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In partial fulfillment of the course requirements in
CMSC 150: Numerical and Symbolic Computation

CMSC 150 DASHBOARD
USER MANUAL

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INTRODUCTION

CMSC 150 Dashboard is a free, interactive, and user-friendly R-based web application that applies numerical and symbolic approaches in solving problems. The current version of the application is capable of performing **Polynomial Regression**, **Quadratic Spline Interpolation**, and **Simplex Method** in a Diet Problem. This user manual will provide you a walkthrough of the user interface and the features available in the current version of the CMSC 150 Dashboard.

GETTING STARTED

System Requirements

Ensure that R and RStudio are installed in the computer you are using before running the application. If you haven't installed these yet, you may download it from this link: https://posit.co/download/rstudio-desktop/.

The following are the required R packages of this application:

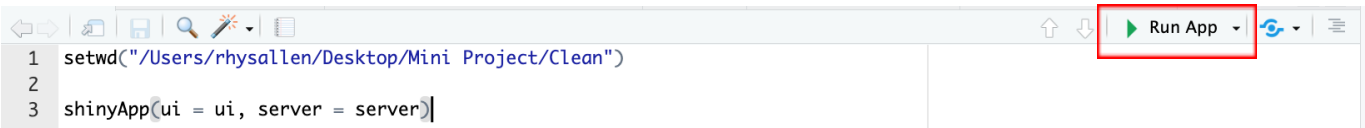
- shiny
- fresh
- shinyWidgets
- htmltools
- DT
- dplyr
- readxl
- ggplot2
- shinyjs

If you haven't installed these packages in your R environment, you may install these using the following code:
install.packages("<package_name>", dependencies = TRUE)

Accessing the Application

To access the CMSC 150 Dashboard, do these steps:

1. Extract the file, "ABEJAY_150PROJECT.zip", in your working directory.
2. Open RStudio, Click File > Open File > Choose "app.R" > Select File
3. Modify the following code in line 1 of app.R to change your current working directory:
   setwd("<path_containing_the_dashboard_script>")
4. Click "Run App" in the upper right corner of the source pane to run the application.



The application will launch on the Home section of the dashboard, where you can easily navigate through the various features available in the application.

DASHBOARD OVERVIEW

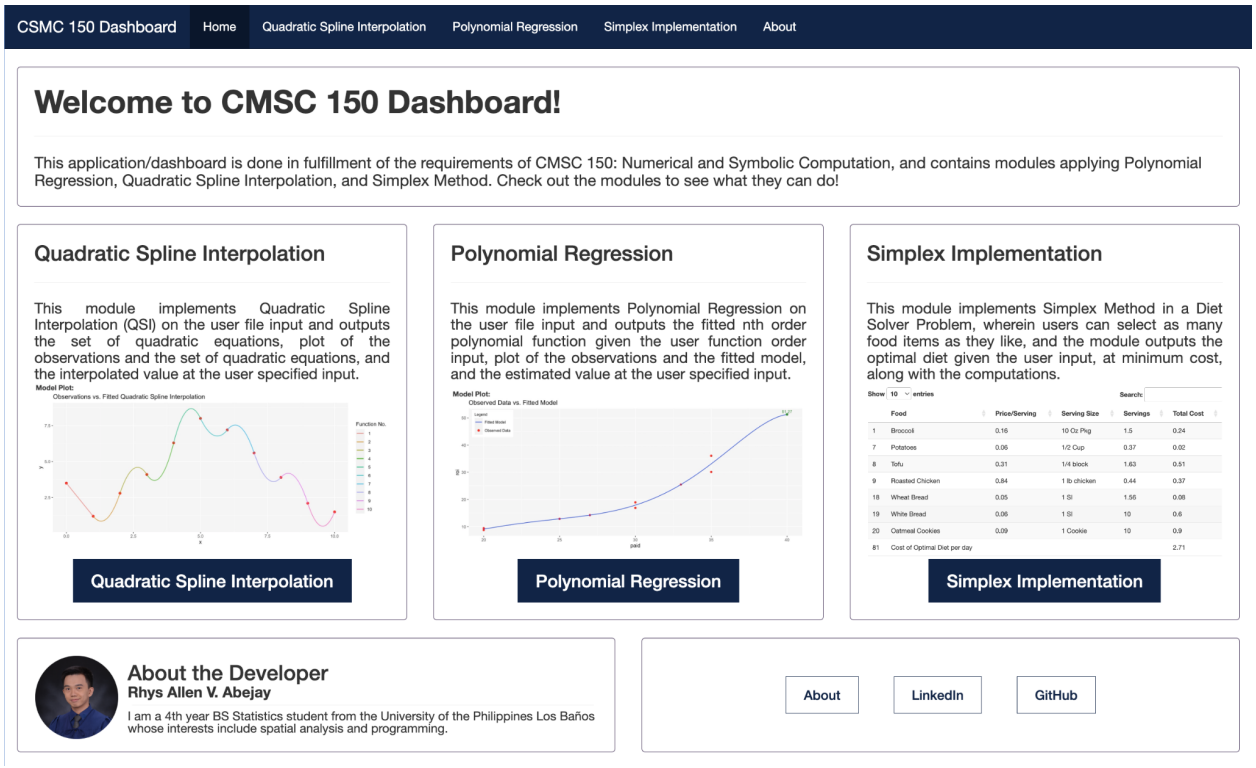
Navigation

Use the navigation bar in the top of the application to navigate between the different sections of the dashboard. Click the tabs to access the features available in the dashboard.

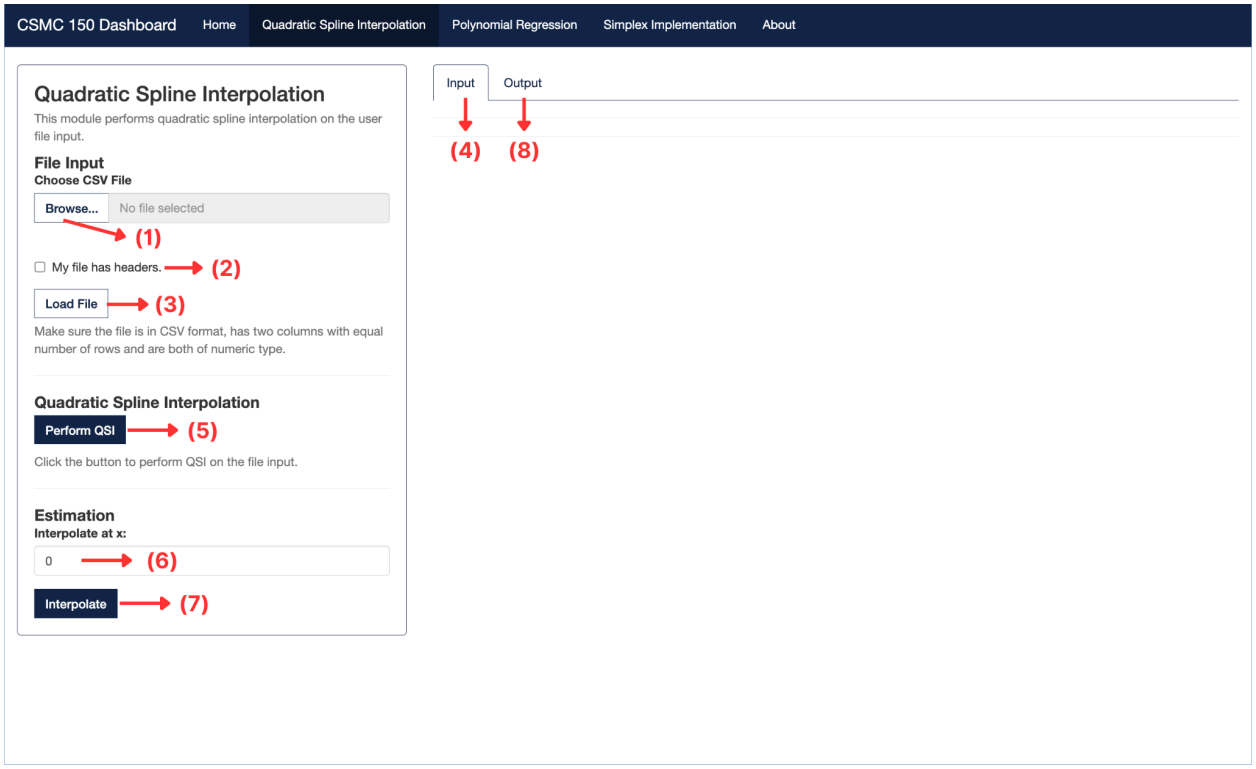
Menu/Sections

Home

The home section of the dashboard provides an overview of the features available in the application and a brief introduction about the dashboard's developer.



Quadratic Spline Interpolation



(1) Click the "Browse" button to select a CSV file containing the data you want to use for Quadratic Spline Interpolation. Valid CSV files only have two columns, with equal number of rows, and are both of numeric type.

(2) Click the checkbox if the file you want to upload has headers. An example of a valid CSV file with and without headers are as follows:

With headers:

	A	B
1	x_large	y_large
2	0	3.5
3	1	1.2
4	2	2.8
5	3	4.1
6	4	6.3
7	5	8
8	6	7.2
9	7	5.6
10	8	3.9
11	9	2.1
12	10	1.5

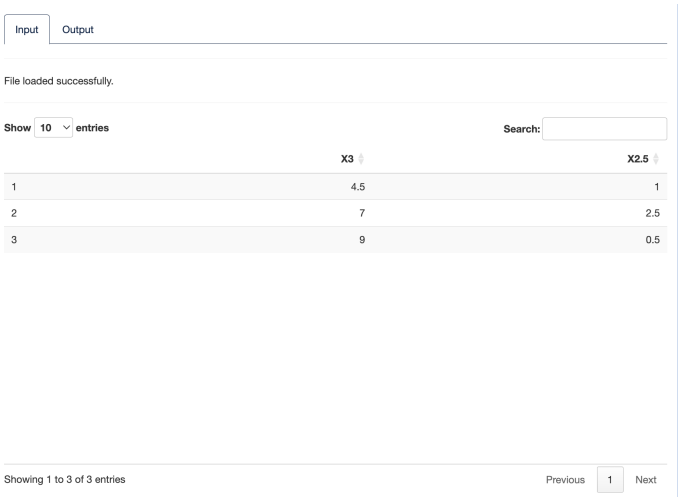
Without headers:

	A	B
1	3	2.5
2	4.5	1
3	7	2.5
4	9	0.5

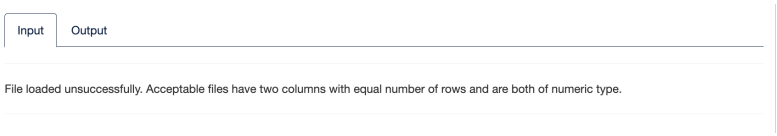
(3) Click the "Load File" button to upload the file in the application.

(4) After clicking the “Load File” button, the file contents will be displayed in the “Input” tab. A message whether the file has been successfully uploaded or otherwise is also displayed.

Successful file upload:

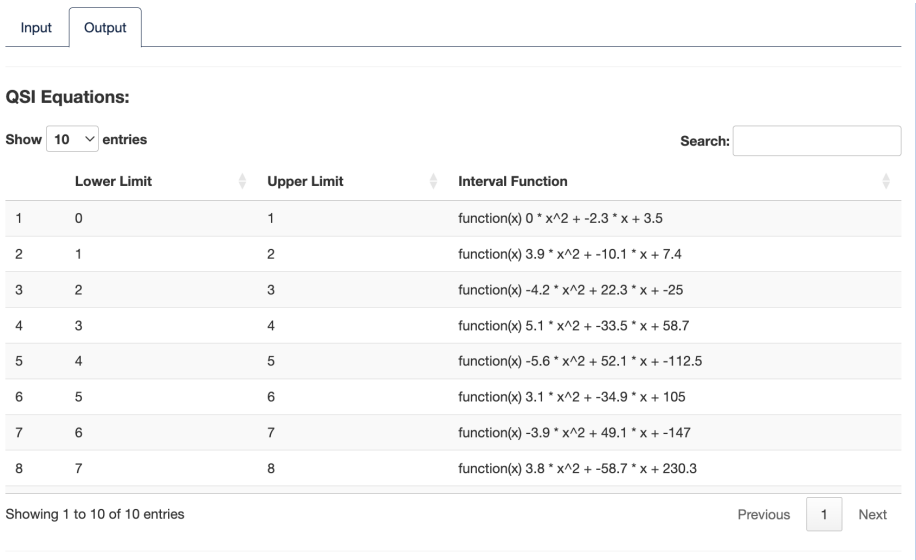


Unsuccessful file upload:

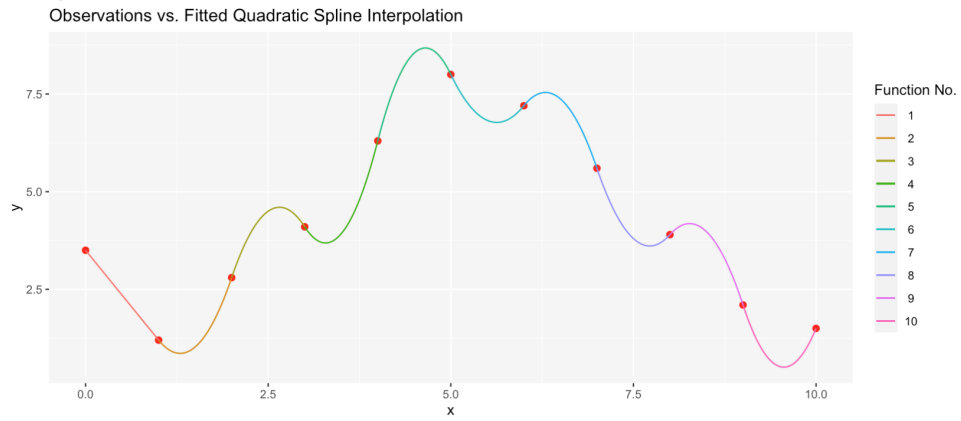


(5) Click the “Perform QSI” button to perform QSI on the uploaded file
(6) Enter a value in the input bar to interpolate a value at your input.
(7) Click the “Interpolate” button to show the interpolated value.
(8) After clicking the “Perform QSI” button or the “Interpolate” button, the “Output” tab will be active containing the set of QSI equations, the plot of these equations and the observations, and the interpolated value .

Sample Output tab contents:



QSI Equations Plot:



Interpolated Value:
3.5

Sample output with an invalid file input:

Input | Output

QSI Equations:

Show 10 **entries** **Search:**

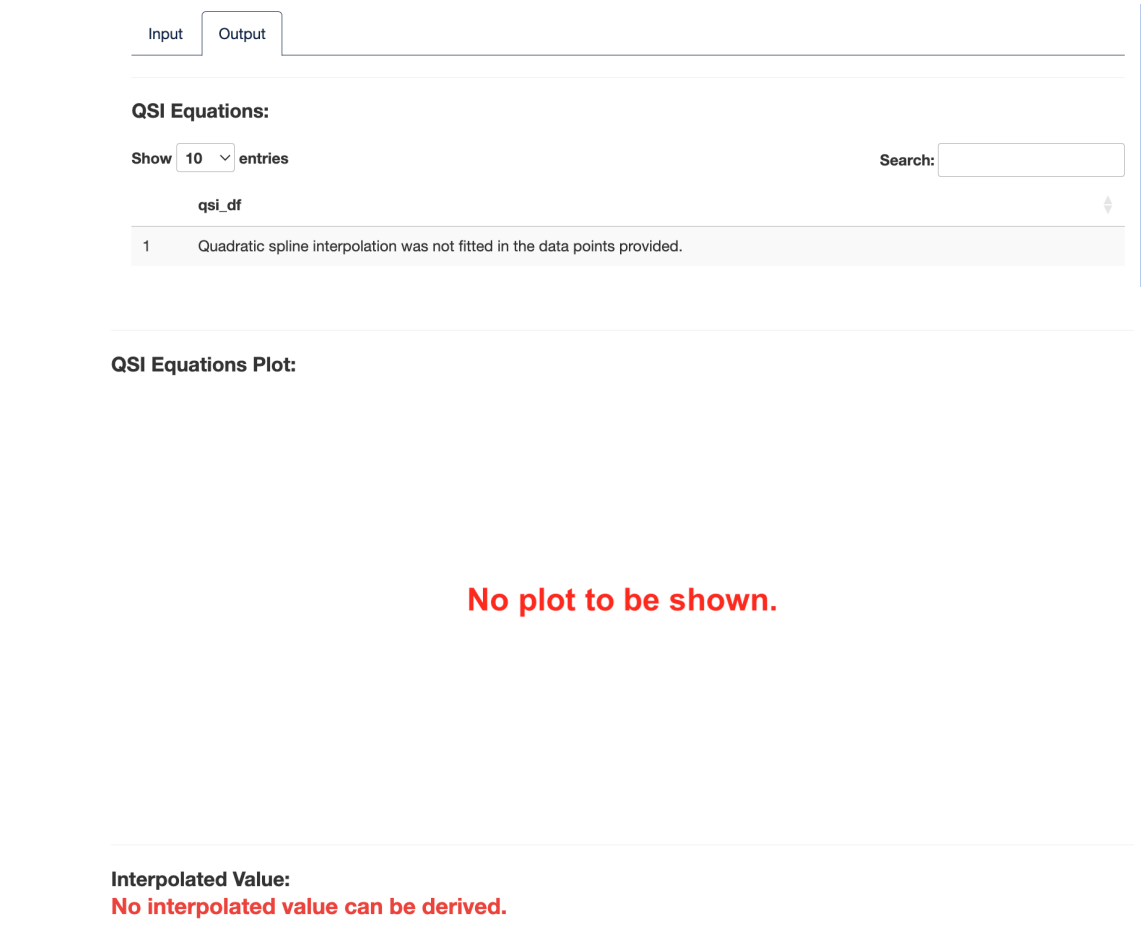
	qsi_df
1	File input is invalid, hence quadratic spline interpolation cannot be performed.

QSI Equations Plot:

No plot to be shown.

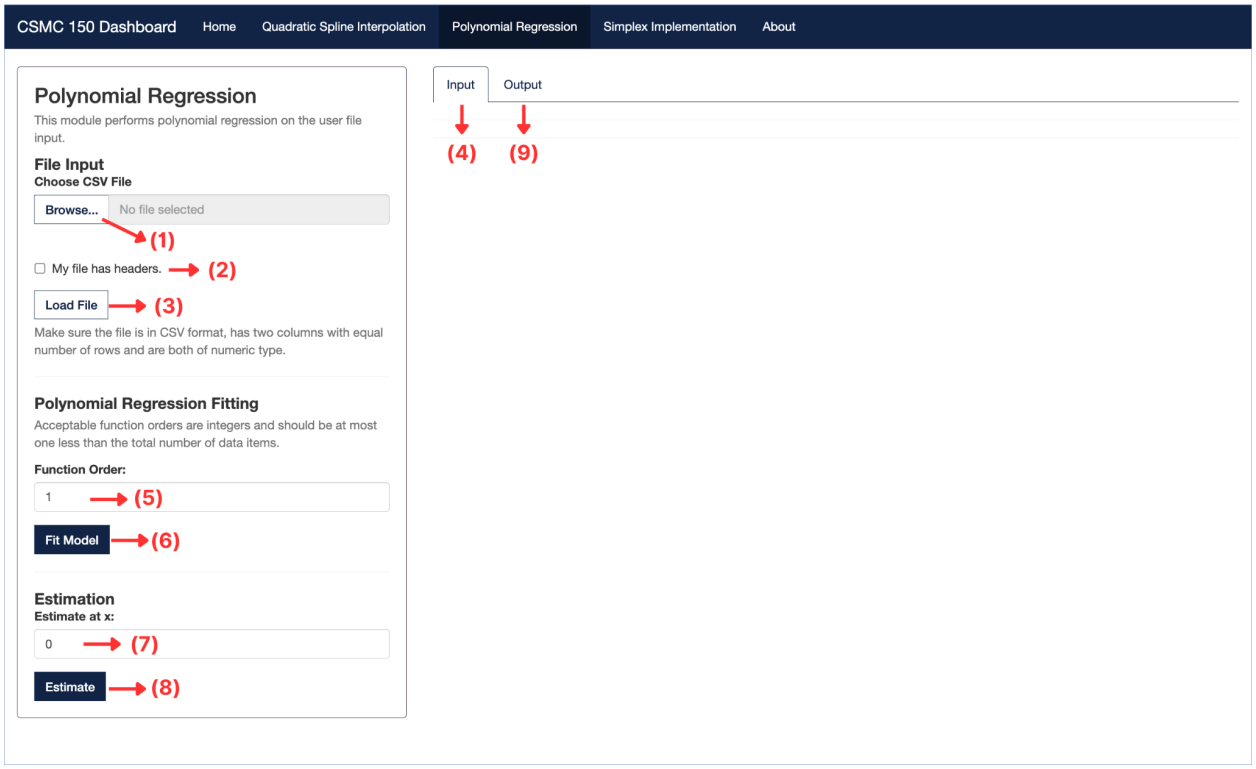
Interpolated Value:
No interpolated value can be derived.

Sample output with a file not suitable (valid file) for QSI:



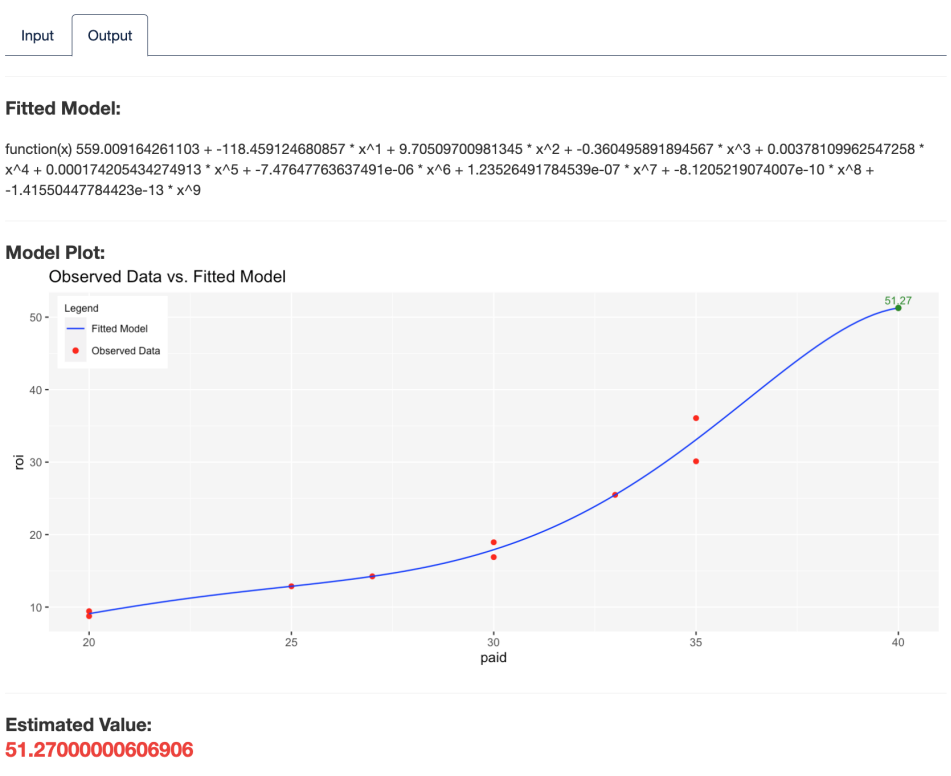
Sample output with an invalid interpolation input (beyond the range of the data points provided):

Polynomial Regression

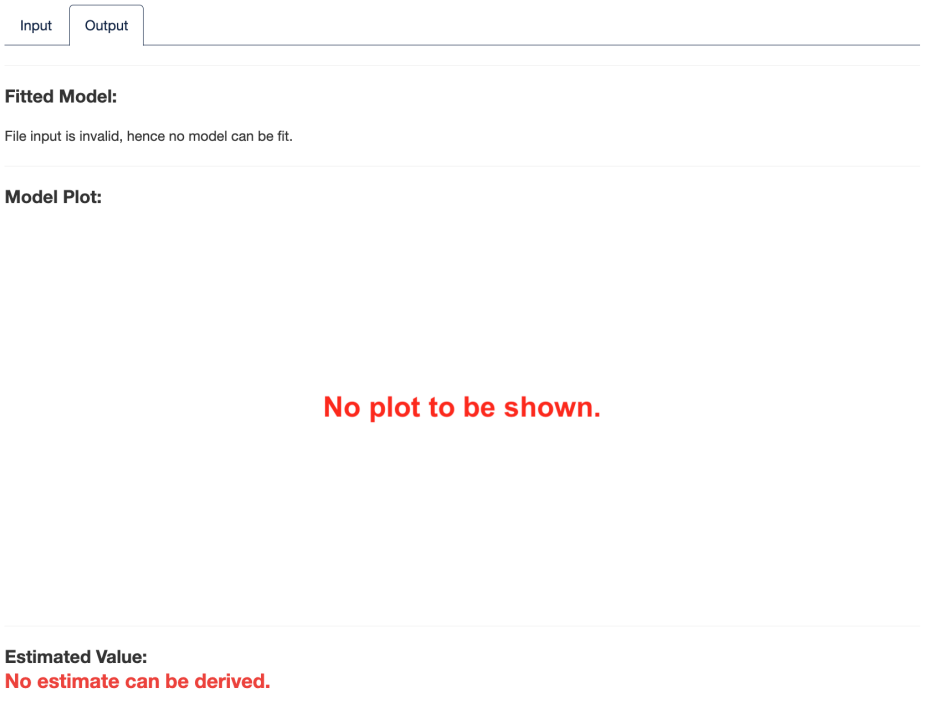


(1) Click the "Browse" button to select a CSV file containing the data you want to use for Quadratic Spline Interpolation. Valid CSV files only have two columns, with equal number of rows, and are both of numeric type.
(2) Click the checkbox if the file you want to upload has headers. An example of a valid CSV file with and without headers are in the Quadratic Spline Interpolation section of this user manual.
(3) Click the "Load File" button to upload the file in the application.
(4) After clicking the "Load File" button, the file contents will be displayed in the "Input" tab. A message whether the file has been successfully uploaded or otherwise is also displayed. (See the sample outputs in the Quadratic Spline Interpolation section of this user manual)
(5) Enter the desired function order in the input bar for the desired nth-order polynomial to be fit on the data provided. Valid function orders range from one to *n-1* where *n* is the number of data points in the data provided, and are integers.
(6) Click the "Fit Model" button to proceed with the polynomial regression fitting.
(7) Enter a value in the input bar for the desired x value to be estimated using the fitted model.
(8) Click the "Estimate" button to display the estimate at your desired value.
(9) The fitted model, plot of the model and the observations, and the estimate is displayed in the "Output" tab, which will be active once the "Fit Model" or "Estimate" buttons are clicked.

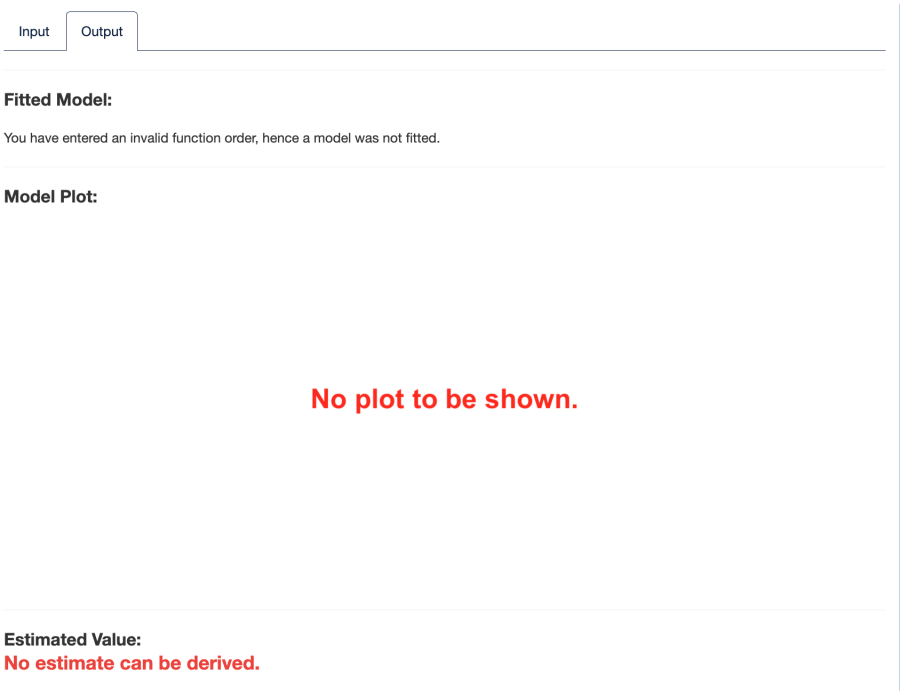
Sample Output tab with valid inputs:



Sample Output tab with invalid file input:

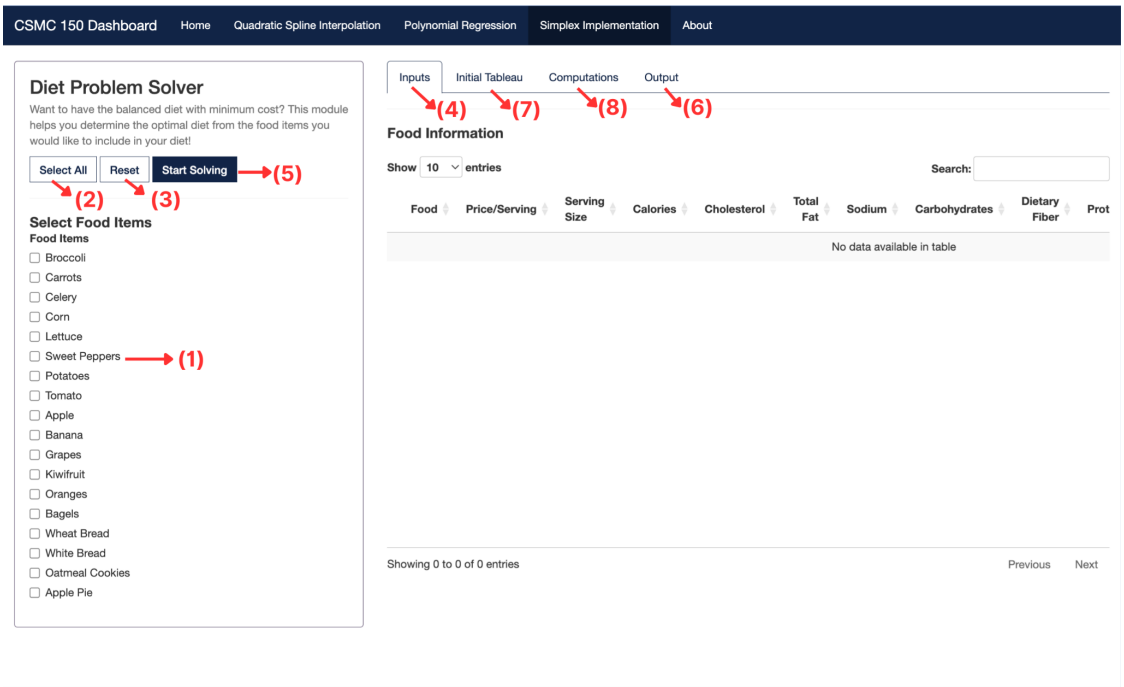


Sample Output tab with invalid function degree input:



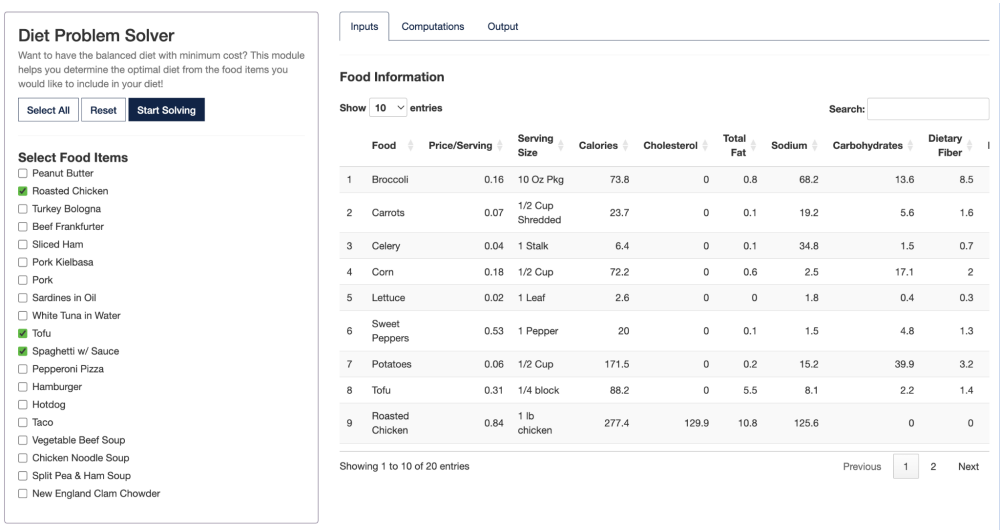
Simplex Implementation

The simplex method is implemented in a diet problem solver wherein you can choose from the 64 food items you would like to add to include in your diet. What this feature does is gives you the optimal diet - a diet that meets your nutritional needs at the minimum cost.

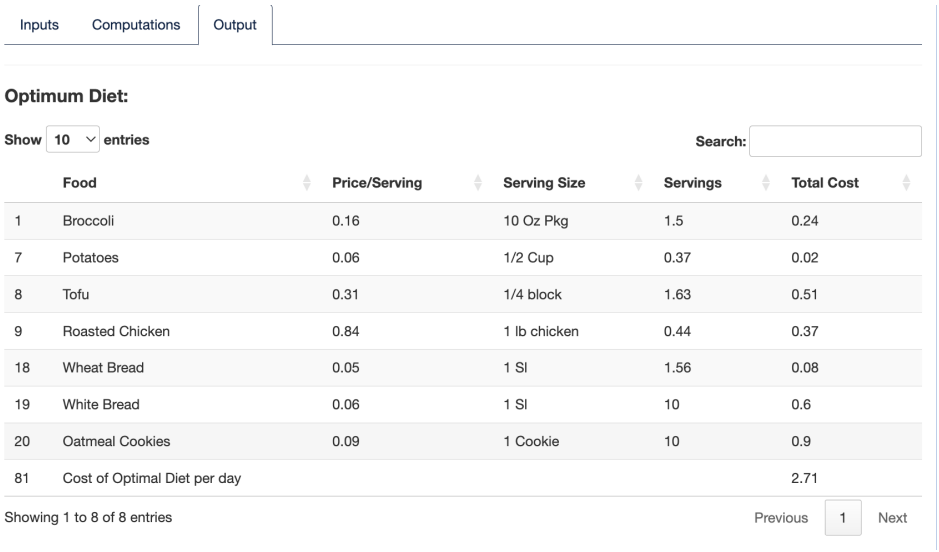


(1) Select as many food items as you like from the 64 food item checkboxes available. This is scrollable, and you can scroll down to see the other food items hidden from view.
(2) Click the “Select All” button to check all the food items available.
(3) Click the “Reset” button to unselect the food items you have selected.
(4) The “Inputs” tab will show the details of the food items you have selected. This updates automatically as you add food items.
(5) Click the “Start Solving” Button to determine the optimal diet from your selected food items.
(6) The optimal diet identified will show up on the “Output” tab.
(7) The Initial Tableau of the problem created from the selected food items are presented on the “Initial Tableau” tab.
(8) The calculations using the simplex method are presented in the “Computations” tab.

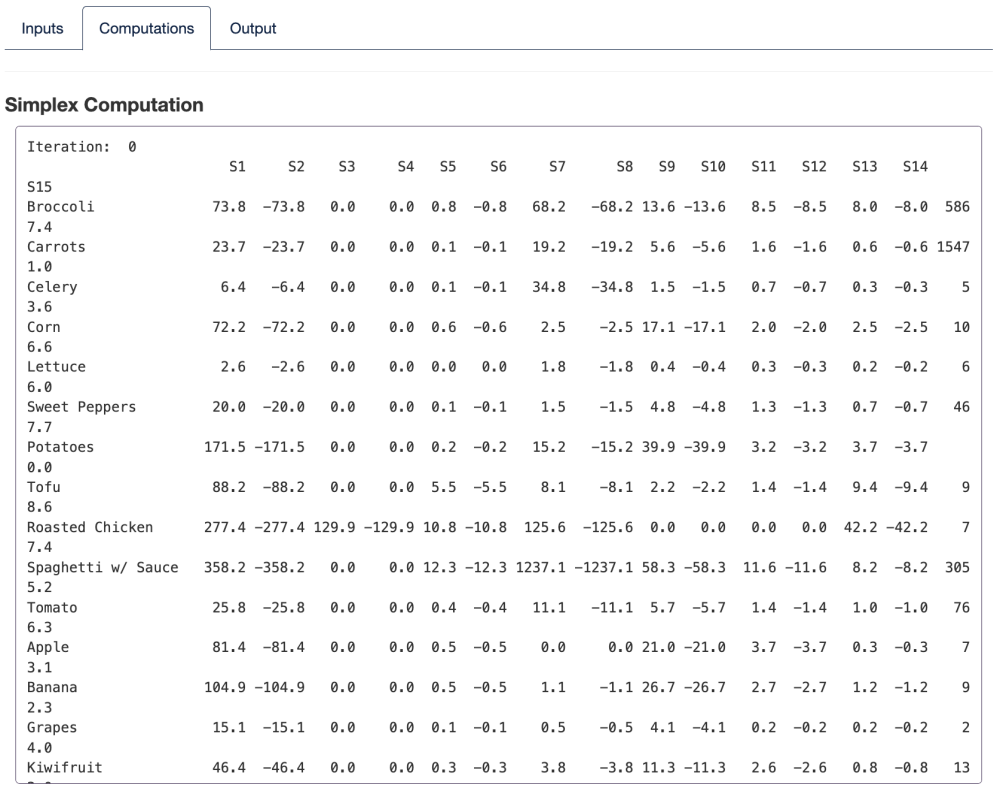
Sample Input tab:



Sample Output tab:



Sample Computations tab:

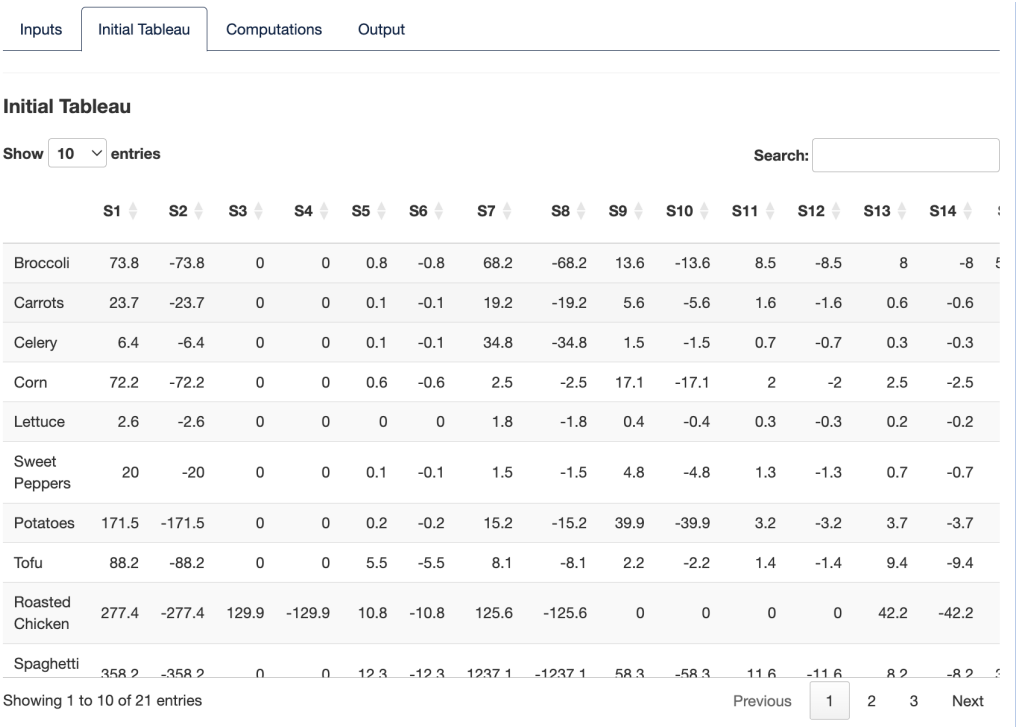


Inputs | Computations | Output

Simplex Computation

```
Iteration:  0
                        S1     S2    S3     S4    S5    S6     S7      S8    S9    S10   S11   S12   S13   S14
S15
Broccoli              73.8  -73.8   0.0    0.0   0.8  -0.8   68.2   -68.2  13.6 -13.6   8.5  -8.5   8.0  -8.0  586
7.4
Carrots               23.7  -23.7   0.0    0.0   0.1  -0.1   19.2   -19.2   5.6  -5.6   1.6  -1.6   0.6  -0.6 1547
1.0
Celery                 6.4   -6.4   0.0    0.0   0.1  -0.1   34.8   -34.8   1.5  -1.5   0.7  -0.7   0.3  -0.3    5
3.6
Corn                  72.2  -72.2   0.0    0.0   0.6  -0.6    2.5    -2.5  17.1 -17.1   2.0  -2.0   2.5  -2.5   10
6.6
Lettuce                2.6   -2.6   0.0    0.0   0.0   0.0    1.8    -1.8   0.4  -0.4   0.3  -0.3   0.2  -0.2    6
6.0
Sweet Peppers         20.0  -20.0   0.0    0.0   0.1  -0.1    1.5    -1.5   4.8  -4.8   1.3  -1.3   0.7  -0.7   46
7.7
Potatoes             171.5 -171.5   0.0    0.0   0.2  -0.2   15.2   -15.2  39.9 -39.9   3.2  -3.2   3.7  -3.7
0.0
Tofu                  88.2  -88.2   0.0    0.0   5.5  -5.5    8.1    -8.1   2.2  -2.2   1.4  -1.4   9.4  -9.4    9
8.6
Roasted Chicken      277.4 -277.4 129.9 -129.9  10.8 -10.8  125.6  -125.6   0.0   0.0   0.0   0.0  42.2 -42.2    7
7.4
Spaghetti w/ Sauce   358.2 -358.2   0.0    0.0  12.3 -12.3 1237.1 -1237.1  58.3 -58.3  11.6 -11.6   8.2  -8.2  305
5.2
Tomato                25.8  -25.8   0.0    0.0   0.4  -0.4   11.1   -11.1   5.7  -5.7   1.4  -1.4   1.0  -1.0   76
6.3
Apple                 81.4  -81.4   0.0    0.0   0.5  -0.5    0.0     0.0  21.0 -21.0   3.7  -3.7   0.3  -0.3    7
3.1
Banana               104.9 -104.9   0.0    0.0   0.5  -0.5    1.1    -1.1  26.7 -26.7   2.7  -2.7   1.2  -1.2    9
2.3
Grapes                15.1  -15.1   0.0    0.0   0.1  -0.1    0.5    -0.5   4.1  -4.1   0.2  -0.2   0.2  -0.2    2
4.0
Kiwifruit             46.4  -46.4   0.0    0.0   0.3  -0.3    3.8    -3.8  11.3 -11.3   2.6  -2.6   0.8  -0.8   13
```

Sample Initial Tableau tab:



Inputs | Initial Tableau | Computations | Output

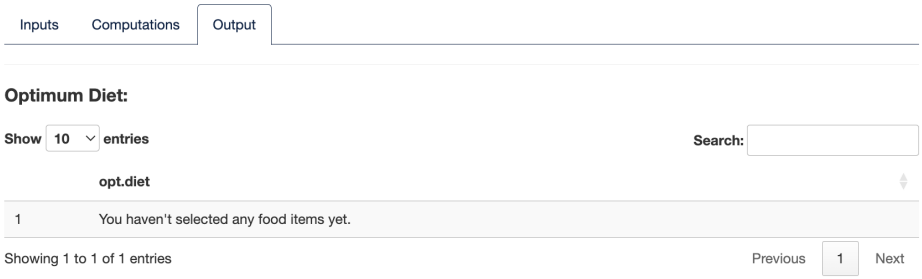
Initial Tableau

Show 10 entries Search:

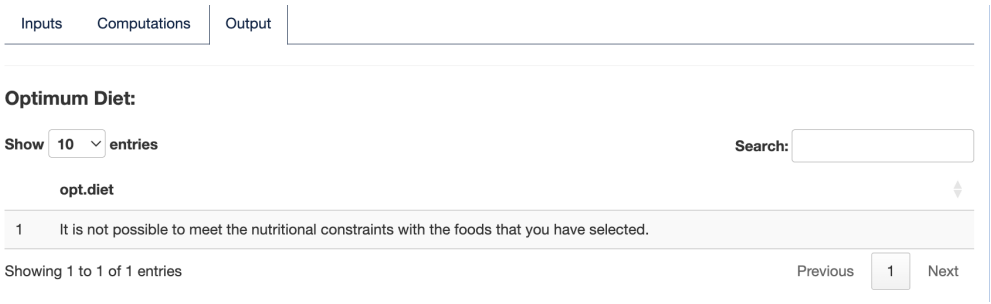
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Broccoli	73.8	-73.8	0	0	0.8	-0.8	68.2	-68.2	13.6	-13.6	8.5	-8.5	8	-8
Carrots	23.7	-23.7	0	0	0.1	-0.1	19.2	-19.2	5.6	-5.6	1.6	-1.6	0.6	-0.6
Celery	6.4	-6.4	0	0	0.1	-0.1	34.8	-34.8	1.5	-1.5	0.7	-0.7	0.3	-0.3
Corn	72.2	-72.2	0	0	0.6	-0.6	2.5	-2.5	17.1	-17.1	2	-2	2.5	-2.5
Lettuce	2.6	-2.6	0	0	0	0	1.8	-1.8	0.4	-0.4	0.3	-0.3	0.2	-0.2
Sweet Peppers	20	-20	0	0	0.1	-0.1	1.5	-1.5	4.8	-4.8	1.3	-1.3	0.7	-0.7
Potatoes	171.5	-171.5	0	0	0.2	-0.2	15.2	-15.2	39.9	-39.9	3.2	-3.2	3.7	-3.7
Tofu	88.2	-88.2	0	0	5.5	-5.5	8.1	-8.1	2.2	-2.2	1.4	-1.4	9.4	-9.4
Roasted Chicken	277.4	-277.4	129.9	-129.9	10.8	-10.8	125.6	-125.6	0	0	0	0	42.2	-42.2
Spaghetti	358.2	-358.2	0	0	12.3	-12.3	1237.1	-1237.1	58.3	-58.3	11.6	-11.6	8.2	-8.2

Showing 1 to 10 of 21 entries Previous 1 2 3 Next

Sample Output tab for entering no food items:



Sample Output tab for an infeasible diet (selected food items don't meet nutritional requirements):



About the Developer

This section displays information about the dashboard's developer, including his interests, skills, and contact information.