values to the other total. Now add the number of serfs and the total money in the treasury. This is the Economy Index, the Gross Domestic Product of the State.

Now determine the tax base for each tax:

For Customs Tax, add the number of promotions (0 to 6 for Sir to Princess), the number of Nobles, and half of the number of clergy. If this number exceeds 40, set it to 40. Take this number, divide by 100 to get a percentage, and multiply by the Economic Index to get the Potential Customs Tax at the 100% rate. For Sales tax, take the smaller of the Economic Index or the number of Merchants times 100. This is the Sales Tax Base.

For Income Tax, Divide the economic index by 15 to get the Income Tax Base.

Add together the excess of each tax rate over 5% to get the penalty index

If the penalty index is above 30% reduce each tax base by 10%

If the penalty index is above 50% reduce each tax base by another 10%

If the penalty index is above 70% reduce each tax base by another 10%

If the penalty index is above 80% reduce each tax base by another 10%

If the penalty index is above 90% reduce each tax base by another 10%

If the penalty index is above 100% reduce each tax base by another 10%

Multiply the Customs Tax Base by the Customs Tax Rate to get the Customs Tax

Multiply the Sales Tax Base by the Sales Tax Rate to get the Sales Tax

Multiply the Incomes Tax Base by the Income Tax Rate to get the Income Tax

Very Fair Justice costs 5 Florins per merchant

Harsh Justice raises 10 Florins per merchant in fines

Outrageous Justice raises 10 Florins per merchant plus 1 Florin for every 10 serfs.

Note that these calculations will have to be redone every time the tax rates change to display potential tax revenue to the player, but the actual tax revenue will be added to the player's account only once a year.



**R017 Qualifications for Promotion**

**To be promoted, you must have at least one soldier for every 500 hectares, total taxes less than 50%, justice not worse than harsh, grain demand met at least 100%, and meet all of the following tests for the new level:**

Title	Palace	Cathedral	Serfs	Treasury	Land
Sir, Lady	Level 0	Level 0	0	0 Florins	0 Hectares
Baron, Baroness	Level 1	Level 1	1000	2000	10000
Count, Countess	Level 2	Level 2	2000	4000	20000
Marquis, Marquise	Level 3	Level 3	3000	8000	30000
Duke, Duchess	Level 4	Level 4	4000	12000	40000
Grand Duke, Duchess	Level 5	Level 5	5000	20000	50000
Prince, Princess	Level 6	Level 6	6000	50000	75000
King, Queen	Level 7	Level 7	7000	100000	100000

This test is done at the beginning of every year for each player. If a player is promoted to King or Queen, display a Crown, play God Save the King (Queen) and announce the winner. Then display a comparative table of the players, ranked in order of title, then total population.

**Requirements Part III: Player Turns**

On each turn, the player has an opportunity to make decisions that affect the game.

**R018 Screen Display (Map)**

The screen Display consists of two basic screens, with additional dialogue boxes for input of variables.

There should be a toggle between the screens (R003)

The core display is a map of an individual state, with the following elements:

Each city state should be identified on the screen with it's name, a graphical shield, and the title and name of its ruler. (R002) The current Year should be indicated.

There is a Wall in front of the City State. If there is less than 1 soldier for every 1000 hectares of land, the wall is broken. If there is at least 1 soldier for every 1000 hectares, the wall has a small tower on each end. If there is at least 1 soldier for every 500 hectares of land, the wall as a large tower at each end with soldiers visible on top.

There is a field behind the wall, displaying the percentage of land in production and showing unemployed serfs. See R015 for details.

There is a row of markets, in two sizes. Each large market represents 5 small markets.

There is a row of woolen mills, in two sizes. Each large mill represents 5 small mills.

There is a location for a church and a palace. Depending on the level of those buildings, they should appear as follows:

Level	Church	Palace
Sir, Lady	Cross	Mud Hut
Baron, Baroness	Cross on pile of rocks	Wood Hut
Count, Countess	Small church	Frame House
Marquis, Marquise	Larger Church	2 Story House
Duke, Duchess	add Chapel to Church	Large House
Grand Duke, Duchess	Cathedral, no towers	Palace
Prince, Princess	Add tower	Small Castle
King, Queen	Add second tower	Large Castle

Note: A player must build the palace and church for the next level before they can be promoted to that level, but may not build again until promoted.

One of the two basic screens consists of the above elements, reduced in size, showing all six city states on a single screen. The other is a larger version of an individual city state, with supporting data and icons to allow user decisions.

**R019 Screen Display (Player Details)**

The following supporting data should be displayed on the player screen.

Customs Tax Rate, Sales Tax Rate, Income Tax Rate, and Justice Level

Revenue from Taxes and Fines, Markets, and Woolen Mills

Number of Nobles, Clergy, Merchants, Soldiers, Serfs and Hectares of Land

Amount of Grain On Hand, in Reserves, and Released for Consumption

There should be an Icon to change Tax Rates, an Icon for Building Structures, an Icon for Equipping

Soldiers, an Icon to manage Grain, and an Icon to buy and sell Land.

The current price of Grain (R009) and Land (R020) should be displayed.

Message lines should report changes in population (R011, R012, R013, R014), Grain eaten by Rats over the winter, (R009) Current weather (R009), and special events like plagues (R010)

**R020 Buy and Sell Land**

The base price of land is 5 times the current grain production (Table R005) times the current price for Grain (R009). Add 1 percent to the price for each percentage of serfs who are unemployed. (Building a woolen mill should reduce the price of land by reducing unemployment. Reduce the base price by the percentage of land that was not in production last year.

Examples:

Weather	Harvest	Grain Price	Unemployment	Idle Land	Land Price
Average	3 steres/hectare	3.3 Florins	12%	0%	55 Florins/Hectare
Excellent	4 ½ steres	1.7 Florins	0%	23%	29 Florins/Hectare

$(5 \times 3 \times 3.3 \times 112\% = 55.44)$   $(5 \times 4.5 \times 1.7 \times 77\% = 29.45)$

Note that land prices are rounded to the nearest Florin. Because buying and selling land affects either unemployment or idle land, it changes the price. To prevent game delays by a player making multiple purchases or sales to get better prices, only one purchase or sale can be made each year.

**R021 Set Tax Rates**

The player can set tax rates as follows

Tax	Values
Customs Duty	0% to 100%
Sales Tax	0% to 50%
Income Tax	0% to 25%

In addition, the player can change the level of Justice

Level of Justice
Very Fair
Moderate
Harsh
Outrageous

Each time a tax or Justice level is changed, the program recalculates the tax yield (R016), so that the player can adjust rates for maximum yield.

**R022 Build Structures**

A player can build the following structures

Structure	Price	Population Effect
Market	1000 Florins	3 serfs become merchants
Woolen Mill	2000 Florins	100 farmers become mill workers (remain serfs)
Add to palace	3000 Florins	1 noble moves to state
Add to church	5000 Florins	2 serfs become clergy

Note that church and palace construction can only build to the level required for the next level of nobility. (See R018)

### **R023 Equip Soldiers**

The player can equip as many platoons of soldiers as desired, as long as there are serfs and cash available.

Selection	Price	Population Effect
Equip Platoon	500 Florins	20 serfs become soldiers

Note that soldiers prevent invasion and conquest, which is a game ending disaster for a player.

### **R024 Manage Grain**

The player can buy or sell grain at the Market Price (R009). Because sales affect grain prices, only one sale and one purchase are allowed each year.

The player also decides how much grain will be released for consumption. The rest will be held in reserve. A minimum of 20% of the total grain must be released for consumption, and at least 10% must be held in reserve. Reserved grain is eaten by rats (up to 50%) and then is available for seed grain to plan the next years crops, or to feed the population in the event of a bad harvest, or to speculate with.

Because inadvertent entries can be disastrous here, there must be an undo button to allow the player to reverse all grain transactions for the current year. Obviously, that means the original values must be stored until the end of the turn, along with the cash and grain amounts of transactions to be reversed.

## **Requirements Part IV: Special Events**

### **R025 Player Elimination**

If a player dies (R006), goes bankrupt (R026), or is conquered (R027), they are eliminated from the game.

Values for a dead player are stored for comparison at the end of the game. Screen maps and variables for invaded and bankrupt players are reset to the initial values for display on the global screen (R018). A message is put on the map in this format:

Prince Igor of Torricello died in 1447

Duchess Jasmine of Romagna went to debtor's prison in 1425

Marquis Manual of Molinetto was conquered and executed in 1432

It is no longer possible to access the individual screen for a player that has been eliminated.

Special Case: A player becomes King or Queen. (See R017)

### **R026 Bankruptcy**

Players own their government, so they have generally good credit. However, 10 percent interest is added to any negative treasury balance before taxes are collected each year. If, after tax collection, the player owes more than 10,000 florins times their level (Lady = 1, Prince = 7), they go bankrupt and are eliminated from the game. There should be a suitable announcement, perhaps showing them hauled away to debtor's prison.

**R027 Invasion**

A player that does not keep at least one soldier per 1000 hectares can be invaded. The test is made each year after population changes, so that normal deaths and especially plague might trigger invasion before the player can do anything about it.

Invasion is fully automatic. Here is the process.

If after population changes, a player has less than one soldier per 1000 hectares.

Check all other players to see if any has at least one soldier per 500 hectares AND at least twice as many soldiers as the player to be invaded. If so, pick the player with the most soldiers.

If, after reducing that player's soldiers by 25%, that player will still have more than one soldier per 1000 hectares for both city states combined, invasion is automatic.

Announce the invasion

Invading Player loses Random(Up to 25)% of soldiers in the invasion.

All of the soldiers and nobles of the invaded city state are killed.

Half of the serfs are killed or flee. The rest are added to the invader's country.

If the invaded country had a higher level palace or church, the invader gets that level, even if they are not far enough advanced in title to build that level. (Make sure building routines can handle this situation.)

Half of the markets and mills are burned in the invasion. The invader gets the rest. (Round down.)

Invader gets half of the treasury, half of the merchants, and half of the clergy of the invaded country.

All of the grain reserves are captured intact, and the player gets all of the land of the conquered city state.

Add all of the gains to the totals in the original City State.

## Requirements Part V: Computer Player

### **R028 Automation of the Player Role**

Because it is difficult for the computer to compete with a human player, it is given one advantage. If at the beginning of any term, the computer has less than 120% of the amount of grain necessary to fully meet the needs of the current population, automatically increase the grain supply to that level.

Decisions:

#### **Tax**

Leave Tax Rates and Justice Level at the Default Values.

#### **R029 Grain**

If the grain supply is less than 125% of demand, release 100% of the demand, and reserve the rest

Between 125% and 140%, release 105% of demand

Above 140%, Release 120% of demand. If the grain price is above 3 Florins, sell half of the rest.

#### **R030 Soldiers**

If the number of soldiers drops below 1 per 700 Hectares, purchase more as funds are available until there is at least one per 450 Hectares

#### **R031 Unemployment**

If the land is fully farmed:

If land price is below 45 Florins, and the need can be met completely with cash on hand, buy more land until everyone is farming.

If there is not enough cash to buy that much land, purchase 1 mill and then as much land as possible.

If land price is 45 Florins or higher, buy enough mills to absorb the unemployment

#### **R032 Palace**

If enough money is left after the above steps, and the Palace has not been improved to the next level, purchase the next level.

#### **R033 Church**

If enough money is left after the above steps, and the Church has not been improved to the next level, purchase the next level.

#### **R034 Markets**

If enough money is left after the above steps, purchase 1 market.

#### **R035 Additional Land**

If land has not been purchased under R031, and there is enough money, and land price is under 35 Florins, buy as much as possible.