Software Requirements Specification

for

Fraction Worksheet Creator

**Version 1.0 approved**

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**2/18/2016**

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# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Date** | **Reason For Changes** | **Version** |
| Release 1 | 02/18/2016 |  | 1.0 |
|  |  |  |  |
|  |  |  |  |

# Introduction

This section gives a scope description and overview of everything included in this SRS document. Also, the purpose for this document is described and a list of abbreviations and definitions is provided.

## Purpose

The purpose of this document is to give a detailed description of the requirements for the “Fraction Worksheet Creator” (FWC) software. It will illustrate the purpose and complete declaration for the development of system. It will also explain system constraints, interface and interactions with other external applications. This document is primarily intended to be proposed to a customer for its approval and a reference for developing the first version of the system for the development team.

## Product Scope

The “Fraction Worksheet Creator” (FWC) is an off-line worksheet generation tool designed by Elementary Engineers to help elementary school teachers to create a lot of exercises for students to study and practice fractions. The fractions worksheets are randomly created and never repeated so the teachers have an endless supply of quality fractions worksheets to use in the classroom or at home. The generated worksheets can contain fraction problems of various difficulty levels, from basic addition and subtraction problems with visuals and images suitable for small children, to quite advanced fraction equations. The worksheets created with “Fraction Worksheet Creator” are not pre-designed but are randomly generated based on a complex set of algorithms corresponding to the specific mathematical structure of each type of worksheet. This allows for virtually unlimited original worksheets. Furthermore, FWC will also generate an answer sheet. The worksheets will be created as PDF documents which are automatically opened on the computer once the generating process is done.

The “Fraction Worksheet Creator” worksheets are free to print, easy to use, and very flexible.

## Intended Audience and Reading Suggestions

This document is to be read by the customer, development team, the project managers, testers, documentation writers and end users. The SRS has been organized approximately in order of increasing specificity. The developers and project managers need to become intimately familiar with the SRS.

Others involved need to review the document as such:

*Overall Description* – The customer and end users have to become accustomed to the various product features in order to effectively advertise the product.

*System features* – Testers need an understanding of the system features to develop meaningful test cases and give useful feedback to the developers.

*External Interface Requirements* – The software developers need to know the requirements of the system they need to build.

*Nonfunctional and Functional Requirements* – The software developers.

## References

[1] IEEE Software Engineering Standards Committee, “IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications”, October 20, 1998.

[2] Fractions worksheet. (2016, February 12).

Retrieved from http://www.fractions4kids.com/worksheets/

[3] Basic Fractions Worksheets. (2016, February 12).

Retrieved from https://www.superteacherworksheets.com/fractions-basic.html

[4] Fraction worksheets 1.Fraction addition, subtraction, multiplication, and division. (2016, February 12). Retrieved from https://www.homeschoolmath.net/worksheets/fraction.php

[5] Test and Worksheet Generators for Math Teachers. Home Page. (2016, February 12). Retrieved from https://www.kutasoftware.com/freeipa.html

[6] Microsoft Math Worksheet Generator Software. (2016, February 12).

Retrieved from http://microsoft-math-worksheet-generator.software.informer.com/

## 1.5 Overview

The remainder of this document includes three chapters and appendices.

The second one provides an overview of the system functionality and system interaction with other systems. Further, the chapter also mentions the system constraints and assumptions about the product.

The third chapter provides the requirements specification in detailed terms and a description of the different system interfaces. Different specification techniques are used in order to specify the requirements more precisely for different audiences.

The fourth chapter deals with the prioritization of the requirements. It includes a motivation for the chosen prioritization methods and discusses why other alternatives were not chosen. The fifth chapter describes other nonfunctional requirements. The sixth chapter contains the database schema used in in the FWC database.

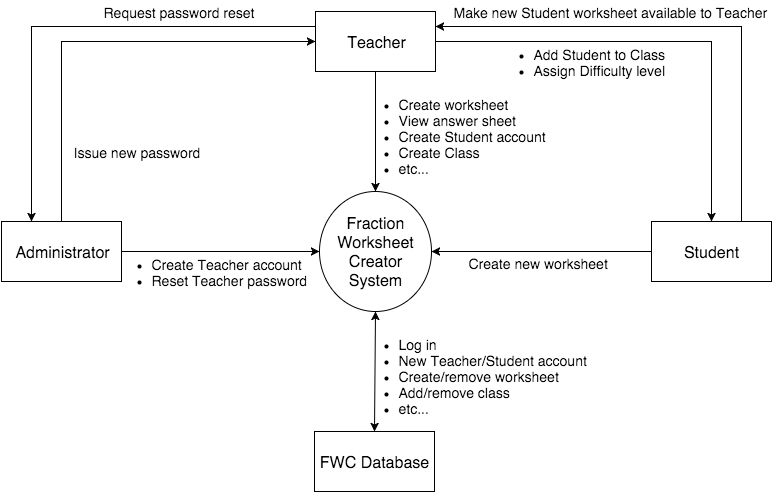
The Appendices in the end of the document include all the results of the requirement prioritization and a release plan based on them.

# Overall Description

## Product Perspective

The Fraction Worksheet Creator (FWC) is a new stand-alone product that allows teachers and students to create random exercise worksheets to practice operations with fractions. There exist many alternative online fraction worksheet creators. However, this system is accessible offline and stores worksheets and user information for all teachers and students that share the workstation on which the product is installed. This project is being produced by students at Framingham State University with help from Dr. Andrew Jung.

Figure 1 below demonstrates the entities of the system and its interfaces, which may be altered from each release to the next to meet the requirements in this specification.



**Figure 1** *–**Context diagram for release 1.0 of the Fraction Worksheet Creator*

## User Classes and Characteristics

|  |  |
| --- | --- |
| Administrator | An Administrator is a teacher or other employee at the school in which the FWC will be used who installs the FWC on a workstation to be used by Teachers and Students. The Administrator shall use the FWC system only to create and remove Teacher user accounts, as well as reset Teacher passwords on-demand. |
| Teacher (favored) | A Teacher is an employee at the school that uses the FWC to create random exercise worksheets for fractions to distribute to students in his/her classes. The Teacher must have access to the answer sheet of every worksheet he/she creates or that his/her Students create. The Teacher can create Classes and rosters for them, creating an account for each Student in a class and providing the students with their usernames and passwords in order to access the FWC. The Teacher can assign difficulty levels for the worksheets that each of his/her Students creates. The Teacher has access to all worksheets he/she has previously created in the FWC system. |
| Student | A Student is a participant in one of a Teacher’s classes that shall be able to create random fraction worksheets of the Student’s assigned difficulty level. Like the Teacher, the Student is able to refer to worksheets that he/she previously created. |

## Operating Environment

* The FWC shall operate with any Operating System that has Java installed.
* The FWC shall interface with Adobe Reader in order to open the created worksheets as PDF files and allow the user to save or print the worksheets.
* The FWC shall operate with any system that has a printer installed.

## Design and Implementation Constraints

* The system’s Software Requirements Specification shall use the IEEE Requirements Specification Template. [1]
* The FWC shall use any version of Adobe Reader that is installed on the same system.
* The FWC shall secure the passwords of all user accounts created.
* After installation of the FWC, the maintenance of the teacher accounts will be the responsibility of the Administrator.
* The FWC shall be re-installed on the system on the occasion that the Administrator forgets his/her master password.

Further implementation constraints will be added in this section to aid with the development process after the first release of this specification.

## User Documentation

* The FWC system shall provide a help utility within its user interface to aid all users with tasks to perform on the specific page on which the utility is invoked.
* The FWC system shall provide video tutorials for Teachers and Students to provide examples and aid for solving the fraction worksheets the FWC creates.

## Assumptions and Dependencies

* The system on which the FWC is installed also has Java installed.
* The system on which the FWC is installed also has Adobe Reader installed.
* Teachers and Students are able and permitted to save files to the system on which the FWC is installed.
* The FWC data does not need to be accessible from a workstation other than the one on which it is originally installed.

# User Requirements

## Functional Requirements

*These are the non-technical versions of the Functional Requirements for the Fraction Worksheet Creator.*

*Requirements for the Admin System Features*

* The admin shall be able to register teacher accounts.
* The admin shall be able to reset teacher account passwords.

*Requirements for the General System Features*

* The system shall provide administrative privileges to an assigned user during installation.
* The system shall provide a graphical user interface for all software interactions.
* The system shall provide help for each screen displayed in the GUI.
* The system shall provide three levels of worksheet difficulty.
* The system shall provide three worksheet types per difficulty level.
* The system shall provide tutorial content for each worksheet.
* The system shall generate random exercises for each worksheet.
* The system shall generate instructions on the worksheet for each problem type.
* The system shall allow previewing, printing and saving worksheets and answer sheets via PDF.
* The system shall provide a search feature on the class roster screen to search for students and student worksheets.

*Requirements for the Teacher System Features*

* The teacher shall be able to access the system using a username / password.
* The teacher shall be able to request a password reset.
* The teacher shall be able to select any worksheet regardless of difficulty and problem type.
* The teacher shall be able to select a range of values for numerator and denominator for intermediate and advanced worksheets.
* The teacher shall be able to review student generated worksheets and answer sheets.
* The teacher shall be able to delete student generated worksheets and answer sheets.
* The teacher shall be able to create rosters for each class they teach.
* The teacher shall be able to create / modify / delete logins for students.
* The teacher shall be able to set difficulty levels for each student.

*Requirements for the Student System Features*

* The student shall be able to access the software using a username / password provided by the teacher.
* The student shall be able to request a password reset.
* The student shall be able to select various problem types based on assigned difficulty level.

## Non-Functional Requirements

*These are the non-technical versions of the Non-Functional Requirements for the Fraction Worksheet Creator*

* The system shall run on a Windows or Mac OS device running Java 8 or higher.
* The system shall have access to a printer to print worksheets and answer sheets.

## Software Interfaces

* The software will interface with a database for the storage of user logins and worksheet generation seeds for answer sheet recall.
* The software will interface with an API for the creation of PDFs. The PDFs will be how worksheets and answer sheets are formatted, saved and printed.
* The software will interface with Adobe Reader. Adobe Reader will be used to preview the worksheets and answer sheets. Adobe Reader provides printing and saving options that will be available to the users.

# System Requirements

*These are the technical versions of the Functional Requirements for the Fraction Worksheet Creator. Additional detail will be added during the next version of the SRS.*

## Admin System Features

*Features that will be utilized only by the Administrator Account*

4.1.1 Requirement: Teacher Registration

Description: The admin shall be able to register teacher accounts. The admin shall utilize the ADMIN GUI Panel to create new accounts for any teachers using the software. The admin shall create the teacher’s username and the system will provide a randomly generated eight character’s password.

4.1.2 Requirement: Teacher Password Reset

Description: The admin shall be able to reset teacher account passwords. The admin shall utilize the ADMIN GUI Panel to reset forgotten teacher passwords. The admin shall click a <Reset Password> button for the teacher. Doing so will randomly generate a new eight character password. This password is temporary and can be provided to the teacher outside the FWC software.

## General System Features

*Features that will be utilized by both Student and Teacher user accounts*

4.2.1 Requirement: Admin Account Setup

Description: During the initial installation of the FWC, the system shall require an admin account be created. This account will be responsible for administration of teacher accounts. Both for account creation and password management.

4.2.2 Requirement: Graphical User Interface

Description: The system shall provide a graphical user interface to access all components of the software.

4.2.3 Requirement: Help System

Description: The system shall provide help for each screen displayed in the GUI. This help will provide instructions for navigating that section of the software.

4.2.4 Requirement: Worksheet Difficulty

Description: The system shall provide three levels of worksheet difficulty. Those levels will be named Beginner, Intermediate and Advanced.

4.2.5 Requirement: Worksheet Types

Description: The system shall provide three worksheet types per difficulty level.

Beginner – All three will be image based problems.

Worksheet 1 – Order images from least to greatest (10 Problems)

Worksheet 2 – Specifics are TBD (10 Problems)

Worksheet 3 – Specifics are TBD (10 Problems)

Intermediate – These will be simpler problems without images.

Worksheet 1 – Addition (20 Problems)

Worksheet 2 – Subtraction (20 Problems)

Worksheet 3 – Specifics are TBD (20 Problems)

Advanced – These will be word based problems.

Worksheet 1 – Addition (20 Problems)

Worksheet 2 – Subtraction (20 Problems)

Worksheet 3 – Specifics are TBD (20 Problems)

4.2.6 Requirement: Tutorial Content

Description: The system shall provide tutorial content for each worksheet. These will be video based tutorials that will walk users through solving an example problem for that worksheet type.

4.2.7 Requirement: Random Exercise Generation

Description: The system shall generate random exercises for each worksheet. The system shall use a randomly generated seed number that can be used to create the exercises. The seed will be stored for each worksheet / answer sheet retrieval.

4.2.8 Requirement: Worksheet Instructions

Description: The system shall generate instructions on the worksheet for each problem type. After the header information at the top, the next printed section on the worksheet will be an example problem with instructions for how to solve.

4.2.9 Requirement: Worksheet Output

Description: The system shall allow previewing, printing and saving worksheets and answer sheets via PDF. The system will save a PDF document which will be automatically opened when the user requests a worksheet or answer sheet. Using the default options within Adobe Reader the user can save or print the document being previewed.

4.2.10 Requirement: Search Feature

Description: The system shall provide a search feature on the class roster screen to search for students and student worksheets. A search bar will be displayed. Text entered into this field will be compared to the class roster and any results for that text will be displayed in place of the all data available view.

## Teacher System Features

*Features that will be utilized by Teacher user accounts*

4.3.1 Requirement: Teacher System Access

Description: The teacher shall be able to access the system using a username / password. This information shall be entered in to the login screen. Username to be provided by the administrator. Password to be randomly generated by the admin. The teacher will be required to change their password the first time they login.

4.3.2 Requirement: Teacher Password Reset

Description: The teacher shall be able to request a password reset. Clicking on the <Password Reset> button on the login screen will prompt a pop-up on the ADMIN GUI Panel the next time the Admin logs in.

4.3.3 Requirement: Teacher Worksheet Selection

Description: The teacher shall be able to select any worksheet regardless of difficulty and problem type. All available difficulties and worksheets will be visible on the main worksheet creation page.

4.3.4 Requirement: Worksheet Parameter Options

Description: The teacher shall be able to select a range of values for numerator and denominator for intermediate and advanced worksheets. These values will be used during the creation of the problems for the worksheet.

4.3.5 Requirement: Student Worksheet Review

Description: The teacher shall be able to review student generated worksheets and answer sheets. Using the Class Roster Panel the teacher will be able to view a list of worksheets generated by the students. This list will include the student name, date generated, the difficulty and worksheet type created. Clicking on a listing will open a PDF copy of the worksheet and answer sheet.

4.3.6 Requirement: Student Worksheet Deletion

Description: The teacher shall be able to delete student generated worksheets and answer sheets. Using the Class Roster Panel the teacher will be able to remove listings for generated worksheets. Permanently removing those listings from the database.

4.3.7 Requirement: Class Roster Creation

Description: The teacher shall be able to create rosters for each class they teach. Using the Class Roster Panel the teacher will be able to create a roster of students for each course they teach. Allowing the teacher to see all students in a particular class at a glance. Data entered for the class roster will be used as part of the worksheet header.

4.3.8 Requirement: Student Login Management

Description: The teacher shall be able to create / modify / delete logins for students. Using the Student Data Panel the teacher will be able to add new students, modify their username / password, and delete the student account.

4.3.9 Requirement: Student Difficulty Management

Description: The teacher shall be able to set difficulty levels for each student. Using the Student Data Panel the teacher will be able to assign available difficulty levels to the student.

## Student System Features

*Features that will be utilized by Student user accounts*

4.4.1 Requirement: Student System Access

Description: The student shall be able to access the system using a username / password. This information shall be entered in to the login screen. Username and password to be provided by the teacher.

4.4.2 Requirement: Student Password Reset

Description: The student shall be able to request a password reset. Clicking on the <Password Reset> button on the login screen will prompt a pop-up on the Teacher Class Roster Panel the next time they log in.

4.4.3 Requirement: Student Worksheet Option

Description: The student shall be able to select various problem types based on assigned difficulty level. Based on the difficulty level set by the teacher, only those worksheets will be visible on the main worksheet creation page.

# Other Nonfunctional Requirements

## Performance Requirements

* **Number of Users:** The number of registered users shall not be limited, since the software shall be designed to be used by only one user at any given time.

## Safety Requirements

No safety requirements have been identified.

## Security Requirements

* The system shall only allow unauthorized users to access the login and registration pages and the help utility.
* The system shall require a username and password to gain access to the FWC.
* The system shall store user passwords securely in a database.

## Software Quality Attributes

* **Correctness:** The system shall create a correct answer sheet for each generated worksheet.
* **Interoperability:** The system shall work seamlessly with the database to store login, teacher-student, worksheet, and answer sheet information and retrieve such information for use in the software.
* **Usability:** The system shall be easy to use and have an internal help utility to show users how to perform functions offered by the software.

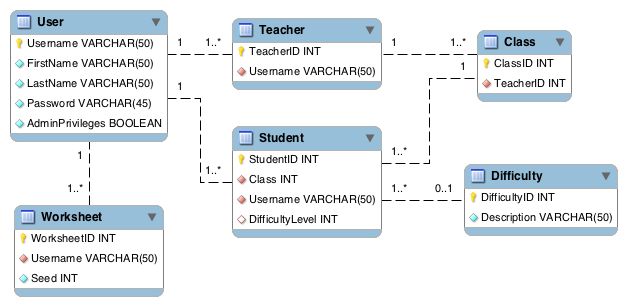
## Business Rules

* The system shall allow the administrator to register teacher accounts.
* The system shall allow teachers to register student accounts and classes.
* The system shall allow students to generate worksheets and view previous worksheets, but not to view answer sheets.
* The system shall allow teachers to view answer sheets for worksheets created by their students.
* The system shall allow both teachers and students to access and delete existing worksheets from their previously created worksheets.

# Other Requirements

* 1. **Database Schema**

The database schema that is used in the FWC database is given below.



**Figure 2** *– Database schema diagram for release 1.0 of the Fraction Worksheet Creator*

# Appendix A: Glossary

**Table 1 - Definitions, acronyms, and abbreviations**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| |  |  | | --- | --- | | **Acronyms/ Abbreviations** | **Definitions** | | SRS | Software Requirement Specification | | FWC | Fraction Worksheet Creator | | API | Application Program Interface | | TBD | An abbreviation meaning in official documents "to be determined" | | PDF | Portable Document Format | | GUI | Graphical User Interface | | Mac OS | Series of graphical user interface–based operating systems developed by Apple Inc. for their Macintosh line of computer systems. | | Windows | Computer operating system developed by Microsoft Corporation to run personal computers | | Java 8 | The latest release for Java that contains new features, enhancements and bug fixes to improve efficiency to develop and run Java programs | | Adobe Reader | Free global standard for reliably viewing, printing, and commenting on PDF documents | | Admin/Administrator | System administrator or teacher at the school who is given specific permission for managing and controlling the system | | User | Someone who interacts with the software | | Teacher | Employee at the school that uses the FWC to create random exercise worksheets for fractions to distribute to students in his/her classes. | | Student | Participant in one of a Teacher’s classes that shall be able to create random fraction worksheets of the Student’s assigned difficulty level. | | Worksheet | Sheet of paper with questions for students and places to record answers. | |

# Appendix B: To Be Determined List

**Table 2 - List of TBD**

|  |  |
| --- | --- |
| **Number of the TBD references** | **The References of TBD** |
| [1] | Certain constraints will be imposed upon the specification |
| [2] | Design of the FWC will be derived from upper-level specifications |
| [3] | Design and specifics of worksheets will be provided per difficulty levels |
| [4] | Video tutorials will be created and recorded per difficulty levels |
| [5] | Content of the fractions problems will be developed based on difficulty levels |