
Software Requirements Specification

for

MathCast Equation Editor

Requirements for Version 0.90

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30-November-2011

Table of Contents

1. Introduction	1
1.1 Purpose	1
1.2 Document Conventions	1
1.3 Intended Audience and Reading Suggestions	1
1.4 Project Scope	2
1.5 References	2
2. Overall Description	3
2.1 Product Perspective	3
2.2 Product Features	4
2.3 User Classes and Characteristics	5
2.4 Operating Environment	6
2.5 Design and Implementation Constraints	6
2.6 User Documentation	7
3. System Features	8
3.1 New equation list	8
3.2 Open Equation List	9
3.3 Save Equation List	10
3.4 Insert Equation List	11
3.5 Append Equation list	12
3.6 Import Equation from Welcome Screen	14
3.7 Import Equation from Edit Screen	15
3.8 Export Equation	16
3.9 Edit Equation/Rapid Mathline	17
3.10 Copy equation	20
3.11 Cut Equation	20
3.12 Paste Equation	21
3.13 Delete Equation	22
3.14 Equation Move Up/Move Down	23
3.15 Add Equation	24
3.16 Insert Equation	25
3.17 Select All equations	26
3.18 Unselect Equations	27
3.19 Select Few Equations	27
3.20 Browser	29
3.21 Settings	30
3.22 Math	32
3.23 Equation List Pane	34
3.24 Equation Name	35
3.25 Quick Keys	36
3.26 Hotkeys	37
3.27 Download	38
3.28 Preview Mathcasting	39
4. External Interface Requirements	40
4.1 User Interfaces	40
4.2 Hardware Interfaces	44
4.3 Software Interfaces	44
4.4 Communications Interfaces	44
5. Other Nonfunctional Requirements	45
5.1 Performance Requirements	45
5.2 Safety Requirements	45
5.3 Security Requirements	45
5.4 Software Quality Attributes	45
6. Special Thanks	46

1. Introduction

1.1 Purpose

This document includes software requirements for MathCast equation editor, release number 0.90. MathCast equation editor is a Mathematics Equation Editor distributed under the terms of the GNU General Public License. Since MathCast embeds Mozilla, the Mozilla Public License is also included. Additionally, the STIX fonts license, the Noia icons set license (LGPL) and the Nuvola icons set license (LGPL) are also included. The system gives a solution in visualizing mathematical equations. Its purpose is to help the user create and manipulate mathematical equations or lists of them, save and edit them and then later use them whenever he chooses. MathCast consists of 4 basic screens: The Welcome Screen, the Settings Screen, a Browser Screen and the Edit Screen where the user can edit equations. Only one Screen is active at a time, but the user can easily switch between them according his needs. The equations created can be inserted into: word processors such as Microsoft Word and OpenOffice.org, presentations and web pages. The equations can be rendered graphically to the screen, to picture files, or to MathML. MathCast also provides the ability to expose an equation list as a RESTful HTTP service and thus equation lists can be browsed in a network.

1.2 Document Conventions

- When writing this document it was inherited that all requirements have the same priority.
- First there is presented an overall view about MathCast Equation Editor and then all features and functions are analyzed in detail.
- In this document we assume that the user is male for convenience. However MathCast is intended for both male and female users.
- When writing this document it was inherited that no System/Subsystem Specification documents (SSS) or any other contract document exists.
- This Software Requirements Specification document is written based on the general SRS template made by Karl E. Wiegers.

1.3 Intended Audience and Reading Suggestions

This requirement document contains general information about MathCast, main classes and use cases, functions, features and special technologies. It describes in detail all that MathCast needs to work properly and with safety.

The rest of the document is divided into chapters for better understanding.

- In chapter 2 an overall description of MathCast is provided. First product perspective is presented with product features and main functions. Then follow user classes and characteristics, operating environments that MathCast supports as well as design and implementation constraints. After all that, user documentation is presented and will provide you with more details about each feature's technology.
- In chapter 3 most important features are presented with detailed description, use cases and requirements.
- In chapter 4 user, hardware, software and communication interfaces are described.

- In chapter 5 requirements about security, safety and performance are presented along with the software quality attributes of MathCast.

This document is intended for

Developers: in order to be sure they are developing the right project that fulfills the requirements provided in this document.

Testers: in order to have an exact list of the features and functions that must respond according to requirements.

Users: in order to get familiar with the idea of the project and suggest other features that would make it even more functional.

Documentation writers: to know what features and in what way they have to explain. What technologies are required, how the system will respond in each user's action etc.

Advanced end users, end users/desktop and system administrators: in order to know exactly what they have to expect from the system, right inputs and outputs and response in error situations.

1.4 Project Scope

MathCast Equation Editor is a system that allows the user to create graphical equation and use them according to his needs. Its purpose is to solve a problem that really bothers many people today when they have to visualize the equations they want to use during a presentation or some other aspect of their work. Because the user can create as many equations as he finds fit, MathCast acts as an Equation List Manager. Equation are stored in lists, and MathCast supports editing of equations individually or simultaneously, thus allowing the user to copy and paste, move around, delete and save the equations files which can then be copied, emailed, deleted, edited etc. One of the key features of MathCast is the Rapid Mathline, a text input line. Using this line the user can create equations, using letters, numbers and a vast collection of math symbols which is provided. Additional symbols can be used for formatting such as under-script, bolt, etc. The user can copy-paste the equations directly to word processors but MathCast also provides additional ways to handle the list management. Single equations can also be exported in BMP, PNG and EMF picture file formats. MathCast's main language is MathML 2.0 Presentation and that is the reason why all files are described in XML based files thus allowing the user to save and load equation to and from .mml files (an XML file with one math tag).

MathCast's top feature is Mathcasting. What Mathcasting does is basically handling all the mathematics of an XHTML page. When the user opens an XHTML file, MathCast only loads the <math> tags of that file in its Edit Screen. User can then edit the equations as he wishes, and then later when he saves the file, MathCast replaces the original math tags with the user changes.

1.5 References

More about MathCast can be found at

- <http://sourceforge.net/projects/mathcast/>

In this website you can find out more about the project and discuss any questions in the forums. You can go back and look at previous releases, code and problems that have been solved. There you can also find information about the developer as well as the project's main characteristics such as programming language and algorithms.

- <http://mathcast.sourceforge.net/home.html>

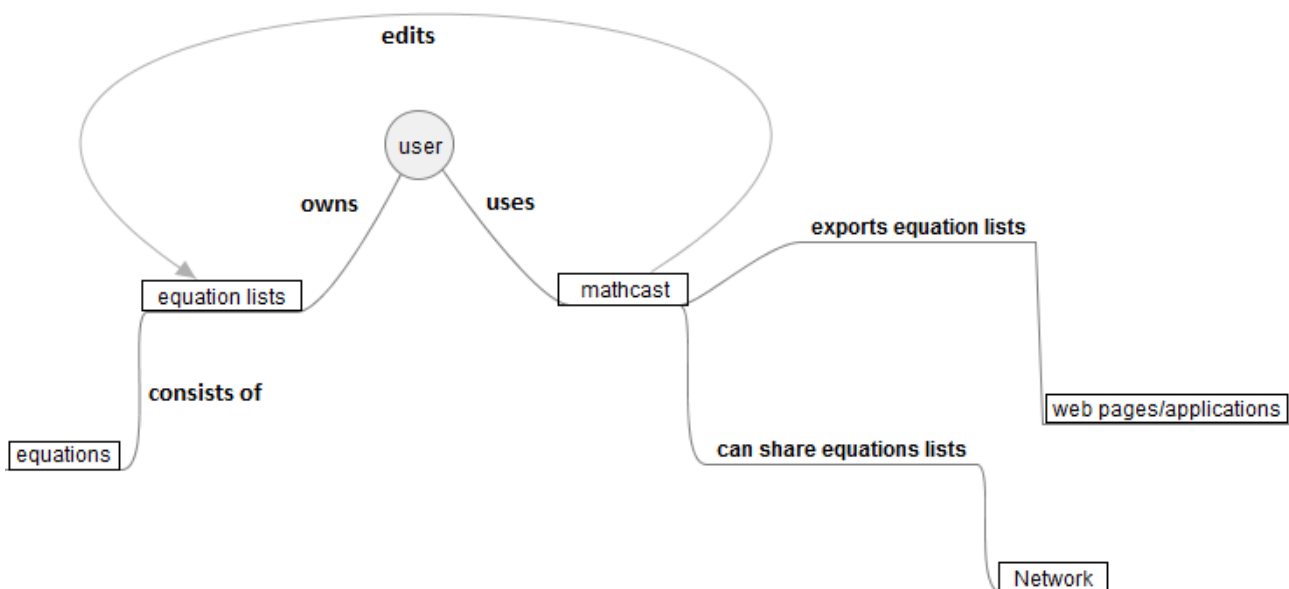
This is the project's official website where you can find links to all above and also find examples about MathCast, and feature requests for developing and documentation.

2. Overall Description

2.1 Product Perspective

MathCast is a stand-alone program that provides a powerful graphical interface for rapid development of mathematical equations. MathCast works best with STIX fonts (which can be provided with the download of the program). User owns equation lists which he can create or download from other users. The equation lists are consisted of equations which the user can edit at will using the application. MathCast does not limit the user in the number of equation lists he can own meaning that the user can categorize his equations in lists according to his scientific needs and thus he can have readymade lists for transformation, series etc. The user can then share his lists with other users through the network that use MathCast, thus providing the opportunity of a collective creation of equation lists. By using MathCast the user can also export his equation lists or specific equations to word processors or he can save his list as a picture and use it with other applications. MathCast also provides the user with the opportunity to edit and replace the mathematics components of an XHTML page, without changing other components of the page. This ability is called Mathcasting as mentioned before.

In the diagram below there are the main components of the system, subsystem interconnections and external interfaces to help you understand the main idea of MathCast. All of them are analyzed with more details in this document.



2.2 Product Features

MathCast Equation Editor provides the user with the following functions:

- **Equation List - New, Open, Save, Insert, Append, Download**

User can create a new equation list. The equation list can be opened or closed whenever the user wants to. Changes on the equations are permitted and the changes can be saved. The user can also select one, few, all or unselect the equations in the list. Additionally the user can use the Save As function if he wants to save the current list with a different name. The user can also open an equation list from disk and insert it to the current list, replacing the selected equation or alternatively he can append an equation list from disc and insert it at the end of the current list. Additionally the user can download an equation list from another IP address, or make his selection available to others by checking the Enable HTTP Server checkbox on the Setting Screen, and entering a port number for the coming connections.

- **Equation – Import, Export, Edit, Copy, Cut, Paste, Delete, Move Up, Move Down, Add, Insert, Select Few, Select All, Unselect**

A new equation can be added, deleted, pasted and be moved up and down throughout the equation list on the Edit Screen. Insertion of a new equation is also supported. Importation and exportation are also supported so that the user is able to import or export an existing equation from/to an existing file. Editing an equation is done using the Edit Screen which offers a huge variety of features, symbols and customization options. The user should also be able to Copy, Cut and Paste selected equations.

- **Browser**

MathCast is built with a Web browser integrated. By using the browser screen the user can easily switch to MathCast's Website without losing his work on the Edit Screen. The Browser Screen also comes with a set of useful mathematical resources on the Web.

- **Settings**

The Settings Screen consists of configuration options. The user can there choose the default Clipboard copy format(Bitmap, Enhanced Metafile 1, Enhanced Metafile 2, MathML), the default XML layout for saving files(Named, Hex, Unicode), the selected default display property(Block, Inline), equation size, color, antialiasing types(None, Standard, Windows XP ClearType) and Enable the HTTP server which is used for list exchanging through a network. All of the above features will be explained more thorough further down on this document.

- **Math**

Math is a main menu option which offers the user a set of signs used in various mathematic areas.

- **Download**

User is able to download lists of equations that belong to other users by entering the IP address of the second one. Users should enable the HTTP server option in the settings menu in order for the transaction to go through.

- **Rapid Mathline**

User can type new equations or edit existing ones using the Rapid Mathline which is a text input line. Users can use letters, numbers and math symbols that are provided.

Other symbols such as under-script and bold are used for formatting the equation. All the available elements which can be entered into the Rapid Mathline can also be selected from the Math menu, which was mentioned above.

- **Equation List Pane**
All the loaded or created equations are listed on the equation list pane. The user can select equations by clicking on them and then he can edit.
- **Equation Name**
User can name each equation specifically using a link which is included in the Rapid Mathline.
- **Quick Keys**
MathCast uses Quick Keys in its Rapid Mathline. Quick Keys are used to input different characters with more than one keystroke of a specific keyboard symbol.
- **Hotkeys**
Special characters can be entered in the Rapid Mathline by pressing combinations of Ctrl key and another key.
- **Preview Mathcasting**
This feature is available when the user edits equations of an XHTML page. By using this feature the user can see a preview of how the equations will be visualized into the rest of the XHTML page.

2.3 User Classes and Characteristics

- **Advanced end users:** users that have deep knowledge of mathematics and can personalize and create equations and equations lists, and generally use more sophisticated and advance symbols and functionalities.
- **End users/Desktop:** users with a more general knowledge about mathematics that want an easy way to visualize equations, in order to use them in a presentation or a site. Possible students, bachelors etc.
- **Science/Research departments:** for easily having access to a variety of mathematical equations. Since every user can create a list and later share it with another one, MathCast can be used so that Scientific and Research departments build their own lists and every participant in the department can have access to.
- **Teachers/Professors:** for easily sharing lists with students.
- **Web developers:** for easily altering mathematical components of web pages.
- **Other Audience**

2.4 Operating Environment

MathCast is a standard Windows application and is capable of running on Microsoft Windows 2000, XP or newer. The user desktop color quality should be 32 bits. The processor should be at least Pentium III or Athlon XP 1GHz or newer. 500MB RAM and 50MB free hard drive space are also required in order for MathCast to be fully functional.

A user can select to download MathCast 0.90 with or without the STIX fonts. However, if the user selects not to include the STIX fonts in the download, he should download DejaVu Sans or Cambria Math fonts. MathCast can also be downloaded in a binary.zip file. The default MathCast downloading option is with STIX fonts and it's an .msi file named MathCast 0.9 with STIX Fonts.msi. However the user can choose to download an .msi file without the STIX fonts named MathCast 0.9 without STIX Fonts.msi. Additionally users can download the source code of MathCast, which is provided in MathCastSource090.7z file. Users can also download MathCast components without installing MathCast through downloading MathCast090.zip. Nothing more than the MathCast 0.9 with STIX fonts.msi is required for a fully functional MathCast.

2.5 Design and Implementation Constraints

Specific technologies and tools that will be used in the making of MathCast

- In order to keep MathCast flexible, files that are supported are categorized into two groups: descriptive files, and picture files. Since MathCast's main language is MathML 2.0 Presentation, descriptive files are described in XML based files. Single equations can be exported in pictures files using BMP, PNG and EMF file format. EMF stands for Enhanced Metafile. EMF pictures offer higher detail and thus they are more suitable for printing.
- MathCast uses DiligentXML which is the official XML parser for MathCast. DiligentXML features a DOM3 compatible C++ library.
- MathCast can be used with HTML and there are two ways available in achieving this goal. The first one is inserting the desired equation in a picture file and then adding it to the web page. The second way is using MathML. In this case the user should work with XHTML and not HTML, because some browsers do not support MathML on HTML pages.
- XHTML files produced by MathCast are compatible with Mozilla, Firefox and Netscape browsers, which have an internal support for MathML. Internet Explorer however does not have a native way of displaying MathML and requires program updates to enable the displaying of MathML.
- MathCast manages all the mathematics of an XHTML page. This is called Mathcasting as mentioned before. Whenever an XHTML file is opened, MathCast loads its <math> tags into the Edit Screen. After any editing and upon saving the document MathCast replaces the original <math> tags with the newly created equations or with the edited ones. Only the <math> tags are altered meaning that the rest of the markup in the file is not altered. Mathcasting provides a "WYSIWYG" tool for authoring XHTML web pages with mathematical equations.

- ASCII character set is used for the default encoding of XML files. However if a selected file has no ASCII characters or is declared as UTF-16, MathCast saves the file as a UTF-16 Unicode file.
- As mentioned in paragraph 2.4 Operating environment, MathCast requires a font package to render the equations. MathCast works best with STIX fonts however the user can try different font packages such as DejaVu sans and Cambria Math fonts.
- MathCast includes images from the Noia icons set and the Nuvola icons set, as well as the bmp2png utility which is a freeware converter between Windows BMP format to PNG format.

Language Requirements

- MathCast is written in English. The Help files are also written in English. There are no available translations available.

Regulatory Policies

- There are no regulatory policies concerning MathCast, as it will be a Freeware. This means that users will be free to download and use it.

Communication protocols

- MathCast will use the HTTP protocol for downloading and web browsing. MathCast (via the embedded browser) can use HTTP also to download web pages (in the browser screen).

2.6 User Documentation

By downloading MathCast Equation Editor, the user also gets:

- A compiled HTML Help file with a full help on all features provided.
- A folder with a comprehensive list of examples.
- The user is able to navigate to MathCast's webpage where help is provided, along with forums.

3. System Features

System features are organized by use cases and functional hierarchy so that the main functions of the system will be understandable. In the description of system features there are several references in various system interfaces. These interfaces are better explained in section 4.1 of this document.

3.1 New equation list

This feature provides the ability to create a new equation list

3.1.1 Description

It is the first thing a user must do in order to start editing equations. The user can create a new equation list, either directly from the Welcome Screen or by navigating to the Edit Screen and adding equations. In order for a list to be created a user must add at least one equation.

3.1.2 Stimulus/Response Sequences

Data Flow

3.1.2.1 Basic Data Flow

1. User opens MathCast and selects New Equation List button
2. User is prompted to Edit Screen
3. User selects Add Equation Button
4. The Edit Screen features appear

3.1.2.2 Alternative Data Flows

3.1.2.2.1 Alternative Data Flow 1

3. User selects Equation → Add Equation
4. The Edit Screen features appear

3.1.2.2.2 Alternative Data Flow 2

3. User selects Help → Help
4. The Help options appear

3.1.2.2.3 Alternative Data Flow 3

3. User selects File → Exit
4. A new window appears asking the user to confirm the exit

3.1.2.2.4 Alternative Data Flow 4

3. User selects File → Browser Screen
4. The Browser Screen Opens

3.1.2.2.5 Alternative Data Flow 5

3. User selects File → Welcome Screen
4. The Welcome Screen opens

3.1.2.2.6 Alternative Data Flow 6

3. User selects File → Download
4. The Download Screen opens

3.1.2.2.7 Alternative Data Flow 7

1. User opens MathCast and selects To the Edit Screen button
2. User selects File → New
3. A new equation list is created

3.1.3 Functional Requirements

REQ-1: MathCast must be downloaded and installed

3.2 Open Equation List

This feature provides the ability to open an existing Equation List.

3.2.1 Description

When choosing to open an Equation List a user is transferred to his documents where he navigates to find the equation list he wants. The user then selects the equation list and MathCast loads it to the Edit Screen. User can also open an existing equation list from the Edit Screen

3.2.2 Stimulus/Response Sequences

Data Flow

3.2.2.1 Basic Data Flow

1. User opens MathCast and selects Open Equation List button
2. A system window opens
3. User navigates through his folders
4. User selects an eligible file or writes an eligible file name in the field and presses Open
5. Edit Screen opens with the selected Equation List

3.2.2.2 Alternative Data Flows

3.2.2.2.1 Alternative Data Flow 1

- 4a. User selects or types a name of an ineligible file and presses Open
- 4b. A message “There was an error opening the file.” appears
5. Users is prompted to the Welcome Screen

3.2.2.2.2 Alternative Data Flow 2

3. User chooses cancel
4. User returns to the Welcome Screen

3.2.2.2.3 Alternative Data Flow 3

- 3a. User does not select a file or leaves the file name field empty and presses Open
- 3b. Nothing happens

3.2.2.2.4 Alternative Data Flow 4

1. User has already opened MathCast and is working on an equation list
2. User selects File → Open
3. A system window opens
4. User navigates through his folders
5. User selects an Equation List and presses Open
6. The new equation list is opened in the Edit Screen replacing the old one

3.2.3 Functional Requirements

REQ-2: The eligible files for this feature are MathML XML Files and are of type (*.xml;*.xht;*.xhtml;*.html)

REQ-42: If there is a previously opened equation list in the Edit Screen and the user selects to open a new one, any changes made in the first equation are lost and the new equation list appears in the Edit Screen.

3.3 Save Equation List

This feature allows the user to save any changes he has performed in an Equation list.

3.3.1 Description

When an Equation List is opened, the user can organize, add new equations, edit existing ones and so much more. When it is time for the equation list to close or during his work on the equation list, the user can save any of the changes he made.

3.3.2 Stimulus/Response Sequences

Data Flow

3.3.2.1 Basic Data Flow

1. User opens MathCast and makes changes to an equation list
2. User selects File → Save
3. Equation List is saved
4. User exits MathCast

3.3.2.2 Alternative Data Flows

3.3.2.2.1 Alternative Data Flow 1

- 2a. User selects File → Save as
- 2b. A system window appears letting the user navigate through his folders
- 2c. User gives a new equation list name and presses save
- 2d. A new equation list is saved with the specified name

3.3.2.2.2 Alternative Data Flow 2

- 2a. User selects File → Save as
- 2b. A system window appears letting the user navigate through his folders

- 2c. User gives a new equation list name or selects a file which already exists
- 2d. A window appears asking the user if he wants to replace the existing file
- 3. User presses yes and the new equation list is saved replacing the older one, or user chooses no and returns to the system window

3.3.2.2.3 Alternative Data Flow 3

- 2a. User selects File → Save as
- 2b. A system window appears letting the user navigate through his folders
- 3. User presses cancel and returns to the Edit Screen

3.3.2.2.4 Alternative Data Flow 4

- 4. User continues working after he saves the database

3.3.2.2.5 Alternative Data Flow 5

- 2. User wants to exit MathCast
- 3. A message appears asking the user if he wants to exit the application
- 4. User selects yes and exits, or no and returns to the equation list

3.3.2.2.6 Alternative Data Flow 6

- 2a. User selects File → Save as
- 2b. A system window opens letting the user navigate through his folders
- 2c. User presses save without giving a file name nor selecting an existing file
- 2d. Nothing happens

3.3.3 Functional Requirements

REQ-2: The eligible files for this feature are MathML XML Files and are of type (*.xml;*.xht;*.xhtml;*.html)

REQ-3: Equation lists must have different names or the newly saved equation will replace the older one.

REQ-43: Filenames must consist of at least one character.

REQ-44: This feature is available even if there is no equation loaded in the Edit Screen

3.4 Insert Equation List

This feature allows the user to insert an equation list into another equation list.

3.4.1 Description

This function is only available if the user has an active equation list loaded or created in Equation List Pane of the Edit Screen. Inserting an equation list requires that the user specifies where this list will be imported. This is done by selecting an equation from the equation list that is currently active on the Edit Screen. When the user uses insert the selected equation list is loaded in the current equation list at the point where the selected element was, replacing it. If the loaded list has more than one equation these elements are loaded right under the position from where the first element of the list was loaded thus pushing the already existing items of the first list further down.

3.4.2 Stimulus/Response Sequences

Data Flow

3.4.2.1 Basic Data Flow

1. User is in the Edit Screen and has an equation list loaded or created with one or more equations in the Equation List Pane
2. User selects File → Insert
3. A system window opens letting the user navigate through his folders
4. User selects an eligible file or writes an eligible file name in the field and presses open
5. The list is inserted into the already existing list starting from the selected equation

3.4.2.2 Alternative Data Flows

3.4.2.2.1 Alternative Data Flow 1

4. User selects Cancel
5. User is prompted back to the Edit Screen

3.4.2.2.2 Alternative Data Flow 2

4. User selects an ineligible file to insert and presses open
5. An error window appears
6. User is prompted back to the Edit Screen

3.4.2.2.3 Alternative Data Flow 3

- 3a. A system window opens letting the user navigate through his folders
- 3b. User writes an ineligible file name to insert and presses open
- 3c. A window appears saying that this file was not found
- 3d. User Presses OK
- 3e. System returns to the system window and the user can make a new selection

3.4.2.2.4 Alternative Data Flow 4

- 3a. A system window opens letting the user navigate through his folders
- 3b. User does not select a file or leaves the file name empty
- 3c. User presses Open
- 3d. Nothing happens

3.4.3 Functional Requirements

REQ-2: The eligible files for this feature are MathML XML Files and are of type (*.xml;*.xht;*.xhtml;*.html)

REQ-45: This feature is unavailable if there are no items loaded in the Equation List Pane.

3.5 Append Equation list

This feature allows the user to insert an equation list at the bottom of an existing equation list

3.5.1 Description

In order for the append option to be available the user must be on the Edit Screen and have at least one equation in the Equation List Pane. The user can then select append

from the file menu and choose an equation list. This equation list will be added at the bottom of the existing equations in the Equation List Pane.

3.5.2 Stimulus/Response Sequences

Data Flow

3.5.2.1 Basic Data Flow

1. User is at the Edit Screen and has one or more equations in the Equation List Pane
2. User selects File → Append
3. A system window opens allowing the user to navigate through his folders
4. User selects an eligible file and presses open
5. The list is inserted at the bottom of the Equation List Pane

3.5.2.2 Alternative Data Flows

3.5.2.2.1 Alternative Data Flow 1

4. User selects Cancel
5. User is prompted back to the Edit Screen

3.5.2.2.2 Alternative Data Flow 2

4. User selects an ineligible file to insert and presses open
5. An error window appears
6. User is prompted back to the Edit Screen

3.5.2.2.3 Alternative Data Flow 3

- 3a. A system window opens allowing the user to navigate through his folders
- 3b. User writes an ineligible file name to append and presses open
- 3c. A window appears saying that this file was not found
- 3d. User Presses OK
- 3e. System returns to the system window and the user can make a new selection

3.4.2.2.4 Alternative Data Flow 4

- 3a. A system window opens letting the user navigate through his folders
- 3b. User does not select a file or leaves the file name empty
- 3c. User presses Open
- 3d. Nothing happens

3.5.3 Functional Requirements

REQ-2: The eligible files for this feature are MathML XML Files and are of type (*.xml;*.xht;*.xhtml;*.html)

REQ-45: This feature is unavailable if there are no items loaded in the Equation List Pane.

3.6 Import Equation from Welcome Screen

This feature allows the user to import an equation from an eligible file in his disk into his current equation list when the program is at the Welcome Screen.

3.6.1 Description

This functionality is available in the Welcome screen and in the Edit screen but works a little different so both ways will be explained in this section and on section 3.7. If the user does not have one or more equations active in his Equation List Pane, only the import option from the Welcome Screen is available. Else both import options from the two screens are available. The user chooses import and selects a file. If the file has more than one equation stored, only the first equation of this file is imported in the Equation List Pane. If MathCast does not have an equation list loaded when user selects Import Equation, the equation that is imported opens on the first place of the Equation List Pane. Else, the equation that is imported, replaces and takes the spot of the equation that was currently selected in the Equation List Pane

3.6.2 Stimulus/Response Sequences

Data Flow

3.6.2.1 Basic Data Flow

1. User opens MathCast and selects Import Equation
2. A system window opens allowing the user to navigate through his folders
3. User selects an eligible file or types an eligible file name and presses open
4. The Edit Screen appears and the first equation of the selected file is placed in the Equation List Pane

3.6.2.2 Alternative Data Flows

3.6.2.2.1 Alternative Data Flow 1

3. User selects an ineligible file and presses open
4. An error message appears and user must press ok to continue
5. The program returns to the Welcome Screen

3.6.2.2.2 Alternative Data Flow 2

3. User selects Cancel
4. The system returns to the Welcome Screen

3.6.2.2.3 Alternative Data Flow 3

- 1a. User is at the Edit Screen
- 1b. User selects an equation from the Equation List Pane
- 1b. User selects File → Welcome Screen
- 1c. Application switches to the Welcome Screen
- 1d. User selects Import Equation

3.6.2.2.4 Alternative Data Flow 4

- 2a. A system window opens allowing the user to navigate through his folders
- 2b. User types an ineligible name and presses Open
- 2c. A system window appears letting the user know that the file was not found
- 2d. User selects OK

2e. System returns at the system window allowing the user to select a new file

3.6.2.2.5 Alternative Data Flow 5

- 2a. A system window opens allowing the user to navigate through his folders
- 2b. User does not select a file or leaves the file name field blank
- 2c. User presses Open
- 2d. Nothing happens

3.6.3 Functional Requirements

REQ-41: File selected must be of a type MathML MML Files and that is (*.mml;*.xml)

REQ-44: This feature is available even if there is no equation loaded in the Edit Screen

3.7 Import Equation from Edit Screen

This feature allows the user to import an equation from an eligible file in his disk into his current equation list when the program is at the Edit Screen.

3.7.1 Description

As mentioned above (section 3.6) user can import an equation through the Edit Screen. This functionality differs from the one mentioned in section 3.6, because the system responses are different. This option is available only if the user has equations loaded/created on the Equation List Pane.

3.7.2 Stimulus/Response Sequences

Data Flow

3.7.2.1 Basic Data Flow

- 1. User is at the Edit Screen and the Equation List Pane has one or more equations
- 2. User selects an equation
- 3. User selects Equation → Import Equation
- 4. A system window opens allowing the user to navigate through his folders
- 5. User selects an eligible file or types an eligible file name and presses open
- 6. The first equation of the selected file is placed in the position of the selected equation in the Equation List Pane

3.7.2.2 Alternative Data Flows

3.7.2.2.1 Alternative Data Flow 1

- 5. User selects an ineligible file and presses open
- 6. An error message appears and user must press ok to continue
- 7. The program returns to the Edit Screen

3.7.2.2.2 Alternative Data Flow 2

- 5. User selects Cancel
- 6. The system returns to the Edit Screen

3.7.2.2.3 Alternative Data Flow 3

- 4a. A system window opens allowing the user to navigate through his folders
- 4b. User types an ineligible name and presses Open
- 4c. A system window appears letting the user know that the file was not found
- 4d. User selects OK
- 4e. System returns at the system window allowing the user to select a new file

3.7.2.2.4 Alternative Data Flow 4

- 4a. A system window opens allowing the user to navigate through his folders
- 4b. User does not select a file or leaves the file name field blank
- 4c. User presses Open
- 4d. Nothing happens

3.7.3 Functional Requirements

REQ-41: File selected must be of a type MathML MML Files and that is (*.mml;*.xml)

REQ-45: This feature is unavailable if there are no items loaded in the Equation List Pane.

3.8 Export Equation

This feature describes the exportation of a selected equation from the Equation List Pane to a file.

3.8.1 Description

Exportation of an equation can create a new file, or take place in an existing one. The user just chooses the exportation option and is transferred to a system window. Then the user has two choices. The first one is exporting the equation to an existing eligible file. By doing so this file's contents are replaced by the selected equation. The second choice that the user has is exporting the equation to a non existing file, which means that a new file is created. The user chooses a name and a type for the file. The available files that are eligible for exportation are bitmap files(.bmp), MathML MML Files(.mml/.xml), Portable Network Graphics Files(.png), Transparent PNG Files(.png) and Enhanced Metafile Files(.emf)

3.8.2 Stimulus/Response Sequences

Data Flow

3.8.2.1 Basic Data Flow

1. User is at the Edit Screen and selects an equation from the Equation List Pane
2. User selects Equation → Export Equation
3. A system window opens allowing the user to navigate through his folders
4. User selects an existing eligible file or types an eligible file name and presses save
5. A window appears asking if the user really wants to replace this file
6. User presses yes and returns to the Edit Screen or no and the system returns to the system window for file selection

3.8.2.2 Alternative Data Flows**3.8.2.2.1 Alternative Data Flow 1**

- 3a. A system window appears allowing the user to navigate through his folders
- 3b. User chooses no file or leaves the file name empty and presses Save
- 3c. Nothing happens

3.8.2.2.2 Alternative Data Flow 2

- 4. User selects Cancel
- 5. Program returns to the Edit Screen

3.8.2.2.3 Alternative Data Flow 3

- 4. User types a name in the file name that does not correspond to an existing element in users system
- 5. User selects the type of file that his equation wants to be saved as. The type of files that user can select are these that are described in the description section of this feature
- 6. A new file is created, with the file name that the user gave and with the extension he chose.
- 7. Program returns to the Edit Screen

3.8.3 Functional Requirements

REQ-4: The eligible file that user can replace or create are of a type MathML MML(*.mml;*.xml), Bitmap (*.bmp), Portable Network Graphics (*.png), Transparent PNG (*.png), Enhanced Metafile (*.emf)

REQ-5: In order for a file to be exported the user must type something in the file name or select an existing file.

REQ-6: This feature is available only when the user is at the Edit Screen and has at least one equation active on the Equation List Pane

3.9 Edit Equation/Rapid Mathline

This feature allows the user to perform editing actions on a selected equation from the Equation List Pane

3.9.1 Description

In order for the user to be able to edit an equation he must first create a new equation list or load an existing one on the Edit Screen. All Editing operations are performed in the Edit Screen. The user is then able to edit an equation from an equation list loaded in the Equation List Pane. The user must select the equation he wants to edit. Once the user selects the desired equation it appears in the Rapid Mathline. The user is then able to perform a set of editing operations on the selected equation such as deleting symbols, adding symbols and changing equation name. The main disadvantage of the Rapid Mathline is that the equations are displayed in a calculator-like row instead of a mathematical representation. This feature though offers the user an easier way of editing the selected equations. After doing so, Rapid Mathline, automatically styles the selected equations because it incorporates an intelligent engine. The mathematics that MathCast generates are based on the standard presentation which is adopted by the mathematics community. The user is able to insert symbols in the Rapid Mathline by many means. The user can type symbols from his keyboard, or by using

Quick Keyes and Hotkeys (which will be explained latter in this document), or from the Lowlist. Every available element which can be entered into the Rapid Mathline can also be selected from the Math Menu. The Rapid Mathline identifies the following elements: numbers (a series of digits without spaces, that may include commas and periods), letters ('A' to 'Z', 'a' to 'z', Greek letters, double-struck letters, special letters), function names (predefined names consisting of a few letters grouped together), mathematical operators (one-character long symbols used in mathematics), shortcuts(characters represented by another character) and markup (elements with special appearance or meaning. These elements require parameters).

Markup consists of:

- Superscripts, Subscripts, Underscripts, and Overscripts.
These elements, except subsubscript and underoverscript, have two parameters. The base and the argument with the following syntax: base, symbol, argument.
Subsubscript and underoverscript take two arguments and have the following syntax: base, symbol, argument1,'E, argument2.
- Fractions
A fraction requires 2 parameters: a numerator and a denominator. The syntax of a fraction is: numerator/denominator.
- Roots
Roots have the following syntax: $\sqrt[n]{}$, followed by whatever the user needs in the root. The n'th root takes two arguments, one before the root symbol which is used to determine the number of the root and one after the root symbol which is what the user need in the root.
- Bold
The syntax is: $\blacktriangle$ Bold and the rendered result is: **Bold**.
- Text
The syntax is: double-quotes and text between them.
- Spaces
The syntax is: character $\boxtimes$ character, where $\boxtimes$ is the markup character for space.
- Block and Parentheses
Block and Parentheses are used for grouping elements. The syntax for a Block is: '<', elements, '>'. Parentheses have the same syntax except that the characters '(' and ')' are used.
- Vector – 2D Matrix
The syntax is: '[' character, 'E, character ']'. Where 'E' is the argument separator character.
- Matrix
A matrix, like the vector, requires the '[', ']', and argument separator characters. The syntax is for example: '[[aEb][cEd]]'. The outer '[' and ']' tell the Rapid Mathline that we are talking about a matrix. While the internal '[' and ']' represent the rows of the matrix.

When the user finishes editing he can click OK. Rapid Mathline then handles the transformation of the equation from a calculator like row to a styling equation. The new edited equation appears in the position of the equation that the user selected for editing. A detailed list of the supported symbols is given in section 3.22.

3.9.2 Stimulus/Response

Data Flow

3.9.2.1 Basic Data Flow

1. User opens MathCast and creates or loads an equation or an equation list
2. An equation or an equation list is loaded or created in the Edit Screen
3. User selects an equation

4. This equation appears in the Rapid Mathline
5. The user clicks in the Rapid Mathline and starts editing
6. The user clicks OK in the Rapid Mathline
7. The modified equation appears in the Equation List Pane at the spot where the unmodified equation was

3.9.2.2 Alternative Data Flow

3.9.2.2.1 Alternative Data Flow 1

6. User clicks Cancel
7. All the editing actions that the user performed are lost and the equation appears in the Rapid Mathline unedited

3.9.2.2.2 Alternative Data Flow 2

6. User clicks on another equation from the Equation List Pane
7. This equation takes the place of the previous equation in the Rapid Mathline and all the changes are lost

3.9.2.2.3 Alternative Data Flow 3

3. User selects multiple equations
4. The equation that is higher in the Equation List Pane appears in the Rapid Mathline and is eligible for editing

3.9.2.2.4 Alternative Data Flow 4

6. User Opens a new Equation List
7. The selected item of the previous Equation List is lost and the first item of the new list becomes selected

3.9.2.2.5 Alternative Data Flow 5

- 5a. User click in the Rapid Mathline and starts editing
- 5b. User selects some symbols that are not mathematically eligible
- 5c. An error message appears and user selects Ok.
6. The system returns in the Edit Screen with the equation loaded in the Rapid Mathline.
7. End of Data Flow

3.9.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user adds one this is the selected equation. The user can then select whichever equation he needs. Either ways there is always one item selected in the Equation List Pane except when there is no item in it.

REQ-25: If the selected equation is empty, the Rapid Mathline is empty. Mathline should always load the elements of the selected equation.

REQ-16: Rapid Mathline is available only if the Equation List Pane is not empty.

REQ-29: Rapid Mathline can support up to a maximum of 32,767 characters.

3.10 Copy equation

This feature creates a copy of a selected equation in the Equation List Pane.

3.10.1 Description

In order for this ability to function the user must have at least one equation loaded or created in the Equation List Pane. The user can select to copy more than one equation but only the first of those equations is copied to the Clipboard. This happens because MathCast internally copies all the equations, but only the first one is copied in the Clipboard. The user can use the equation in word processors by simply pasting it in the word processor window. The user can also paste the selected equation back into MathCast and this action makes a new entry in the Equation List Pane. More about pasting an equation will be discussed in section 3.12 of this document.

3.10.2 Stimulus/Response Sequences

Data Flow

3.10.2.1 Basic Data Flow

1. User is at the Edit Screen and has one or more equations selected in the Equation List Pane
2. User presses Edit→Copy or Ctrl+C, or the Copy button from the Equation Buttons Pane
3. The selected equation or list of selected equations is internally copied in MathCast. Only the first of the list or the single equation is copied in the clipboard also.

3.10.2.2 Alternative Data Flows

Non Exists

3.10.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user Adds one this is the selected equation. The user can then select whichever equation he needs. Either ways there is always one item selected in the Equation List Pane except when there is no item in it.

REQ-8: The copied equation remains “copied” for as long as the user does not copy/cut anything else.

3.11 Cut Equation

This function allows the user to Cut a selected equation or a number of equations from an existing list in the Equation List Pane

3.11.1 Description

The user can cut an equation or a number of equations that exist in the Equation List Pane. The user must first select the equations he wants to cut. He can also select to cut more than one equations but only the first of those equations is copied in the

Clipboard. This happens because MathCast internally copies all the equations that are cut, but only the first one is copied in the Clipboard. After cutting an equation or a list of equations the selected equations are deleted from the Equation List Pane.

3.11.2 Stimulus/Response Sequences

Data Flow

3.11.2.1 Basic Data Flow

1. User is at the Edit Screen and he has one or more equations selected in the Equation List Pane
2. User presses either Edit→Cut, or Ctrl+X, or the Copy button from the Equation Buttons Pane
3. The selected equation or list of selected equations is internally copied in MathCast. Only the first of the list or the single equation is copied in the clipboard also.
4. The selected equation or list of selected equations are deleted from MathCast's Equation List Pane

3.11.2.2 Alternative Data Flow

Non exist

3.11.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user adds one this is the selected equation. The user can then select whichever equation he needs. Either ways there is always one item selected in the Equation List Pane except when there is no item in it.
 REQ-9: The cut equation remains “copied” for as long as the user does not copy/cut anything else

3.12 Paste Equation

This function allows the user to paste a previously copied or cut equation

3.12.1 Description

A user is able to paste a previously cut or copied equation in his Equation List Pane. Before pasting anything a user must have an equation copied or cut in order for Paste to have functionality. The user must select a place in the Equation List Pane that he wants to paste the copied or cut equation. As already mentioned MathCast internally copies all the selected equations when the user cuts or copies, but only copies the first of them to the clipboard. That means that if the user pastes something on a word processor this is going to be copied through clipboard and thus only the first of the copy/ cut equations will be copied into the word processor. Pasting in MathCast does not work this way because the items that are copied /cut are internally copied in MathCast, meaning that the program does not use clipboard to paste something in it. It uses the internally copied or cut items. This means that the user can paste a whole list of equations at once. Once the user pastes the desired equation/s he can re-paste and the items will be pasted again. This can be done repeatedly. When pasting, the

first item of the copied /cut list of equations replaces the selected equation in the Equation List Pane. The other copied/cut items in the list if any are added right under this position pushing other items that might exist in the Equation List Pane further down.

3.12.2 Stimulus/Response Sequences

Data Flow

3.12.2.1 Basic Data Flow

1. User is at the Edit Screen and there is at least one equation in the Equation List Pane
2. User has previously copied/cut one equation
3. User selects an equation in the Equation List Pane
4. User presses File → Paste or CTRL+V or the Paste Equation button from the Equation button Pane.
5. The previously cut/copied equation replaces the selected one.

3.12.2.2 Alternative Data Flows

3.12.2.2.1 Alternative Data Flow 1

2. User has previously copied/cut more than one equation
5. The first equation of the previously cut/copied ones replaces the selected equation. The other copied/cut equations are added right under that position, pushing other equations in the Equation List Pane, if any, further down.

3.12.2.2.2 Alternative Data Flow 2

2. User has not cut/copied anything
5. Nothing Happens

3.12.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user Adds one this is the selected equation. The user can then select whichever equation he needs. Either way there is always one item selected in the Equation List Pane except when there is no item in it.

REQ-10: There must be at least one equation in the Equation List Pane, in order for paste to have functionality.

3.13 Delete Equation

This feature allows the user to delete one or more equations in the Equation List Pane

3.13.1 Description

The user can delete an equation or a set of equations that are in the Equation List Pane by selecting them and pressing either the delete equation button from the Equation Button Pane or Edit→Delete. When this is done the selected items are erased and MathCast removes them from the list. If the user deletes an equation he is not able to retrieve it back.

3.13.2 Stimulus/Response Sequences

Data Flow

3.13.2.1 Basic Data Flow

1. User is at the Edit Screen and there are one or more equations in the Equation List Pane
2. User selects one or more equations
3. User presses either Edit → Delete or the delete equation button from the Equation Button Pane
4. The selected equation/s are permanently deleted and removed from the list

3.13.2.2 Alternative Data Flows

None exists

3.13.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user Adds one this is the selected equation. The user can then select whichever equation he needs. Either ways there is always one item selected in the Equation List Pane except when there is no item in it.
REQ-13: There must be at least one equation in the Equation List Pane in order for delete to have a functionality.

3.14 Equation Move Up/Move Down

This feature allows the user to move a selected equation or a number of selected equations up or down in an existing list.

3.14.1 Description

The user must first select the equation/s which he wants to move and then press either Equation → Move Up/Move Down or the Move equation up/down buttons in the Equation Button Pane. After pressing one of these buttons the selected equation/s is moved one place up or down according to the user selection. If the equation is at the top of the list the Move Up function is unavailable. If the equation is at the bottom of the list the Move Down function is unavailable. If there is a number of equations selected and the first or last item is either the top or the bottom item of the list the same rules apply.

3.14.2 Stimulus/Response Sequences

Data Flow

3.14.2.2 Basic Data Flow

1. User is at the Edit Screen and there is a list of equations in the Equation List Pane
2. User selects an equation
3. User selects either Equation → Move Up/Down or the Move equation up/down button

4. The equation is moved one place up or down in the list according to the selection

3.14.3.2 Alternative Data Flows

3.14.3.2.1 Alternative Data Flow 1

2. User selects a number of equations
4. The equations are all moved one place up or down in the list according to the selection
5. Only the upper item of the selected list that was moved remains selected

3.14.3.2.2 Alternative Data Flow 2

- 2a. User selects an equation and it is the first of the list
- 2b. The Move up function becomes unavailable

3.14.3.2.3 Alternative Data Flow 3

- 2a. User selects an equation and it is the last of the list
- 2b. The Move down function becomes unavailable

3.14.3.2.4 Alternative Data Flow 4

- 2a. User selects an equation list and its first item is the first of the Equation List Pane
- 2b. The Move up function becomes unavailable

3.14.3.2.5 Alternative Data Flow 5

2. User selects an equation list and its last item is the last item of the Equation List Pane
3. User selects to move the selected equations down
4. All the selected items are moved one place down except the last equation

3.14.3 Functional Requirements

- REQ-11: If there is one element in the Equation List Pane this feature is unavailable.
 REQ-12: If the selected item is the first/last item of the Equation List Pane the Move up/Move down function become unavailable accordingly.

3.15 Add Equation

This feature allows the user to add an additional equation in the Equation List Pane

3.15.1 Description

Adding an equation is only achievable through the Edit Panel. If the user wants to add an equation he can do so by either pressing the Add equation button or by selecting Equation → Add Equation. This equation is added at the bottom of the equation list in the Equation List Pane. If the user is in the Edit Screen and he does not have any equations put in the Equation List Pane, this is the only functional button of the Equation Button Pane.

3.15.2 Stimulus/Response Sequence

Data Flow

3.15.2.1 Basic Data Flow

1. User opens MathCast and Welcome Screen appears
2. User selects To the Edit Screen button
3. The Edit Screen appears
4. User selects Equation → Add Equation or Add equation button from the Equation List Pane
5. A new equation is created in the Equation List Pane

3.15.2.2 Alternative Data Flows

3.15.2.2 Alternative Data Flow 1

1. User is already in the Edit Screen and there are items in the Equation List Pane
2. User selects Equation → Add Equation or Add equation button from the Equation List Pane
3. A new equation is created at the bottom of the Equation List Pane
4. End of Data Flow

3.15.3 Functional Requirements

REQ-14: If none equation exists in the Equation List Pane, this function should be available

REQ-15: There is no defined limit to the number of the equations that can be added. At some point when MathCast cannot allocate new memory, the application stops working. The suggested length of an equation list is a few hundred equations.

3.16 Insert Equation

This feature allows the user to insert an equation in a specified location in the list

3.16.1 Description

The user can choose to insert a new equation at a specified position in the equation list of the Equation List Pane. This is done by pressing the insert equation button in the Equation button Pane or by selecting Equation → Insert Equation. Before inserting the user must select an item of the list. The inserted equation will be added above the selected item pushing every item that is under the inserted equation one place down in the list.

3.16.2 Stimulus/Response Sequence

Data Flow

3.16.2.1 Basic Data Flow

1. User is at the Edit Screen with at least on equation loaded in the Equation List Pane
2. User selects an equation
3. User selects Equation → Insert Equation or presses the insert equation button from the Equation Button Pane
4. A new equation is inserted above the item that the user selected

3.16.2.2 Alternative Data Flows

3.16.2.2.1 Alternative Data Flow 1

1. User is at the Edit Screen with no equation in the Equation List Pane
2. Insert feature is unavailable
3. End of Data Flow

3.16.3 Functional Requirements

REQ-7: Every time the user is in the Edit Screen and has one or more equations loaded the first of them is automatically selected by the program. If the Edit Screen does not have a loaded equation and the user Adds one this is the selected equation. The user can then select whichever equation he needs. Either ways there is always one item selected in the Equation List Pane except when there is no item in it.

REQ-15: There is no defined limit to the number of the equations that can be added. At some point when MathCast cannot allocate new memory, the application stops working. The suggested length of an equation list is a few hundred equations.

REQ-16: This function is available only if the Equation List Pane is not empty.

3.17 Select All equations

This feature allows the user to select all equations in the Equation List Pane.

3.17.1 Description

User is able to select all the equations in the Equation List Pane by either pressing CTRL+A or by selecting Edit → Select All. This feature is unavailable if there is no item in the equation list pane. After selecting all the equations the user can perform an eligible action he wishes.

3.17.2 Stimulus/Response Sequence

Data Flow

3.17.2.1 Basic Data Flow

1. User is in the Edit Screen and there is one or more equations loaded in the Equation List Pane
2. User selects Edit→Select All or presses CTRL+A
3. All the equations in the equation list are selected

3.17.2.2 Alternative Data Flows

None exists

3.17.3 Functional Requirements

REQ-16: This function is available only if the Equation List Pane is not empty

REQ-17: Default system features for selection are also available. Single clicking every equation in the list while holding the CTRL key also selects all the equations. Selecting the last equation of the list and pressing Shift while clicking the first element also selects the whole list.

3.18 Unselect Equations

This feature allows the user to unselect his currently selected equations in the Equation List Pane

3.18.1 Description

If the user has selected more than one equation in his list he is able to unselect all of them by clicking Edit → Unselect or by pressing CTRL+U. Because MathCast always has an equation selected, using the unselect function unselects all the equations except the upper-most of the equations that were selected. User is able to unselect a list of equations by simply clicking on another equation too.

3.18.2 Stimulus/Response Sequences

Data Flow

3.18.2.1 Basic Data Flow

1. User is at the Edit Screen and has a list of equations selected from the Equation List Pane
2. User presses Edit → Unselect or CTRL+U
3. All equations are unselected except the upper most of them.

3.18.2.2 Alternative Data Flows

3.18.2.2.1 Alternative Data Flow 1

2. User selects an equation
3. All equations are unselected except the one the user selected

3.18.3 Functional Requirements

REQ-18: If there is one item in the Equation List Pane this feature is available but does nothing because MathCast always has an item selected if there are one or more equations in the Equation List Pane.

REQ-16: This function is available only if the Equation List Pane is not empty.

3.19 Select Few Equations

This feature allows the user to select specific equations from an equation list in the Equation List Pane

3.19.1 Description

If the user wants to select more than one equations but not the entire list he can do so by pressing CTRL+ clicking the desired equations. MathCast however provides a more easy way of selecting equations. The user can select Edit → Select Few or CTRL+F. When the user does this the Rapid Mathline asks for the numbers of the equations that the user wants to select. Every equation in the Equation List Pane is given a number according to their position. The user types the numbers of the equations he wishes to select and presses OK. These equations are selected.

3.19.2 Stimulus/Response

Data Flow

3.19.2.1 Basic Data Flow

1. User is at the Edit Screen and there are one or more equations in the Equation List Pane
2. User selects Edit→ Select Few or presses CTRL+F
3. Rapid Mathline asks the user to write the numbers of the equations he wants to select.
4. User types the numbers of the equations
5. User presses OK
6. The desired equations are selected

3.19.2.2 Alternative Data Flows

3.19.2.2.1 Alternative Data Flow 1

5. User selects Cancel
6. MathCast returns to the state it was before selecting the Select Few option

3.19.2.2.2 Alternative Data Flow 2

4. User types some existing numbers and some none existing numbers
5. User selects OK
6. Only the equations with numbers that existed are selected

3.19.2.2.3 Alternative Data Flow 3

4. User types only numbers of equations that does not exist
5. User selects OK
6. MathCast stops working

3.19.2.2.4 Alternative Data Flow 4

- 4a. User selects Help and an option from the help menu
- 4b. The selected option appears
- 4c. User closes the help selection he chose
- 4d. User types the numbers of the equations in the Rapid Mathline

3.19.2.2.5 Alternative Data Flow 5

4. User selects another feature that will change the consistency of the list
5. Selection stops and the program respond to the new feature
6. End of data flow

3.19.3 Functional Requirements

REQ-16: This function is available only if the Equation List Pane is not empty

REQ-19: Eligible selection has the syntax (no.Eq, no.Eq, noEq) or (no.Eq-no.Eq) where no.Eq is the number of an equation in the Equation List Pane. Using the first syntax the user must specify each number of equations specifically. Using the second syntax the user must specify a start number and an end number. The equations that exist between these two numbers will be selected including these two numbers.

REQ-20: Each equation in the Equation List Pane has a specific number. This number is given to the equation by the program according to its position in the list. The first element of the list is given the number 0, second equation is given number 1, third equation is given number 2 and so on.

3.20 Browser

This feature allows the user to use the integrated browser of MathCast

3.20.1 Description

User can switch to the Browser Screen whenever he chooses. When the user switches to the Browser Screen his work in the Edit Screen remains unchanged and it is not lost. The user can switch back to the Edit Screen and continue his work whenever he wants. Browser consists of a Main Menu and the browsing screen. The main menu consists of the following options: 1.File (New Browser, Edit Screen, Welcome Screen, Exit). 2.Links a. Mathematics(Wikipedia Mathematics, Mathworld, Yahoo Mathematics directory, PlanetMath.org, the freedictionary.com Mathematics Topics, math2.org Math Reference Tables, Project MATHEMATICS!, The Mathematical Atlas), b. Physics(HuperPhysics, Wikipedia Physics, Physics Encyclopedia, Allrefer Physics, Physorg.com), c. Science (Nasa, PBS Science, BBC Science and Nature, Google News- Sci/Tech), d. BooksOnline (Wikibooks Mathematics, American Mathematical Society, The Online Book Page at Upenn, arXiv.org e-Print archive, Online Mathematics Textbooks, Mathematics at FSU, Online Physics Textbooks), e.W3C MathML, f. Mozilla, g. Fonts(STIX Fonts, MathML with Mozilla). 3. Help (Help, MathCast's Website, About MathCast). 4. Back, 5.Forward, 6.Stop, 7.Reload.

3.20.2 Stimulus/Response Sequences

Data Flow

3.20.2.1 Basic Data Flow

1. User is ether at the Welcome Screen or the Edit Screen
2. User selects File→Browser Screen
3. The Browser Screen appears with MathCast's project site loaded in it

3.20.2.2 Alternative Data Flows

3.20.2.2.1 Alternative Data Flow 1

4. User selects File→ New Browser
5. Firefox opens and loads Browser Screen's currently loaded page

3.20.2.2.2 Alternative Data Flow 2

4. User selects File→ Edit Screen
5. Program loads Edit Screen

3.20.2.2.3 Alternative Data Flow 3

4. User selects File→ Welcome Screen
5. Program loads Welcome screen

3.20.2.2.4 Alternative Data Flow 4

4. User selects File→Exit
5. A system window appears asking the user if he really wants to exit the application
6. User selects yes and exits, or no and returns to the Browser Screen

- 3.20.2.2.5 Alternative Data Flow 5
 - 4. User selects Links and any of the offered links
 - 5. Browser loads the selected link in the Browser Screen
- 3.20.2.2.6 Alternative Data Flow 6
 - 4a. User selects Help → Help
 - 5a. The Help document opens in a separate window
 - 4b. User selects Help → MathCast's Website
 - 5b. MathCast's Website is loaded in the Browser Window
 - 4c. User selects Help → About MathCast
 - 5c. A pop-up window appears with information regarding MathCast
- 3.20.2.2.7 Alternative Data Flow 7
 - 4. User selects Back
 - 5. The previously loaded page appears. If no page was loaded previously, MathCast returns either to Welcome Screen or the Edit Screen, depending from where the browser screen was called
- 3.20.2.2.8 Alternative Data Flow 8
 - 4. User navigates through pages and then chooses back
 - 5. Forward option becomes available
 - 6. User presses Forward
 - 7. The browser opens the page that was loaded before hitting the Back option
- 3.20.2.2.9 Alternative Data Flow 9
 - 4. User selects Stop
 - 5. The active link stops loading in the Browser Screen
- 3.20.2.2.10 Alternative Data Flow 10
 - 4. User selects Reload
 - 5. The currently loaded page reloads

3.20.3 Functional Requirements

REQ-20: The user must have an active internet connection in order for Browser Screen to be able to load pages.

REQ-21: Switching between Browser Screen and Edit Screen does not affect the user's equations.

REQ-22: The Browser Screen maintains the loaded links. This means that if the user switches from Browser Screen to the Edit Screen and then back to the Browser Screen, the Browser Screen must be in the state it was when the user switched to Edit Screen.

3.21 Settings

This feature allows the user to change the working settings of MathCast.

3.21.1 Description

User can navigate to the Settings Screen even if there is no equation loaded in the Equation List Pane. Once he is at the Settings Screen, the user can choose from a list of settings according to his needs. The provided settings are:

- Default Clipboard copy format. The user can choose between 1.Bitmap, Enhanced Metafile 1, Enhanced Metafile 2, MathML.
- Default XML layout for saving files. The user can choose between 1.Named, 2.Hex, 3.Unicode
- Display property. The user can choose between 1.Block, 2.Inline
- Default size of equations. The user inputs a numeric value between 0.5 and 3.0
- Default color for equations. User can choose color for foreground and background
- Font smoothing (antialiasing) type. User can choose between 1. None, 2. Standard, 3.Windows XP ClearType
- HTTP server. The user can choose to Enable the HTTP server or not

After choosing the selected setting the user can choose to apply them or cancel. Functionalities of each setting are explained in MathCast's help documentation.

3.21.2 Stimulus/Response Sequences

Data Flow

3.21.2.1 Basic Data Flow

1. User Opens MathCast and navigates to the Edit Screen
2. User Selects Edit→Settings
3. The Settings Screen Opens
4. User makes some changes
5. User presses Set
6. The changes are saved and the programs returns to the Edit Screen

3.21.2.2 Alternative Data Flows

3.21.2.2.1 Alternative Data Flow 1

4. User does not make changes
6. The program returns to the Edit Screen

3.21.2.2.2 Alternative Data Flow 2

5. User selects Back or presses Esc
6. The program returns to the Edit Screen and no changes are saved

3.21.2.2.3 Alternative Data Flow 3

5. User selects Defaults
6. Any change that the user made is reversed to the Defaults settings and the program returns to the Edit Screen

3.21.2.2.4 Alternative Data Flow 4

- 5a. User selects Help →Help
 - 6a. The Help document opens in a separate window
- 5b. User selects Help→ MathCast's Website
 - 6b. MathCast's Website is loaded in the Browser Window
- 5c. User selects Help → About MathCast
 - 6c. A pop-up window appears with information regarding MathCast

3.21.3 Functional Requirements

REQ-14: If none equation exists in the Equation List Pane, this function should be available.

REQ-23: If the user saves some changes and then restarts MathCast, the default settings are applied.

REQ-40: In order for the EnableHTTP server option to function the user must select the checkbox, apply the settings and then restart MathCast.

3.22 Math

Math is a menu option available only in Edit Screen. It provides the user a set of Mathematic symbols to use.

3.22.1 Description

Any time the user selects an equation in the Equation List Pane he can use the Math option. Math provides a list of symbols which the user can insert in the Rapid Mathline, thus this feature allows the user to edit his selected equation. All the symbols that are supported by MathCast are provided by math. Once the user selects a symbol, this symbol is automatically added in the Rapid Mathline. The list of symbols that Math provides is:

- **Arithmetics:** plus, minus, positive, negative, dot, cross, invisible times, asterisk, solidus, division slash, divided by, plus or minus, minus or plus, over, slash over
- **Equal signs:** equals to, not equals to, identical to, proportional to, questioned equal to, almost equal to, not almost equal to, tilde, minus tilde, asymptotically equal to, not asymptotically equal to, approximately equal to, approximately but not equal to, not approximately and not equal to, almost equal or equal to, all equal to, equivalent to, geometrically equivalent, difference between, approaches the limit, geometrically equal to, approximately equal to or the image of, image of or approximately equal to, colon equals, corresponds to, estimates, equiangular to, star equal to, delta equal to, equal to log definition, measured by
- **Greater than-less than signs:** less than, greater than, less than or equals to, greater than or equals to, much less than, much greater than, not less than, not greater than, neither less than or equal to, neither greater than nor equal to, less than or greater than, greater than or less than, neither less than nor greater than, neither greater than nor less than
- **Powers and roots:** -1 power, 1 power, squared, cubed, square root, n'th root(not just 4th)
- **Algebra:** factorial, double factorial, absolute value, sum, product, discriminant/change, logarithm, natural logarithm, exponent, maximum, minimum, constant, sign, decibel
- **Geometry:** right angle, angle, measured angle, spherical angle, right angle with, arc, parallel to, not parallel to, right triangle
- **Trigonometry:** sine, cosine, tangent, secant, cosecant, cotangent, arc-sine, arc-cosine, arc-tangent, arc-cotangent, hyperbolic sine hyperbolic cosine, hyperbolic tangent, Arc-sine, Arc-cosine, Arc-tangent, radian
- **Linear algebra:** determinant, rank, dimension, kernel

- **Complex:** conjugate, real part, imaginary part, absolute value, argument, angle
- **Calculus:** prime, double prime, triple prime, differential d, capital differential D, partial differential, integral, double integral, triple integral, contour integral, double contour integral, clockwise contour integral, counter-clockwise contour integral, reversed prime, reversed double prime, reversed triple prime, limit
- **Operators:** nabla/del/grad, laplacian, diamond, bullet, ring, dot operator, star operator, square, gradient, divergence, curl
- **Basic symbols:** left bracket, right bracket, left curly brace, right curly brace, left quotes, right quotes, apostrophe, degree, colon, semicolon, amperstand, percentage, question mark, number sign, at, backslash, hyphen, comma, period, three periods, mid line three dots, ratio, therefore, because, proportion, filled square, filled triangle, filled circle, caret, divides, does not divide, right track, left track, down track, up track, stretched line
- **Overhead operators:** vector, dot derivative, two dots above, overline, rooftop, tilde above, underline
- **Arrows:** right arrow, left arrow, left-right arrow, up arrow, down arrow, up-down arrow, northwest arrow, northeast arrow, southeast arrow, southwest arrow, right double arrow, left double arrow, right-left double arrow, right double arrow with stroke, left double arrow with stroke, right-left double arrow with stroke
- **Sets and logical operators:** for all, there exists, there does not exist, empty set, is element of, is not element of, intersection, union, set minus, logical and, logical or, subset of, superset of, not a subset of, not a superset of, subset of or equal to, superset of or equal to, neither a subset of nor equal to, neither a superset of nor equal to, multiset, multiset multiplication, multiset union, square image of, square original of, square image of or equal to, square original of or equal to, square cap, square cup, circled plus, circled minus
- **Double-struck letters:** double-struck exponential e, double-struck imaginary I, double-struck C, double-struck H, double-struck N, double-struck P, double-struck Q, double-struck R, double-struck capital Z
- **Special letters:** infinity, Laplace transform, Fourier transform, Planck's constant, degree Celsius, degree Fahrenheit, Kelvin, Angstrom, ounce, Ohm, inverted Ohm, script B, black letter C, script E, Euler constant, scuple, estimated symbol, upside-down F, script g, script H, black letter H, script I, black letter I, script l, script M, script o, script P, script R, black letter R, black letter Z, versicle, alef, bet, gimel, dalet, l-b bar, numero
- **Small Greek letters:** alpha, beta, gamma, delta, epsilon, zeta, eta, theta, iota, kappa, lambda, mu, nu, xi, omicron, pi, rho, final sigma, sigma, tau, upsilon, phi, chi, psi, omega
- **Large Greek letters:** as small Greek letters but capital
- **Markup:** text, Bold, Space, subscript, superscript, subscript-superscript, underscript, overscript, underscript-overscript, Argument separator or Comma
- **Parenthesis-block-matrix-vector:** left parenthesis, right parenthesis, block start, block end, (Matrix, Matrix Row, or Vector start), (Matrix, Matrix Row, or Vector End)

Each of these symbols is offered by the names above. Each name has the corresponding symbol next to it, so the user can better understand which symbol will be inserted in the Rapid Mathline.

3.22.2 Stimulus/Response Sequences

Data Flow**3.22.2.1 Basic Data Flow**

1. User is at the Edit Screen and there is at least one equation in the Equation List Pane
2. User selects an equation from the Equation List Pane
3. The equation appears in the Rapid Mathline
4. User selects a position in the equation
5. User selects Math→ (one of the categories and symbols mentioned in the description)
6. The selected symbol is inserted in the specified position of the Rapid Mathline

3.22.2.2 Alternative Data Flows**3.22.2.2.1 Alternative Data Flow 1**

4. User does not select a position in the equation
6. The selected symbol is inserted as the last elements of the equation in the Rapid Mathline

3.22.2.2.2 Alternative Data Flow 2

4. User highlights a part or all the equation
6. The selected symbol replaces the highlighted part or all the equation

3.22.3 Functional Requirements

REQ-16: This function is available only if the Equation List Pane is not empty

REQ-24: User must specify an equation and a position in the equation that the selected symbol will be inserted. If he does not, the selected symbol will be inserted into the default selected equation and at the end of it.

3.23 Equation List Pane

Equation List Pane is the interface where equations that are created/ loaded appear. It is described in this section because it is more of a feature that has a correspondence to an interface.

3.23.1 Description

Most of the Edit Screen consists of the Equation List Pane. Equation List Pane is the place where the user's equations appear. User can select an equation and this equation appears in the Rapid Mathline for editing. Left clicking on an equation selects that equation. The selected equation is outlined by a pink box surrounding it. Every action which makes any change to the currently displayed equation or list of equations such as deleting/adding/editing/ opening/importing an equation or an equation list affects the Equation List Pane because all the changes correspond to a change in the Equation List Pane.

3.23.2 Stimulus/Response

Because Equation List Pane is basically a feature that enables and supports most of the general editing mentioned above in this document, it does not have a specific use case. Equation List Pane is an element of the Edit Screen and thus the user should open MathCast and navigate to the Edit Screen to see the Equation List Pane. If there is no element loaded or created, the Equation List Pane is inactive and does not appear in the Edit Screen. In every other case, if the user opens/creates/adds/imports etc. any equation or list, the Equation List Pane appears, and all the equations appear in it.

3.23.3 Functional Requirements

REQ-26: Equation List Pane is inactive and does not appear in the Edit Screen if the user does not open/create a list of equations or add a single equation.

REQ-27: Every change in the consistency and appearance of an equation or an equation list corresponds in a change in the Equation List Pane.

REQ-28: There is no defined limit to the number of the equations the Equation List Pane can support. At some point when MathCast cannot allocate new memory, the application stops working. The suggested length of an Equation List is a few hundred equations.

3.24 Equation Name

This feature allows the user to name a specified equation

3.24.1 Description

The user can name specific equations without limitation. This means that the user can give the same name to different equations. This name has nothing to do with the name given when saving files. This feature is provided through the Rapid Mathline. The user simply clicks on the name button, and then the Rapid Mathline asks for an equation name. The user types the desired name and this name is saved. Name appears right under the text field in the Rapid Mathline. Name is always present in the Rapid Mathline. If an equation has no name, the name field simply appears and is empty.

3.24.2 Stimulus/Response Sequences

Data Flow

3.24.2.1 Basic Data Flow

1. User selects an equation from the Equation List pane in the Edit Screen
2. User clicks the name field in the Rapid Mathline
3. The Rapid Mathline displays the current equation name if any and asks for an equation name
4. User edits/writes a name or leaves the name blank
5. User presses OK
6. The name field displays the name the user gave for the selected equation

3.24.2.2 Alternative Data Flows

3.24.2.2.1 Alternative Data Flow 1

5. User presses Cancel
6. System displays the equation in the Rapid Mathline

3.24.2.2.2 Alternative Data Flow 2

- 4a. User selects a different equation
- 4b. User writes a name or leaves the name blank

3.24.3 Functional Requirements

REQ-30: The name field is active when the Rapid Mathline is active.

REQ-31: If an equation does not have a name the name field appears but is empty. In any other case the name field displays the name of the equation.

REQ-32: Different equations can have same names.

3.25 Quick Keys

This feature allows the user to insert different symbols in the Rapid Mathline by pressing the same key multiple times.

3.25.1 Description

Some keys provide different symbols when pressing them more than once, while editing an equation in the Rapid Mathline. If a user presses a key that supports quick keys more than once, a different symbol appears in the Mathline than the one the user pressed. This way the user can input symbols and edit an equation faster. A list of default quick keys is provided in the “Keys.dat” file. The user can also customize the Quick Keys using this file.

3.25.2 Stimulus/Response Sequences

Data Flow

3.25.2.1 Basic Data Flow

1. User selects an equation from the Equation List Pane
2. The equation appears in the Rapid Mathline
3. User clicks inside the Rapid Mathline
4. User presses a key that supports Quick Keys once
5. The corresponding keyboard symbol appears
6. User presses the same symbol twice
7. The second corresponding symbol of Quick Keys for this key appears and so on

3.25.2.2 Alternative Data Flows

3.25.2.2.1 Alternative Data Flow 1

4. User presses a key that it was not assigned with Quick Keys
5. The corresponding keyboard symbol appears
6. End of data flow

3.25.2.2.2 Alternative Data Flow 2

8. User presses the same key one time more than the number of symbols assigned to the Quick Key
9. Go to Basic Data Flow-5

3.25.3 Functional Requirements

REQ-33: Quick Keys only function when user is editing an equation using the Rapid Mathline

REQ-34: Quick Keys function only if the user presses the same key more than once and the time between keystrokes is less than 3 seconds.

REQ-35: User must be able to customize Quick Keys through the “Keys.dat” file.

REQ-36: Quick Keys can be turned on and off by pressing CTRL+Q. Quick keys are active by default when the user starts MathCast.

3.26 Hotkeys

This functionality allows the user to enter some special characters in the Rapid Mathline using a combination of the CTRL key + another key.

3.26.1 Description

The user can enter specific characters quickly using Hotkeys when editing an equation in the Rapid Mathline. User can press a combination of CTRL + “key” and the specified key appears in the Rapid Mathline. These keys are specified and cannot be modified. The Hotkey list is the following:

Squared (Ctrl +2), cubed (Ctrl +3), square root(Ctrl +R), n'th root(Ctrl +T), discriminant/change (Ctrl +D), nabla/del/grad (Ctrl +N), vector (Ctrl + -), dot derivative (Ctrl +4), two dots above (Ctrl +5), overline (Ctrl +=), rooftop (Ctrl +6), tilde above (Ctrl + `), underline (Ctrl +\), Bold (Ctrl +B), Space (Ctrl +S), subscript(Ctrl + L), superscript (Ctrl + H), subscript-superscript (Ctrl + J), underscript (Ctrl + U), overscript (Ctrl +O), underscript-overscript (Ctrl + K), Block star (Ctrl+9 or Ctrl +.), block end (Ctrl + 0 or Ctrl +.), Matrix, Matrix Row, or Vector Start (Ctrl + []), Matrix, Matrix Row, or Vector End (Ctrl +J).

The Hotkeys combinations must be provided in the Math menu, next to the corresponding symbol.

3.26.2 Stimulus/Response Sequences

Because there are no alternative data flows for using Hotkeys we will just describe the basic use case of this function. User can only use the Hotkeys when he is editing an equation in Rapid Mathline. The user simply selects an equation from the Equation List Pane and starts editing. When the control of the program is inside the Rapid Mathline the user can press the Hotkeys mentioned above in Description and the corresponding symbol appears in the Mathline. Pressing Hotkey combinations outside the Rapid Mathline has no functionality

3.26.3 Functional Requirements

REQ-37: The symbols that are inserted when using Hotkeys must be inserted in the position where the controller of the Rapid Mathline is.

REQ-33: Hotkeys only function when user is editing an equation using the Rapid Mathline.

3.27 Download

This feature allows the user to download readymade equation lists from another user through a network.

3.27.1 Description

The user can download an equation list from another user either from a LAN network or through the internet. In order for this to happen, the second user must check the EnableHTTP server checkbox, in the settings screen, give an eligible port number and restart his MathCast. The first user, can then go to the download screen and enter the second user's IP address and the port number in the textbox. By doing so, the first user is able to download the second user's equation list. The first user can download an equation list by using Mozilla too. He can open Mozilla and download another user's equation list directly by typing in the address bar, the second user's IP:port/list.xml. If he only wants to view the second user's equation list he can type IP:port/math.xml. If he wishes for the equation list to refresh every five seconds he can type IP:port/refresh.xml. If he wishes to specify the number of seconds for refreshing the user can type IP:port/refresh.xml?interval =(a number of seconds).

3.27.2 Stimulus/Response Sequences

If the user wants to download an equation list from another user, using MathCast, he must open MathCast, navigate to the Edit Screen, click on the File Menu and then select "Download". The program then opens the download Screen. The second user has to Open his MathCast, go to the Settings Screen, check the EnableHTTP server checkbox, give an eligible port number and then he must restart MathCast. After restarting MathCast he can then open an equation list he wants to share. The first user can then write the IP:port of the second user and click OK. After connecting the equation list of the second user loads in the first user's MathCast. The user can then save the equation list and edit it by every means he wants. If the first user types an ineligible IP or port number, or the second user did not enable the EnableHTTP server checkbox or he did not give an eligible port number or he did not restart MathCast, the first user gets an error message when he tries to connect. An error message appears if one or both users do not have an active Internet connection, when they try to connect through the Internet. After downloading the desired equation lists, the users can choose to cease their connection.

3.27.3 Functional/Requirements

REQ-46: Both users must have an active internet connection when they try to connect through the internet.

REQ-47: The EnableHTTP server requires an eligible port number. In order for this setting to function, the user must restart his MathCast. If he does not restart MathCast, this feature will become available the next time MathCast opens.

REQ-48: The first user can only download the active equation list of the second user.

REQ-49: If the second user uses a firewall in his personal computer, he must add an incoming exception for MathCast.

3.28 Preview Mathcasting

This feature allows the user to see a preview of the XHTML page associated with the equation list.

3.28.1 Description

When a user opens an XHTML file or any other XML, to be me more accurate, MathCast only loads the <math> tags of that file into the Edit Screen. The user can then work on all the equations using MathCast as he would normally do. When the user saves the file, MathCast replaces the original <math> tags with the new equations that the user created, or the older ones that were edited, without altering the rest of the markup in the file. This ability is called Mathcasting as mentioned above in the document. What preview Mathcasting does is that it offers the user a preview of the XHTML page associated with his equation list.

3.28.2 Stimulus/Response Sequences

Data Flow

3.28.2.1 Basic Data Flow

1. User opens MathCast and Opens an eligible file
2. The equation list appears in the Equation List Pane
3. User clicks the preview Mathcasting button on the Equation Button Pane or selects File → Preview Mathcasting
4. MathCast shows a preview of the XHTML page.
5. User selects Back or presses Esc
6. MathCast returns to the Edit Screen

3.28.2.2 Alternative Data Flows

3.28.2.2.1 Alternative Data Flow 1

5. User selects Help
6. The Help options appear

3.28.2.2.2 Alternative Data Flow 2

- 1a. User opens MathCast and Opens an ineligible file
- 1b. An error message appears and the system returns to the Welcome Screen

3.27.3 Functional Requirements

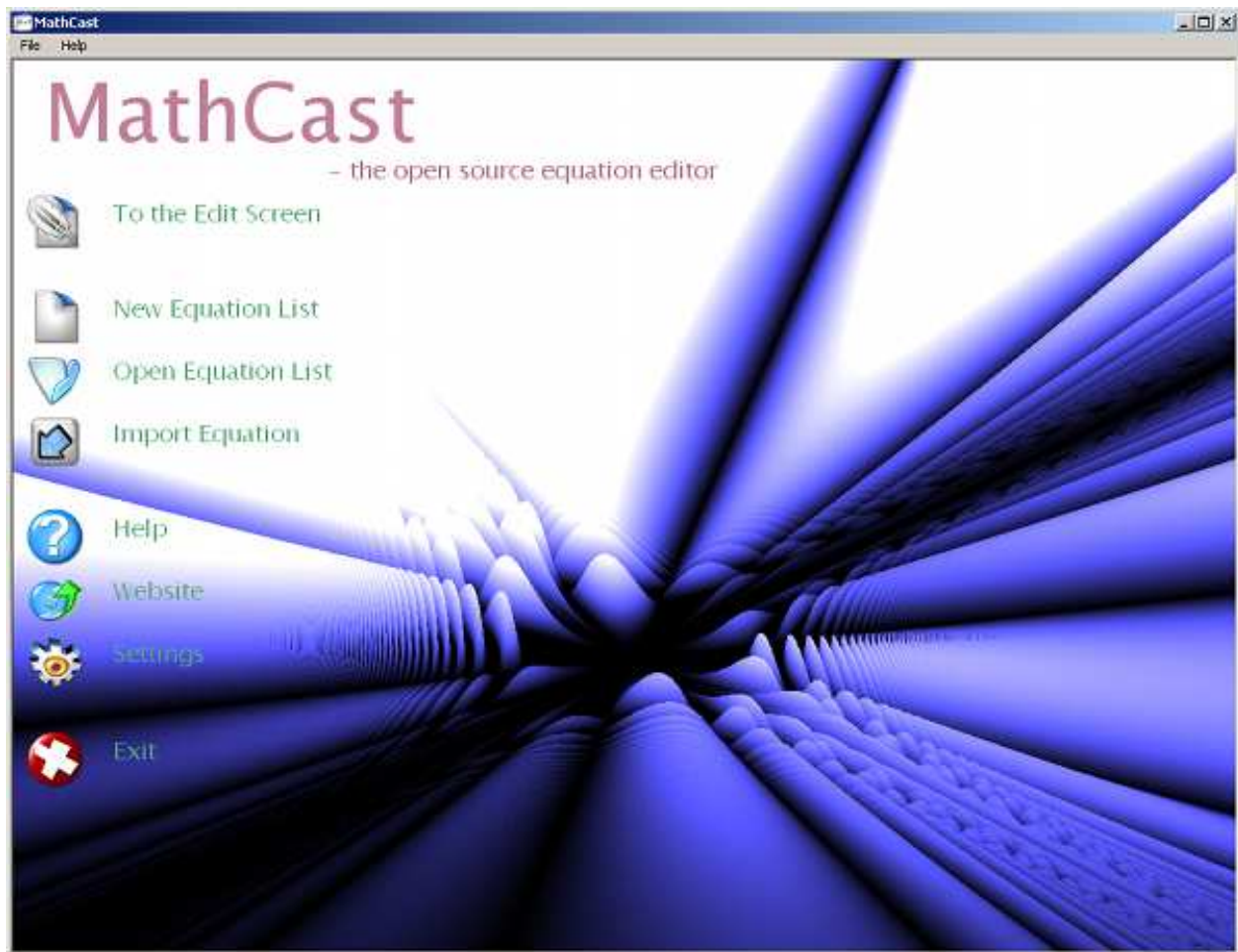
REQ-38: This feature is available only if the user opens an eligible file. This means that if the user creates a new equation list and then save it as an eligible file, preview Mathcasting feature will not available. In order for this feature to be available in that case, the user must Open the file he just saved. User must always Open, not (Insert, Append or Download) an eligible file for this feature to appear.

REQ-2: The eligible files for this feature are MathML XML Files and are of type (*.xml;*.xht;*.xhtml;*.html)

4. External Interface Requirements

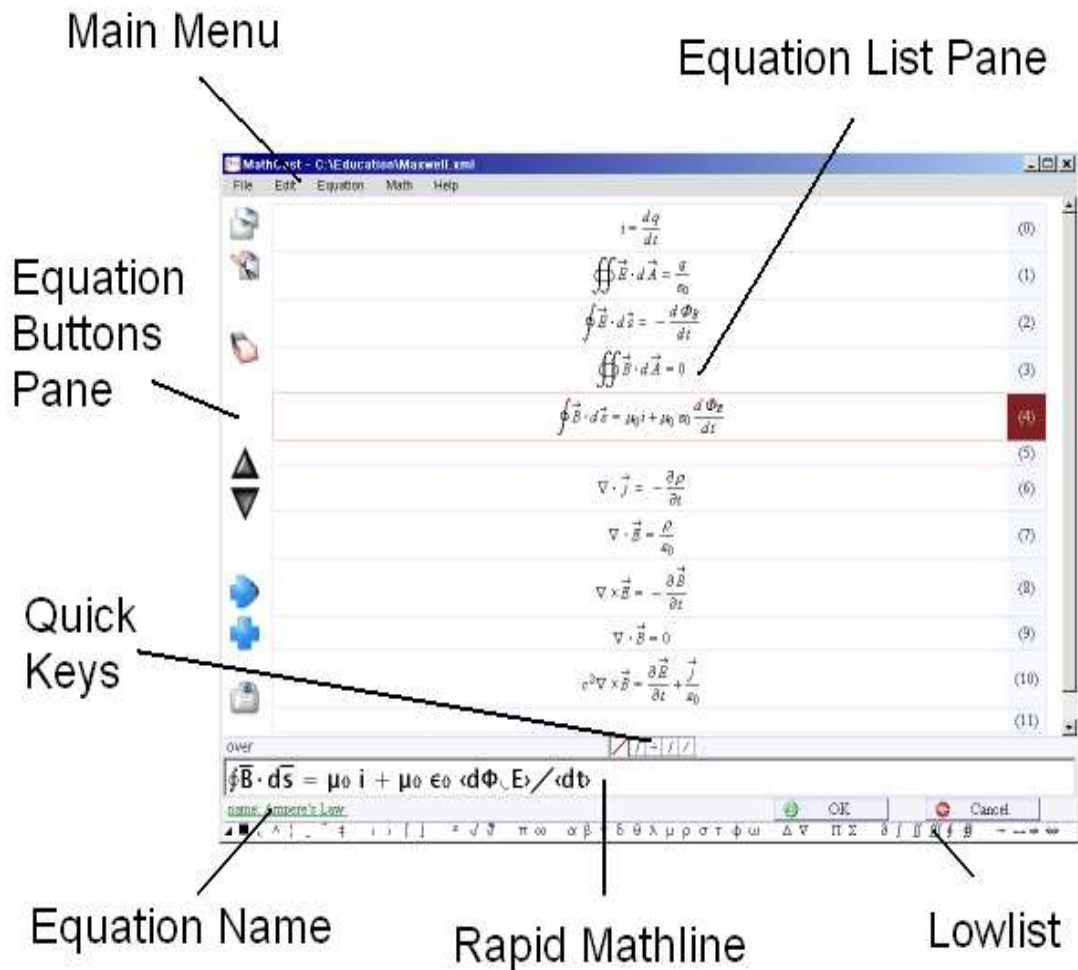
4.1 User Interfaces

The aim of MathCast is to offer a powerful but light-weight equation management tool with a simple to use GUI. MathCast consists of four basic screens: The Welcome Screen, the Edit Screen, the Settings Screen and the Browser Screen. MathCast shows only a particular screen at time but the user can switch between them without losing his work. The main menu changes according to the active screen. The first screen that appears when the user opens MathCast is the Welcome Screen.



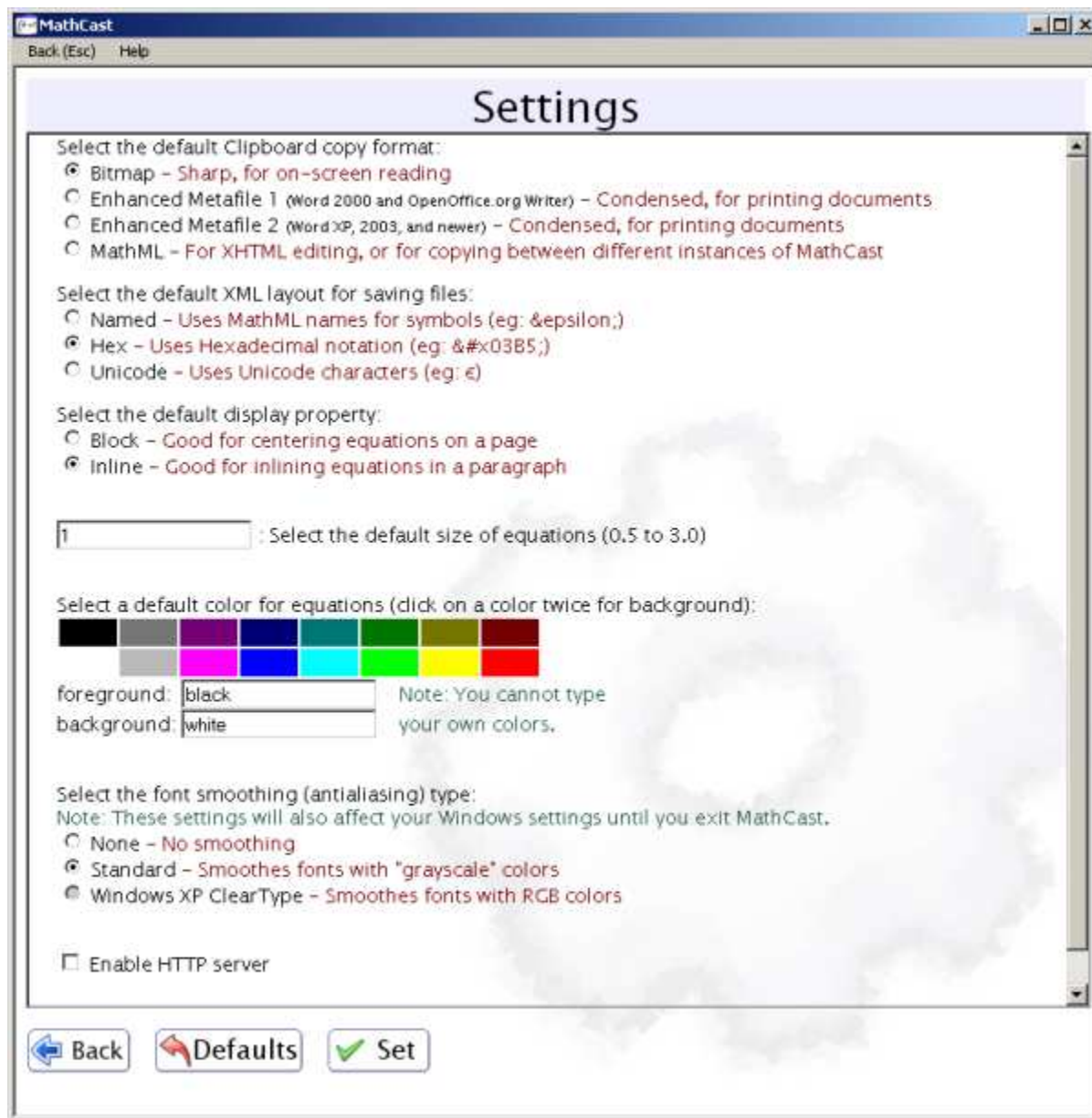
The buttons that appear in the Welcome Screen correspond to features that are explained in Section 3 of this document.

The second screen is the Edit Screen, and is MathCast's main screen. All the editing is done in this screen, and all the equations appear here.

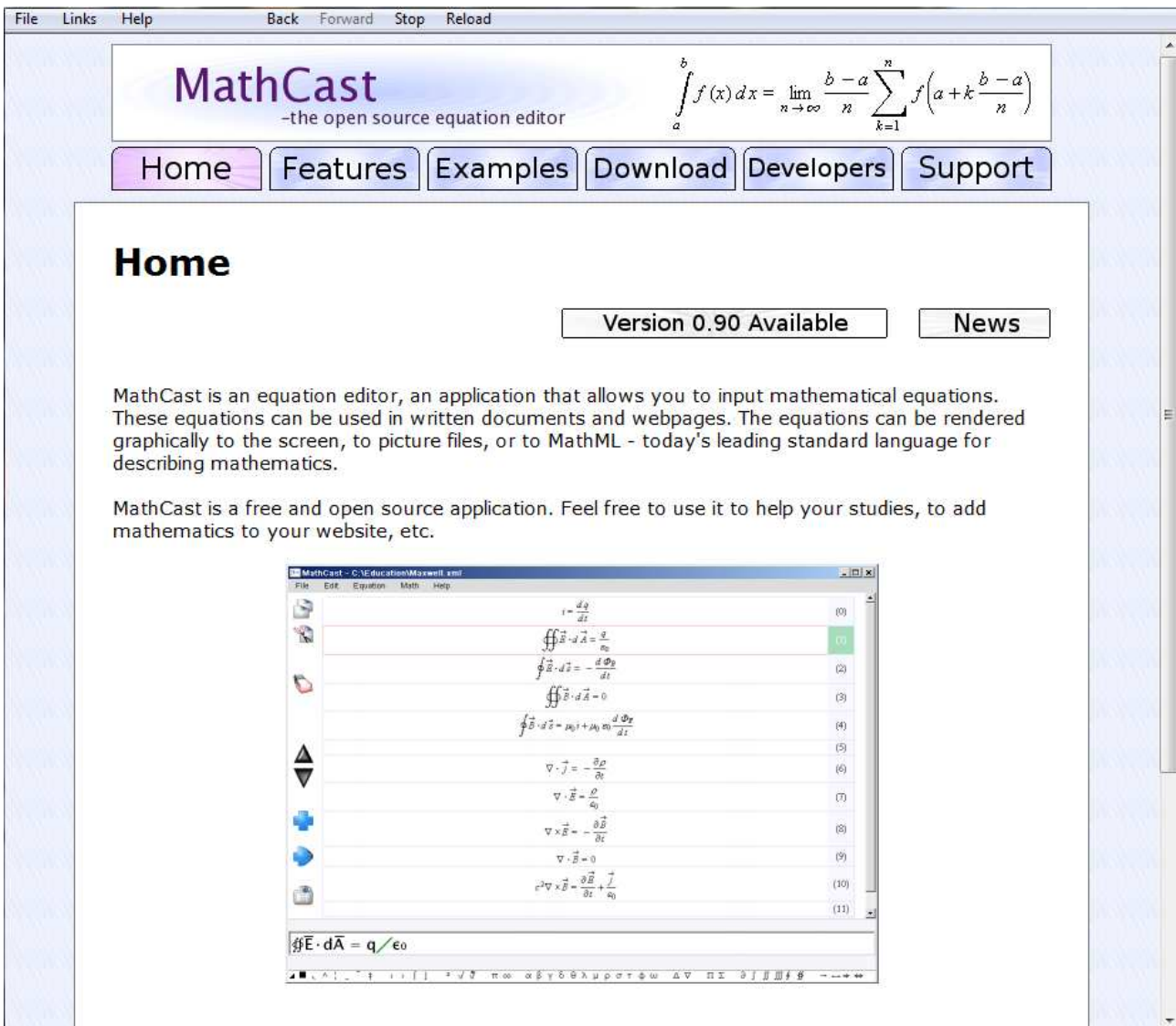


As shown above the Edit Screen is divided in areas. Edit Screen consists of the Main Menu, the Equation List Pane, the Equation Buttons Pane, the Quick Keys, The Equation Name, the Rapid Mathline and the Lowlist. The Equation List Pane was described better in section 3 of this document. The Equation Buttons Pane consists of buttons that represent the most used actions a user would take when using MathCast. These actions are: Copy, Cut, Paste, Delete, Move Up, Move Down, Add, Insert, Preview Mathcasting. The Rapid Mathline is also described better in section 3 of this document. All of the “inputting” and “editing” of equations is done through this mechanism. The Lowlist is the lower section of the Edit Screen and consist of the most commonly used characters. User can click on any of those characters and this character will appear in the Rapid Mathline. Equation Name and Quick Keys were also described in section 3. The Main Menu of this screen is consisted of five other Menus: the File Menu, the Edit Menu, the Equation Menu, the Math Menu and the Help Menu. The File Menu provides the following actions: New, Open, Save, Save as, Insert, Append, Download, Browser Screen, Welcome Screen, Exit. The Edit Menu provides the following options: Undo, Redo, Cut, Copy, Paste, Delete, Select All, Select Few, Unselect, Settings. The Equation Menu provide the following options: Add Equation, Insert Equation, Import Equation, Export Equation, Move up, Move down and the following options which are also available in the Settings Screen: Change Display Type to Block, Change Display Type to Inline, Change Name, Color, Background Color, Size. The Math Menu is described in section 3. The Help Menu consists of: Help, Browse Help, Calculator, Unit Converter, MathCast’s Website, About MathCast.

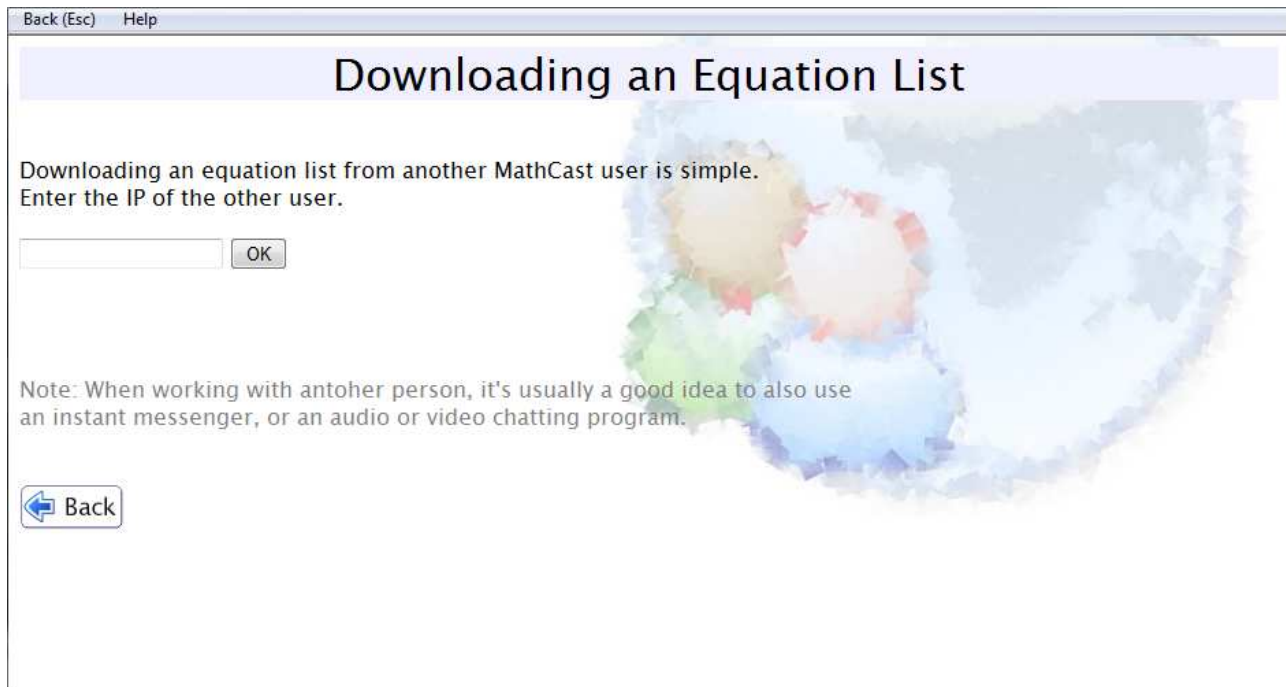
The Settings Screen is described in section 3. This is a screenshot of it



The Browser Screen is also described in Section 3. Here is a screenshot of it



Other screens that appear when using MathCast are the system window that opens so the user can navigate through his folders and the error window that appears when the user performs ineligible actions. There is also a small window that appears when the user wants to replace an existing file during saving an equation list. In addition to these screens MathCast is also consisted of the downloading screen. More information about downloading and this screen can be found in section 3. Here is a screenshot of it.



4.2 Hardware Interfaces

This product requires a functional PC in order to work properly. MathCast should be installed on a PC that meets at least the minimum hardware requirements. That means that the PC must work using a Pentium III or Athlon XP 1GHz processor or newer ones, must have 500MB RAM and 50 MB free hard drive space. MathCast supports some features that require an internet connection. In order for these features to function the user should also have some kind of Modem or Router connected to his PC, though it is not mandatory.

4.3 Software Interfaces

MathCast should be able to run on a Windows based platform using Microsoft Windows 2000, XP or newer versions. Because MathCast supports copying and pasting equations in word processors MathCast also uses the Clipboard. The XHTML files produced by MathCast should be compatible with Mozilla, Firefox and Netscape browsers though Internet Explorer requires a program to enable displaying of MathML. As a communication mechanism for downloading equations and web pages (via download screen or browser screen) HTTP is used because of its reliable services.

4.4 Communications Interfaces

MathCast internally uses HTTP to talk with the embedded browser. MathCast also uses HTTP to download web pages through the browser screen. The user must also enable HTTP server and enter

a port number for incoming connections when using the download feature. Browse Screen requires an internet connection to function.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

MathCast shall run on a minimal amount of memory and take up a small amount of disk space after install. Depending on the performance of the user's computer, the number of equations in the Equation List Pane might slow down MathCast. If the equation number is excessive at some point MathCast cannot allocate memory, and the application crashes. However, serious performance penalties may be applied for long equation lists. In a typical personal computer MathCast may become unusable after a few hundred equations.

5.2 Safety Requirements

MathCast is a fast and responsive program. However as mentioned in section 5.1 working with excessively big equation lists may lead MathCast to become unresponsive or even crash. To avoid any loss of data when working in equation lists that consist of a few hundred equations the user should save his files regularly. It is also advised that an Equation List that consist a few hundred equations is divided into smaller equation lists. However MathCast runs at the user's risk and these choices should be left to the user.

5.3 Security Requirements

User has direct access in MathCast. Password or username are not required. To be able to share his equation lists with others, the user must enable EnableHTTP Server checkbox from the settings screen and enter a port number. It is suggested that the EnableHTTP option remains unchecked by default and be enabled only when the user wants to share an equation list. The user should also share his IP address only with other trusted users.

5.4 Software Quality Attributes

- **Reliability**

MathCast should provide reliability to the user. The product will run stably with all the features mentioned above available and executing perfectly. It should be tested and debugged completely. All exceptions should be well handled.

- **User Friendliness/Simplicity**

MathCast should have a graphical user interface with user friendly menu and options.

- **Supportability**

Help documents and online help is provided. There are also two forums available. A Help forum and a Bugs and Feedback forum.

- **Availability**

MathCast can be downloaded through the project's website or the project's webpage at Sourceforge.net. Both links were given previously in this document. Since MathCast is licensed under the GNU General Public License, it's free software and can be used by everyone without limitation. The source code of the project is also provided.

6. Special Thanks

Special thanks to Mr. Tomer Chakam, the creator of MathCast and diligentXML, for the help and the immediate answers he provided, during the creation of this document.