Sabbatical Leave Report

A. Applicant

Name: George Sturr

Department: Mathematics

Type of Leave: Project

Leave Dates: Spring 2019

B. Purpose of Leave

The purpose of this leave was to develop a student-friendly software application that performs data analysis and statistical calculations appropriate for a Math 15 Elementary Statistics course at SRJC. The application operates within a web browser, is free for students and can be easily switched to a Spanish language version.

C. Objectives

1. To develop a software program that can be used by students to analyze data and perform the statistical calculations taught in SRJC statistics courses. The program includes a data editing table, probability and statistical inference tools, and chart creation tools. Students can use the software from within a web browser operating on laptop, tablet or desktop computer.

2. To develop a language translation feature for the software that allows a user to switch between English and Spanish versions of the software.

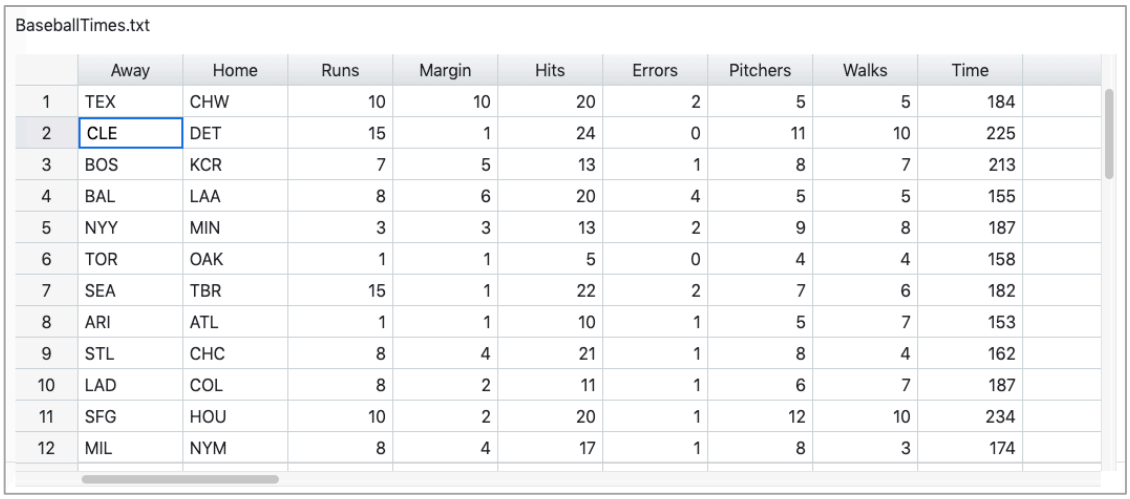
D. Narrative

1. Software Development

The goal of this project was to develop free statistical software. The software was designed as a web-application with four user-friendly modules: (i) a data editor, (ii) a data analysis tool, (iii) a tool to calculate probability, and (iv) a tool to calculate statistical inference. The modules were developed over the course of my sabbatical. A brief description of each module with an illustrative screenshot is given below.

i. Data Editor Module

The data editor displays a table for data entry and editing. Data can be directly entered or loaded from data files stored on a server. The file feature allows a student to easily work with prepared data sets from their textbook or instructor.

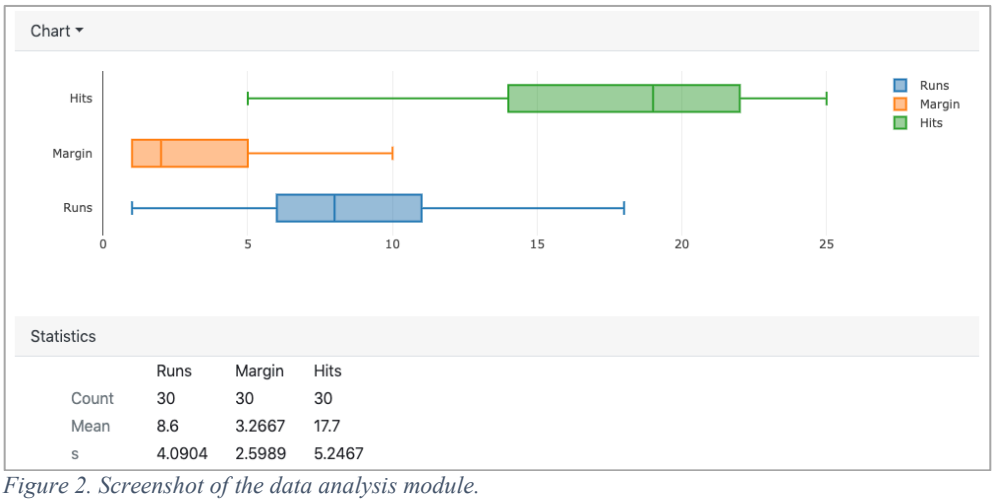

BaseballTimes.txt

	Away	Home	Runs	Margin	Hits	Errors	Pitchers	Walks	Time
1	TEX	CHW	10	10	20	2	5	5	184
2	CLE	DET	15	1	24	0	11	10	225
3	BOS	KCR	7	5	13	1	8	7	213
4	BAL	LAA	8	6	20	4	5	5	155
5	NYY	MIN	3	3	13	2	9	8	187
6	TOR	OAK	1	1	5	0	4	4	158
7	SEA	TBR	15	1	22	2	7	6	182
8	ARI	ATL	1	1	10	1	5	7	153
9	STL	CHC	8	4	21	1	8	4	162
10	LAD	COL	8	2	11	1	6	7	187
11	SFG	HOU	10	2	20	1	12	10	234
12	MIL	NYM	8	4	17	1	8	3	174

Figure 1. Screenshot of the data editor table.

ii. Data Analysis Module

The data analysis module is used to chart and analyze data from the data editor. Within this module a student can create graphs, find statistics, and perform the statistical procedures studied in an introductory statistics course.



	Runs	Margin	Hits
Count	30	30	30
Mean	8.6	3.2667	17.7
s	4.0904	2.5989	5.2467

Figure 2. Screenshot of the data analysis module.

iii. Probability Calculator Module

The probability calculator module computes probabilities from a probability distribution and displays a visualization of the distribution. The module features all of the essential distributions found in an introductory statistics course.

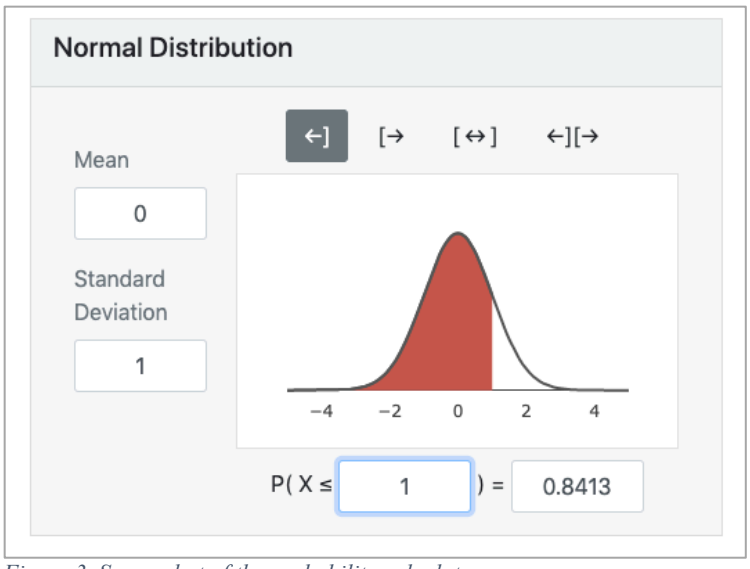


Figure 3. Screenshot of the probability calculator.

iv. Statistical Inference Module

The statistical inference module uses summary statistics to calculate the confidence intervals and hypothesis tests studied in an introductory statistics course.

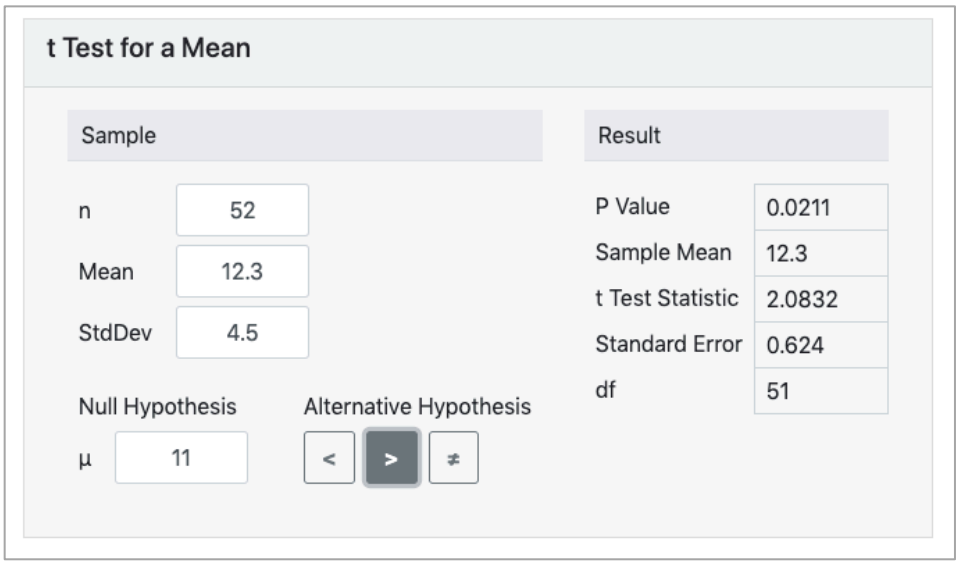


Figure 4. Screenshot of the statistics calculator.

2. Spanish Translation

The application includes a language translation feature. The modules described above were coded to allow menu items, instructions and other phrases to be substituted with translations from other languages. During the module development phase of the project I used Google's language translation service to convert from English to Spanish. This translation often did not properly translate statistical jargon but was good enough for the development of the individual modules. Once the software reached the stage of a working integrated application a better translation was needed. To this end I asked my colleague Salvador Rico, a mathematics instructor at the Petaluma campus, to consult his Spanish statistical textbooks and edit the translations. He agreed and is now working on a mathematically correct translation.

3. Testing and Further Development

Software development is a long-term process. The sabbatical leave gave me time to work intensively developing a complete, operational application. It is now in the "alpha" state, a software application that functions but still requires testing and revision of features.

Using the responses from my statistics students and colleagues this Fall semester, the first "beta" version (software with finalized features and minimal bugs) should be ready for classroom use in the upcoming Spring semester.

4. Technical Details

The application is written in the TypeScript language and compiled to JavaScript. The current version is compiled from 142 TypeScript files containing 9945 lines of code in total. Source code is maintained in a private GitHub repository. Once the code has passed the beta level the repository will be made public and open-sourced.

Several open source projects are used to support the code. React and Bootstrap provide a foundation for building the user-interface, the Plotly library is used for charting, and JStat supplies core probability routines.

E. Evaluation Summary

1. How did this sabbatical leave enhance my work performance at the college?

   The software developed by this project will enhance my instruction of Math 15 Elementary Statistics. It will also provide the opportunity to share my work with colleagues through professional development presentations or workshops.

2. How did this sabbatical leave benefit students in my discipline?

   Math 15 Elementary Statistics is a requirement for a wide spectrum of majors and is one of the most popular transfer courses offered by the SRJC mathematics department. As a result of this project students of Math 15 will have access to a freely available web application that complements and reinforces traditional lectures and homework assignments.

3. How did this sabbatical leave benefit my department?

   SRJC mathematics instructors will be able use the software with their statistics students and in courses with related objectives.

4. How did this sabbatical leave address the SRJC Strategic Plan and/or your department's educational plan?

   This project addresses the SRJC strategic goal of implementing responsive instructional practices to increase the learning and success of our diverse students.

F. Abstract for Board Report Summary

During this sabbatical, George Sturr developed a freely available web application that can be used by students of Elementary Statistics to analyze data and perform statistical calculations. The software design promotes understanding of data analysis and statistics by college students working at an introductory level, can be translated into other languages and function on a variety of devices, including desktop computers, laptops and mobile devices.