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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

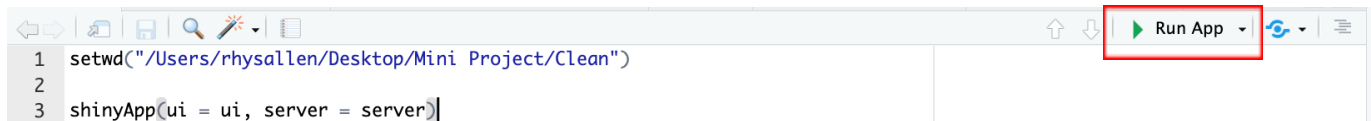
If you haven't installed these packages in your R environment, you may install these using the following code:

```
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

CSMC 150 Dashboard Home Quadratic Spline Interpolation Polynomial Regression Simplex Implementation About

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.

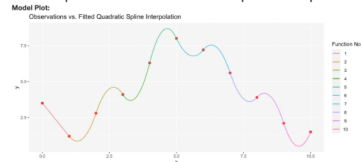
CSMC 150 Dashboard Home Quadratic Spline Interpolation Polynomial Regression Simplex Implementation About

Welcome to CMSC 150 Dashboard!

This application/dashboard is done in fulfillment of the requirements of CMSC 150: Numerical and Symbolic Computation, and contains modules applying Polynomial Regression, Quadratic Spline Interpolation, and Simplex Method. Check out the modules to see what they can do!

Quadratic Spline Interpolation

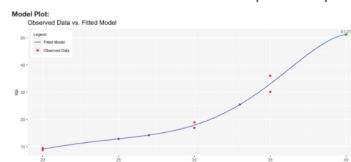
This module implements Quadratic Spline Interpolation (QSI) on the user file input and outputs the set of quadratic equations, plot of the observations and the set of quadratic equations, and the interpolated value at the user specified input.



Quadratic Spline Interpolation

Polynomial Regression

This module implements Polynomial Regression on the user file input and outputs the fitted nth order polynomial function given the user function order input, plot of the observations and the fitted model, and the estimated value at the user specified input.



Polynomial Regression

Simplex Implementation

This module implements Simplex Method in a Diet Solver Problem, wherein users can select as many food items as they like, and the module outputs the optimal diet given the user input, at minimum cost, along with the computations.

Show 10 entries

Food	Price/Serving	Serving Size	Servings	Total Cost
1 Broccoli	0.16	10 Oz Pkg	1.5	0.24
7 Potatoes	0.06	1/2 Cup	0.37	0.02
8 Tofu	0.31	1/4 block	1.63	0.51
9 Roasted Chicken	0.84	1 lb chicken	0.44	0.37
18 Wheat Bread	0.95	1 lb	1.55	0.98
19 White Bread	0.96	1 lb	10	0.6
20 Oatmeal Cookies	0.09	1 Cookie	10	0.9
B1 Cost of Optimal Diet per Day				2.71

Simplex Implementation



About the Developer Rhys Allen V. Abejay

I am a 4th year BS Statistics student from the University of the Philippines Los Baños whose interests include spatial analysis and programming.

About

LinkedIn

GitHub

Quadratic Spline Interpolation

The screenshot shows the 'Quadratic Spline Interpolation' module interface. It includes a navigation bar with links to 'CSMC 150 Dashboard', 'Home', 'Quadratic Spline Interpolation', 'Polynomial Regression', 'Simplex Implementation', and 'About'. The main content area is divided into two sections: 'File Input' and 'Quadratic Spline Interpolation'. The 'File Input' section has a 'Choose CSV File' button (1), a checkbox for 'My file has headers.' (2), and a 'Load File' button (3). The 'Quadratic Spline Interpolation' section has a 'Perform QSI' button (5). Below this is an 'Estimation' section with an 'Interpolate at x:' input field (6) and an 'Interpolate' button (7). On the right side, there are 'Input' and 'Output' labels with arrows pointing to the respective data entry and result areas (4 and 8).

- (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:

Input

Output

File loaded successfully.

Show 10 entries

Search:

	X3	X2.5
1	4.5	1
2	7	2.5
3	9	0.5

Showing 1 to 3 of 3 entries

Previous1Next

Unsuccessful file upload:

Input

Output

File loaded unsuccessfully. Acceptable files have two columns with equal number of rows and are both of numeric type.

- (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:

Input

Output

QSI Equations:

Show 10 entries

Search:

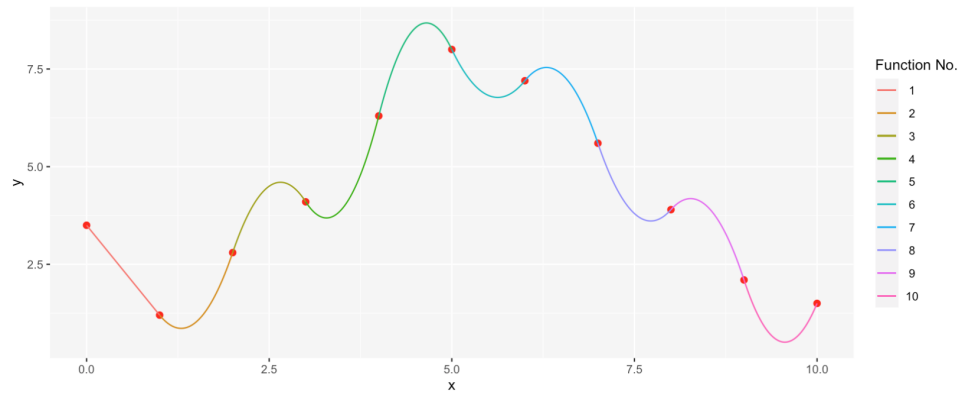
	Lower Limit	Upper Limit	Interval Function
1	0	1	function(x) 0 * x^2 + -2.3 * x + 3.5
2	1	2	function(x) 3.9 * x^2 + -10.1 * x + 7.4
3	2	3	function(x) -4.2 * x^2 + 22.3 * x + -25
4	3	4	function(x) 5.1 * x^2 + -33.5 * x + 58.7
5	4	5	function(x) -5.6 * x^2 + 52.1 * x + -112.5
6	5	6	function(x) 3.1 * x^2 + -34.9 * x + 105
7	6	7	function(x) -3.9 * x^2 + 49.1 * x + -147
8	7	8	function(x) 3.8 * x^2 + -58.7 * x + 230.3

Showing 1 to 10 of 10 entries

Previous1Next

QSI Equations Plot:

Observations vs. Fitted Quadratic Spline Interpolation



Interpolated Value:

3.5

Sample output with an invalid file input:

Input

Output

QSI Equations:

Show 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:

Input

Output

QSI Equations:

Show

10

 entries

Search:

qsi_df

1 Quadratic spline interpolation was not fitted in the data points provided.

QSI Equations Plot:

No plot to be shown.

Interpolated Value:
No interpolated value can be derived.

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

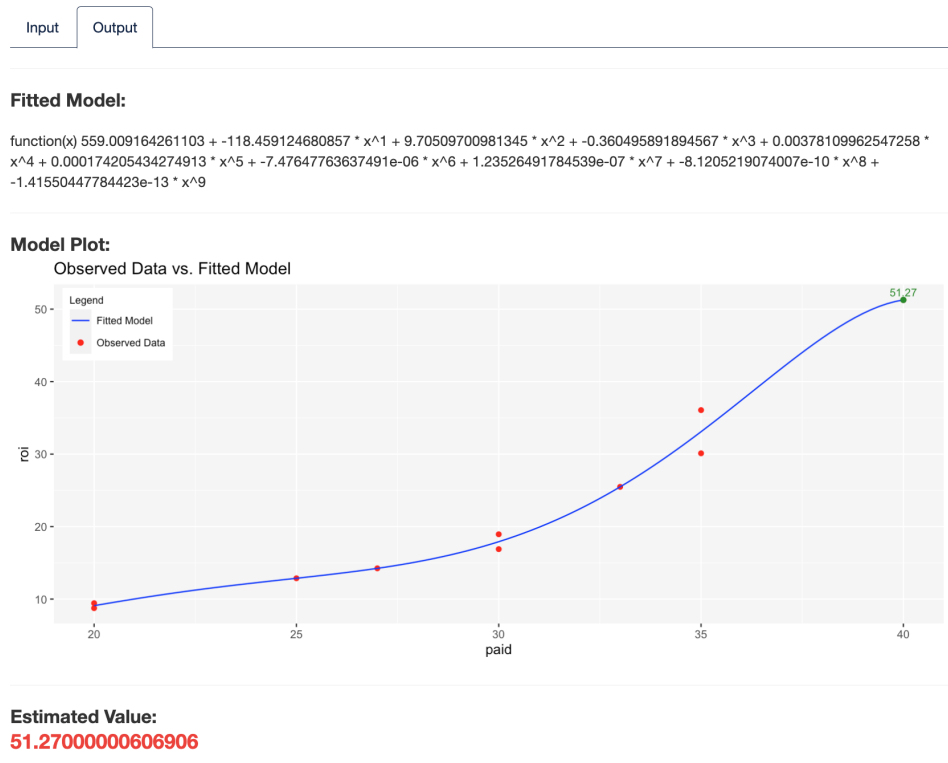


Polynomial Regression

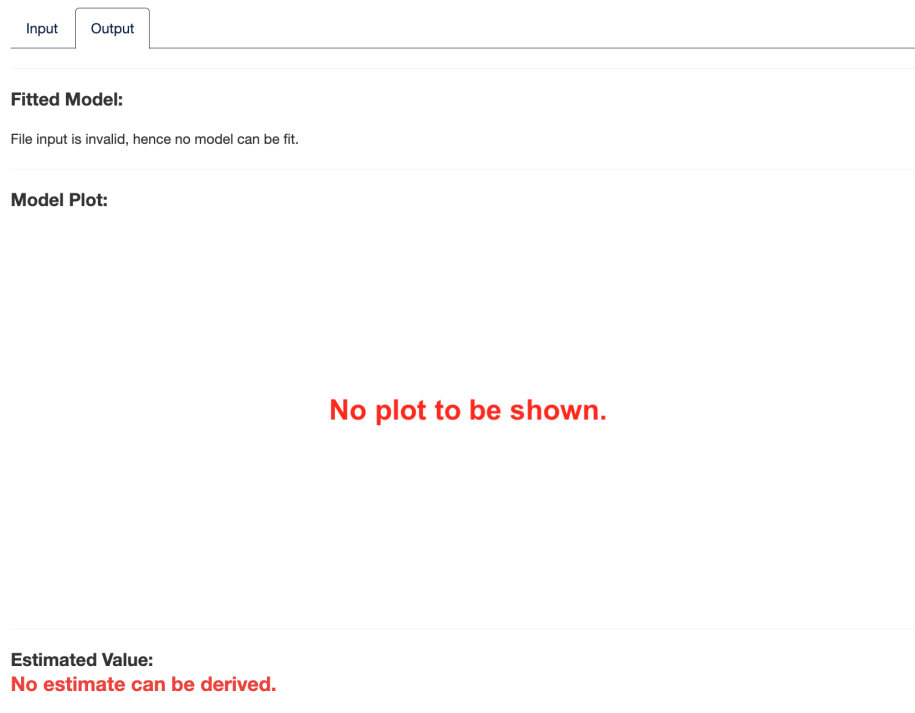
The screenshot shows the 'Polynomial Regression' section of the 'CSMC 150 Dashboard'. The interface is divided into two main panels: 'Input' and 'Output'. The 'Input' panel contains three sections: 'File Input', 'Polynomial Regression Fitting', and 'Estimation'. The 'File Input' section has a 'Choose CSV File' label, a 'Browse...' button (annotated with (1)), a checkbox 'My file has headers.' (annotated with (2)), and a 'Load File' button (annotated with (3)). Below this is a note: 'Make sure the file is in CSV format, has two columns with equal number of rows and are both of numeric type.' The 'Polynomial Regression Fitting' section has a 'Function Order' input field with the value '1' (annotated with (5)) and a 'Fit Model' button (annotated with (6)). The 'Estimation' section has an 'Estimate at x:' input field with the value '0' (annotated with (7)) and an 'Estimate' button (annotated with (8)). The 'Output' panel is currently empty, with an annotation (9) pointing to it. The top navigation bar includes links to 'CSMC 150 Dashboard', 'Home', 'Quadratic Spline Interpolation', 'Polynomial Regression' (active), 'Simplex Implementation', and 'About'.

- (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 n th-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:

Input

Output

Fitted Model:

You have entered an invalid function order, hence a model was not fitted.

Model Plot:

No plot to be shown.

Estimated Value:

No estimate can be derived.

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.

CSMC 150 Dashboard

Home

Quadratic Spline Interpolation

Polynomial Regression

Simplex Implementation

About

Diet Problem Solver

Want to have the balanced diet with minimum cost? This module helps you determine the optimal diet from the food items you would like to include in your diet!

Select All

Reset

Start Solving

(2)

(3)

Select Food Items

Food Items

☐ Broccoli

☐ Carrots

☐ Celery

☐ Corn

☐ Lettuce

☐ Sweet Peppers

☐ Potatoes

☐ Tomato

☐ Apple

☐ Banana

☐ Grapes

☐ Kiwifruit

☐ Oranges

☐ Bagels

☐ Wheat Bread

☐ White Bread

☐ Oatmeal Cookies

☐ Apple Pie

(1)

Inputs

Initial Tableau

Computations

Output

(4)

(7)

(8)

(6)

Food Information

Show 10 entries

Food

Price/Serving

Serving Size

Calories

Cholesterol

Total Fat

Sodium

Carbohydrates

Dietary Fiber

Prot

No data available in table

Showing 0 to 0 of 0 entries

Previous

Next

- (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:

Diet Problem Solver

Want to have the balanced diet with minimum cost? This module helps you determine the optimal diet from the food items you would like to include in your diet!

Select Food Items

☐ Peanut Butter
☒ Roasted Chicken
☐ Turkey Bologna
☐ Beef Frankfurter
☐ Sliced Ham
☐ Pork Kielbasa
☐ Pork
☐ Sardines in Oil
☐ White Tuna in Water
☒ Tofu
☒ Spaghetti w/ Sauce
☐ Pepperoni Pizza
☐ Hamburger
☐ Hotdog
☐ Taco
☐ Vegetable Beef Soup
☐ Chicken Noodle Soup
☐ Split Pea & Ham Soup
☐ New England Clam Chowder

Inputs
Computations
Output

Food Information

Show entries
Search:

	Food	Price/Serving	Serving Size	Calories	Cholesterol	Total Fat	Sodium	Carbohydrates	Dietary Fiber
1	Broccoli	0.16	10 Oz Pkg	73.8	0	0.8	68.2	13.6	8.5
2	Carrots	0.07	1/2 Cup Shredded	23.7	0	0.1	19.2	5.6	1.6
3	Celery	0.04	1 Stalk	6.4	0	0.1	34.8	1.5	0.7
4	Corn	0.18	1/2 Cup	72.2	0	0.6	2.5	17.1	2
5	Lettuce	0.02	1 Leaf	2.6	0	0	1.8	0.4	0.3
6	Sweet Peppers	0.53	1 Pepper	20	0	0.1	1.5	4.8	1.3
7	Potatoes	0.06	1/2 Cup	171.5	0	0.2	15.2	39.9	3.2
8	Tofu	0.31	1/4 block	88.2	0	5.5	8.1	2.2	1.4
9	Roasted Chicken	0.84	1 lb chicken	277.4	129.9	10.8	125.6	0	0

Showing 1 to 10 of 20 entries

Previous
1
2
Next

Sample Output tab:

Inputs

Computations

Output

Optimum Diet:

Show

10

entries

Search:

	Food	Price/Serving	Serving Size	Servings	Total Cost
1	Broccoli	0.16	10 Oz Pkg	1.5	0.24
7	Potatoes	0.06	1/2 Cup	0.37	0.02
8	Tofu	0.31	1/4 block	1.63	0.51
9	Roasted Chicken	0.84	1 lb chicken	0.44	0.37
18	Wheat Bread	0.05	1 Sl	1.56	0.08
19	White Bread	0.06	1 Sl	10	0.6
20	Oatmeal Cookies	0.09	1 Cookie	10	0.9
81	Cost of Optimal Diet per day				2.71

Showing 1 to 8 of 8 entries

Previous

1

Next

Sample Computations tab:

Inputs	Computations		Output												
Simplex Computation															
Iteration: 0															
S15	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	
Broccoli 7.4	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
Carrots 1.0	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
Celery 3.6	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
Corn 6.6	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
Lettuce 6.0	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
Sweet Peppers 7.7	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
Potatoes 0.0	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	
Tofu 8.6	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
Roasted Chicken 7.4	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
Spaghetti w/ Sauce 5.2	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
Tomato 6.3	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
Apple 3.1	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
Banana 2.3	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
Grapes 4.0	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
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

Show10▼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:

Inputs

Computations

Output

Optimum Diet:

Show

10

 entries

Search:

opt.diet

1

You haven't selected any food items yet.

Showing 1 to 1 of 1 entries

Previous

1

Next

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

Inputs

Computations

Output

Optimum Diet:

Show

10

 entries

Search:

opt.diet

1

It is not possible to meet the nutritional constraints with the foods that you have selected.

Showing 1 to 1 of 1 entries

Previous


1

Next

About the Developer

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

CSMC 150 DashboardHomeQuadratic Spline InterpolationPolynomial RegressionSimplex ImplementationAbout



About the Developer

Rhys Allen V. Abejay

Rhys is a fourth-year BS Statistics student from the University of the Philippines Los Baños, currently taking up CSMC 150: Numerical and Symbolic Computations as an elective course this academic year 2023-2024, and this dashboard is in partial fulfillment of the course requirements.

Interests

His recent interests include **spatial and spatiotemporal data analytics**, and programming as well. He is an avid reader of webtoons/manhwa/manga/manhua and his current favorite works include *'Omniscient Reader'*, *'Debut or Die'*, and *'My In-Laws are Obsessed with Me'*. You can talk to him anything about K-pop or webtoons/manga related.

Skills

His skills range from **Statistical Methods**, such as regression and correlation analysis; **Data Science and Analytics**, such as text mining and analysis; **Programming and Tools**, including R and Python; and , including proficiency in Microsoft 365, Google Workspace, and Canva.

Get in touch

If you have any suggestions, questions, or anything to say, you may reach out to him via his emails rvabejay@up.edu.ph or rhysallenabejay@gmail.com or through the links below

Facebook

LinkedIn

GitHub