**Software Requirements**

**Specification**

**for**

**Producers-Consumers Economic Relationships Model**

**Version 1.0**

**Prepared by Mateusz Golab**

**Cranfield University**

**School of Engineering**

**AMAC**

**27th March 2012**

**Table of Contents**

[1. Introduction 3](#_Toc321086238)

[1.1. Purpose 3](#_Toc321086239)

[1.2. Document Conventions 3](#_Toc321086240)

[1.3. Intended Audience and Reading Suggestions 4](#_Toc321086241)

[1.4. Project Scope 4](#_Toc321086242)

[1.5. References 4](#_Toc321086243)

[2. Overall Description 4](#_Toc321086244)

[2.1. Product Perspective 4](#_Toc321086245)

[2.2. Product Features 4](#_Toc321086246)

[2.3. User Classes and Characteristics 5](#_Toc321086247)

[2.4. Operating Environment 5](#_Toc321086248)

[2.5. Design and Implementation Constraints 5](#_Toc321086249)

[2.6. User Documentation 5](#_Toc321086250)

[2.7. Assumptions and Dependencies TODO 5](#_Toc321086251)

[3. System Features 5](#_Toc321086252)

[3.1. Model creation 6](#_Toc321086253)

[3.1.1. Description and Priority 6](#_Toc321086254)

[3.1.2. Stimulus/Response Sequences 6](#_Toc321086255)

[3.1.3. Functional Requirements 6](#_Toc321086256)

[3.2. Simulation 6](#_Toc321086257)

[3.2.1. Description and Priority 6](#_Toc321086258)

[3.2.2. Stimulus/Response Sequences 6](#_Toc321086259)

[3.2.3. Functional Requirements 6](#_Toc321086260)

[3.3. Results presentation 7](#_Toc321086261)

[3.3.1. Description and Priority 7](#_Toc321086262)

[3.3.2. Stimulus/Response Sequences 7](#_Toc321086263)

[3.3.3. Functional Requirements 7](#_Toc321086264)

[4. External Interface Requirements 7](#_Toc321086265)

[5. Other Nonfunctional Requirements 7](#_Toc321086266)

[5.1. Performance Requirements 7](#_Toc321086267)

[5.2. Safety Requirements 8](#_Toc321086268)

[5.3. Security Requirements 8](#_Toc321086269)

[5.4. Software Quality Attributes 8](#_Toc321086270)

[Appendix A : Glossary 8](#_Toc321086271)

[Appendix B: Analysis Models TODO 9](#_Toc321086272)

[1. Use case diagrams 9](#_Toc321086273)

[1.1. System use case diagram 9](#_Toc321086274)

[1.2. Model creation use case diagram 9](#_Toc321086275)

[1.3. Simulation use case diagram 9](#_Toc321086276)

[1.4. Results presentation use case diagram 9](#_Toc321086277)

[2. Sequence diagram 9](#_Toc321086278)

[3. State machine diagram 9](#_Toc321086279)

[Appendix C: Issues List TODO 9](#_Toc321086280)

[TODO : 10](#_Toc321086281)

**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Date** | **Reason for changes** | **Version** |
| Mateusz Golab | 29/03/2012 | Document created | 1.0 |
|  |  |  |  |

# Introduction

## Purpose

The purpose of this document is to provide full software requirements specification for the Producers – Consumers Economic Relationships Model. The document includes functional and non-functional requirements and use cases diagrams. All requirements specified in following document concern system version 1.0 .

## Document Conventions

|  |  |
| --- | --- |
| OE- | Operation environment requirement |
| CS- | Design and implementation constraint |
| AS- | Assumption |
| FR- | Functional requirement |
| PR- | Performance requirement |
| TBD- | “To be defined “ . Issue which is not precisely defined and must be clarified |

## Intended Audience and Reading Suggestions

This project is intended for following readers :

* ***Project manager*** - as a person responsible for whole project
* ***Architects*** – whose overall architecture must meet the requirements specified in this document
* ***Developers*** – whose software components must implements the requirements specified in this document
* ***Testers*** – who must ensure developed software quality and correctness according to requirements specified in this document
* ***Client*** – as the users of the system, should go through this document to check if functional requirements meet their needs.

## Project Scope

The purpose of this project is to provide software which is capable of performing simulations. The aim of these simulations is to show economical interactions between producers and customers. Performing several cycles within each simulation can be very helpful in terms of better understanding economic relationships between producers and consumers. This software is intended to answer questions addressed by the client.

## References

[1] *Advanced Software Engineering Lecture Notes,* *Academic Year 2010/2011* , Dr. Stuart Barnes

[2] *Software Requirements Specification Template,* Karl E. Wiegers 2002

[3] *IEEE Recommended Practice for Software Requirements Specifications, IEEE Std 830-1998,* IEEE Computer Society

# Overall Description

## Product Perspective

* The project is a self-contained product.
* No additional systems or sub-systems are required.
* It is designed to run on local desktop machine.
* System is accessible via text console user interface.

## Product Features

* Creating producers – consumers economic model based on user parameters
* Performing simulation of prepared model
* Presenting simulation results to the user

## User Classes and Characteristics

Client is the only user who will use this product. Producers-Consumers Economic Relationships Model represents dedicated application, which is provided to the specific client.

## Operating Environment

OE-1. Computer with x86 family processor

OE-2. Windows family operating system (XP, Vista, 7). Windows 7 preferred.

## Design and Implementation Constraints

CS-1. Software shall be implemented in C++ programming language.

CS-2. Software shall be designed according to Object Oriented Paradigm.

CS-3. Software shall provide possibility for the user to input simulation parameters from the text console.

CS-4. Unit testing framework shall be used in software development process.

CS-5. Static code analysis tool shall be used to evaluate code coverage.

## User Documentation

Documents delivered along with the software are as follows :

* Software Requirements Specification
* Software Design Descriptions
* Test Plan Document

All documents are in *pdf* format.

## Assumptions and Dependencies TODO

AS-1 Number of producers has to be greater than number of consumers

AS-2 Producer cannot sell a factory.

AS-3 Consumer cannot sell a product.

AS-4 User requests to start simulation, Simulation Manager starts simulation.

AS-5 Producer increases product’s price every 10 cycles.

AS-6 There is no time required for building a factory. It is ready to work in the same cycle it was requested.

AS-7 Product to buy for customers is chosen randomly by Simulation Manager.

AS-8 Customer’s salary can be set by the user How much money Customer receives as a salary ?

AS-9 Once order was accepted by the Producer it stays until being completed.

AS-10 Customer always orders maximum number of particular product he/she can afford.

AS-11 Product’s cost increase relates to final product’s price.

AS-12 Order’s threshold is the maximum number of orders in a queue. It can be set by the user, default value equals 3.

AS-13 Order’s threshold is exactly the same for all Producers.

AS-14 Customer has two another trials for making an order if his order was refused.

AS-15 Customer has to wait for his order to be placed before making another order.

AS-16 Destruction of the factory is not associated with any cost.

AS-17 Factory can become idle after first cycle without manufacturing products.

AS-18 Start-up cost of the factory can be set by the user , default value equals 15.

AS-19 Maximum number of consumers is 5000.

AS-20 Maximum number of producers is 100.

AS-21 Every Producer can have no more than 100 factories.

AS-22 Producer is paying factory running costs even if it is in idle state.

AS-23 Factory’s efficiency is set randomly in range [0.0 , 2.0] when it is built.

AS-24 Producer can produce products only when order was made.

# System Features

Includes main features of the system.

## Model creation

### Description and Priority

To perform the simulation, model has to be created. This activity requires :

* Default parameters
* Parameters provided by the user
* System specific values and constants.

**Priority = Medium**

System can run using default parameters.

### Stimulus/Response Sequences

Stimulus : User requests to specify particular parameter.

Response : System receives user parameter and replace default one.

### Functional Requirements

FR-1. Model can be created using default parameters.

FR-2. The user can set model parameters.

FR-2.1. The user can set a number of customers

FR-2.2. The user can set a number of producers

FR-2.3. The user can set an initial cash of each producer

FR-2.4. The user can set an initial cash of each customer

FR-2.5. The user can set a manufacturing cost for each product.

FR-2.6. The user can set a length of time to manufacture a product.

FR-2.7. The user can set an initial factory running cost.

FR-2.8. The user can set an idle factory start-up cost.

FR-2.9. The user can set a factory construction cost.

FR-3. Model can be created using user specified parameters.

## Simulation

### Description and Priority

Simulation is the main feature of the system. Provides results for prepared model.

**Priority = High**

### Stimulus/Response Sequences

Stimulus : User requests to perform simulation.

Response : System performs simulation using prepared model.

### Functional Requirements

FR-4. The user can start Producers-Consumes Economic Relationships model simulation.

FR-5. Simulation Manager can stop the simulation when some Producer is declared bankrupt.

FR-6. System performs simulation

FR-6.1. Consumer can buy products.

FR-6.2. Consumer receives salary.

FR-6.3. Producer can manufacture different kinds of products using factories.

FR-6.4. Producer can build new factories.

FR-6.5. Producer receives money from sold products.

FR-6.6. Producer can be declared bankrupt if runs out of cash.

FR-6.7. Producer can determine products prices.

FR-6.8. Consumer pays for the products when the order is placed.

FR-6.9. User randomly chooses a product to buy.

FR-6.10. Simulation Manager can destroy unused factory.

FR-6.11. Producer must pay start-up cost for manufacturing in an idle factory.

## Results presentation

### Description and Priority

This feature makes simulation’s results available for the user.

**Priority = High**

### Stimulus/Response Sequences

Stimulus : System finishes simulation.

Response : Results are presented on the screen.

### Functional Requirements

FR-7. System can present simulation’s results on the screen after each cycle

FR-7.1. System can show number of orders per producer

FR-7.2. System can show the number of orders completed per producer

FR-7.3. System can show the number of factories per producer

FR-7.4. System can show the number of completed orders per factory (per producer)

FR-7.5. System can show the cash reserves per producer

FR-7.6. System can show the average cash reserves for all the consumers

# External Interface Requirements

No external requirements specified except display device. Any possible screen format can be used.

# Other Nonfunctional Requirements

## Performance Requirements

PR-1. System should provide simulation’s results in real time .

PR-2. System should perform simulation with several hundreds of consumers and producers.

## Safety Requirements

No safety requirements specified .

## Security Requirements

No security requirements specified .

## Software Quality Attributes

Following quality attributes will be assured. Details are provided in Test Plan Document.

* Availability
* Correctness
* Reliability
* Testability

# Appendix A : Glossary

|  |  |
| --- | --- |
| Bankruptcy | State in simulation, which represents lack of cash of some Producer. |
| Consumer | Internal actor of the system, takes part in simulation. Buys products. |
| Cycle | Period of time in simulation. Each activity in simulation is measured in cycles. |
| Factory | Takes part in simulation. Can be built by Producer. Manufactures products. |
| Model manager | Internal actor of the system. Model creation controller. |
| Order | Takes part in simulation. Represents state of products being booked by the customer. |
| Producer | Internal actor of the system, takes part in simulation. Produces and sells products. |
| Product | Takes part in simulation, has many different kinds and properties. Can be manufactured, sold and bought. |
| Simulation manager | Internal actor of the system, responsible for controlling simulation process. |
| User | User of the system, main external actor. |

# Appendix B: Analysis Models TODO

## Use case diagrams

### System use case diagram

### Model creation use case diagram

### Simulation use case diagram

### Results presentation use case diagram

## Sequence diagram

## State machine diagram

# Appendix C: Issues List TODO

TBD-1 Is it possible to have more consumers than producers ?

TBD-2 Is it possible for Producer to sell a factory ?

TBD-3 Is it possible for Consumer to sell a bought product ?

TBD-4 Who should start simulation ?

TBD-5 Who should increase products costs ?

TBD-6 How much time does it take to build new factory ?

TBD-7 Who should choose particular product to buy for Consumers?

TBD-8 How much money Customer receives as a salary ?

TBD-9 How long an order can wait in a queue ?

TBD-10 Should Customer always buy maximum possible number of products he/she can afford?

TBD-11 Does increase in product’s cost relate to manufacturing cost or final price of a product ?

TBD-12 What is the value of order’s threshold ?

TBD-13 Is order’s threshold value exactly the same for all Producers ?

TBD-14 Is it possible for the Customer to make another order in the same cycle after refusal of the order ?

TBD-15 Is it possible for the Customer to make an order if one from previous cycle has not been placed yet ?

TBD-16 How much does it cost to demolish a factory ?

TBD-17 How many cycles are required for the factory to become idle ?

TBD-18 How much does it cost to start-up a factory ?

TBD-19 What is the maximum number of consumers ?

TBD-20 What is the maximum number of producers ?

TBD-21 What is the maximum number of factories per producer ?

TBD-22 Is producer paying factory running cost when it is idle ?

TBD-23 How efficiency of a factory is determined ?

TBD-24 Can producer produce any products in advance, without any order ?

# TODO :

* Assumptions
* Issues (tbd)
* Sequence diagram
* State machine diagram