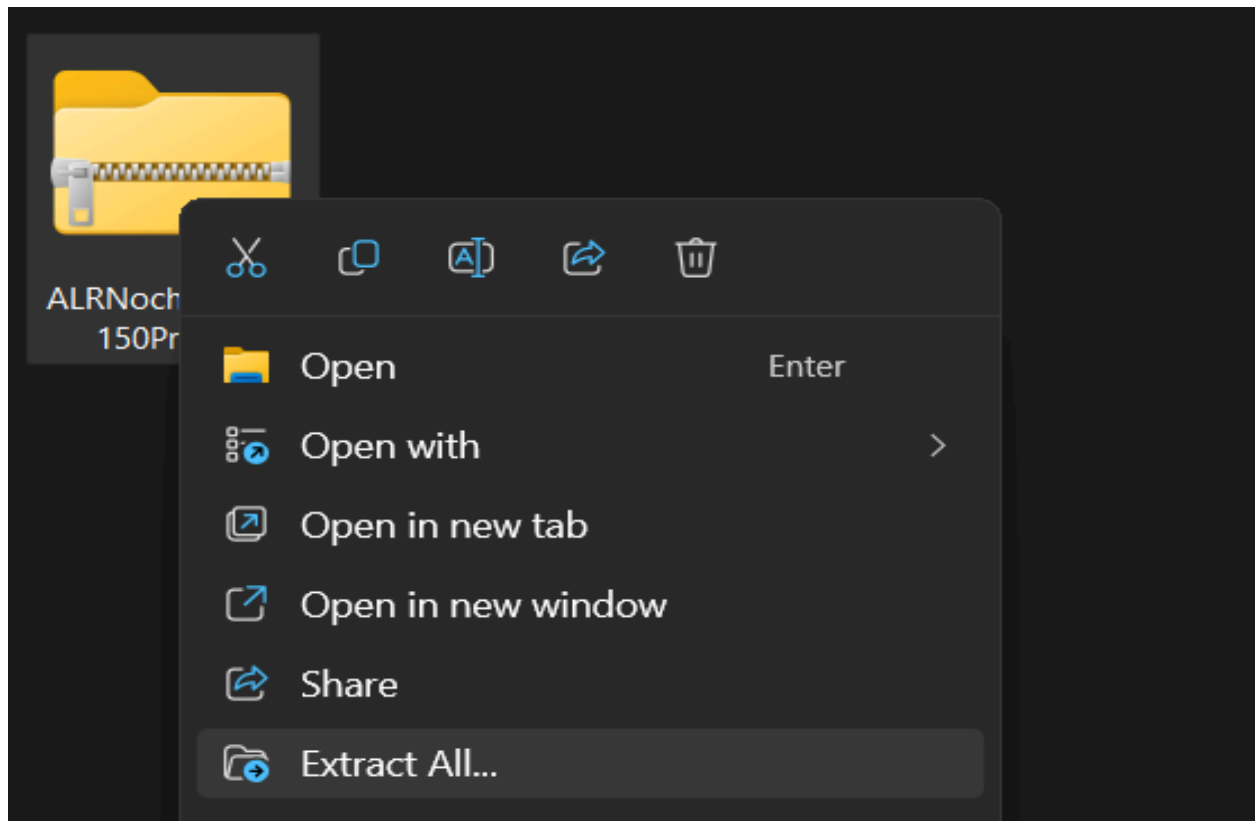


GUIDE TO USE MY DIET PROBLEM SOLVER AND GENERIC SOLVERS

Preparations

1. The user is required to “extract all” or “unzip” the zip file to run the application.

*** (see reference pic below) ***

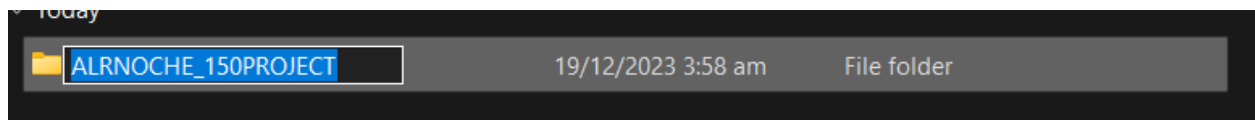


2. The user is required to have an Rstudio in their computer. They should also have the R language installed in their computer.
3. With the first step satisfied, the user is then required to install the following packages in R:
 - a. *shiny*
 - b. *shinydashboard*
 - c. *shinyMatrix*
 - d. *shinythemes*
 - e. *DT*

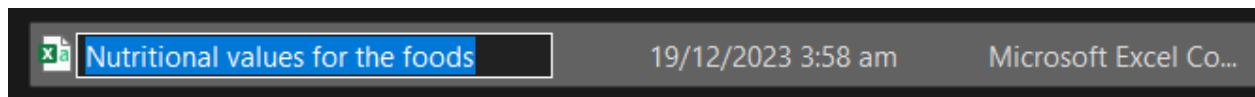
*** Usually, Rstudio recognizes and immediately prompts the user to install such packages. In addition, packages can also be installed by typing 'install.packages("packageName")' in the R console. (see reference pic below) ***

A screenshot of the RStudio interface. The top bar shows the time as 18:12 and a file named '(Untitled)'. Below this, there are tabs for 'Console', 'Terminal', and 'Background Jobs'. The 'Console' tab is active, showing the R prompt '>' followed by the command 'install.packages("packageName")' in orange text. The R version 'R 4.3.1' and the current directory '~/' are also visible.

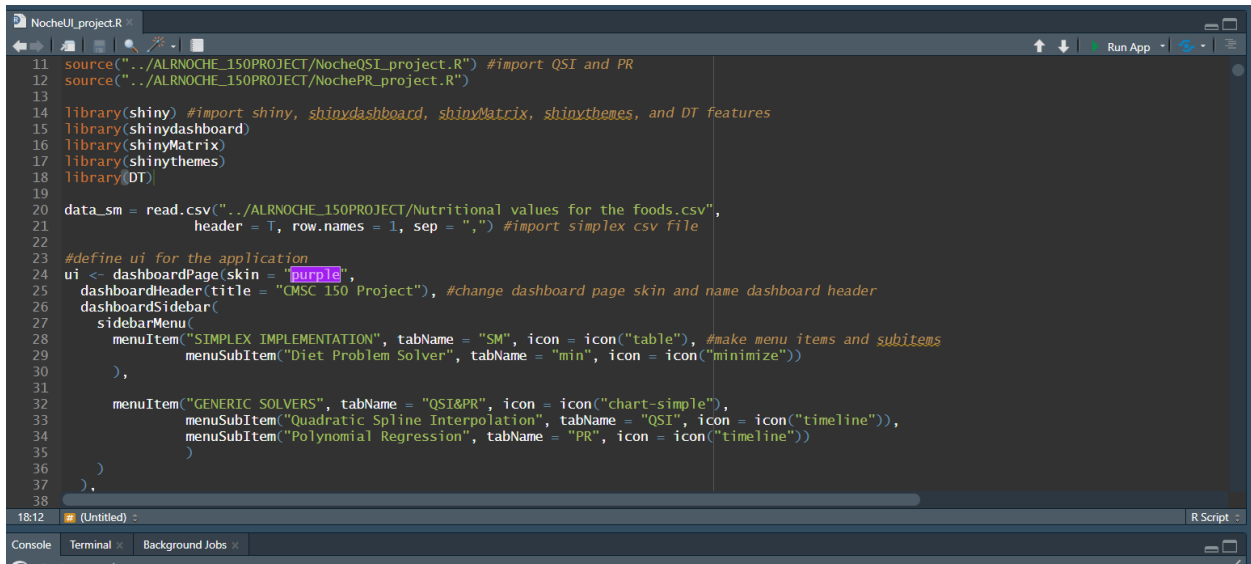
4. It is highly discouraged to **rename** the **application's folder** (see pic below). Doing so causes the application to run an **extreme error**.



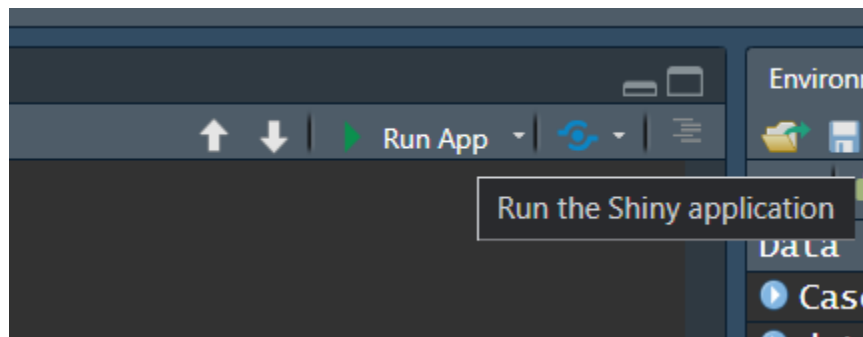
5. The user is also discouraged from making **unnecessary changes** (see pic below) in the **"Nutritional values for the foods.csv" file** (i.e., changing values from the dataset, renaming the file, etc.).



6. To launch the application, the user must click **“Run App”**, which can be seen on the right region of Rstudio (see pics on the next page).

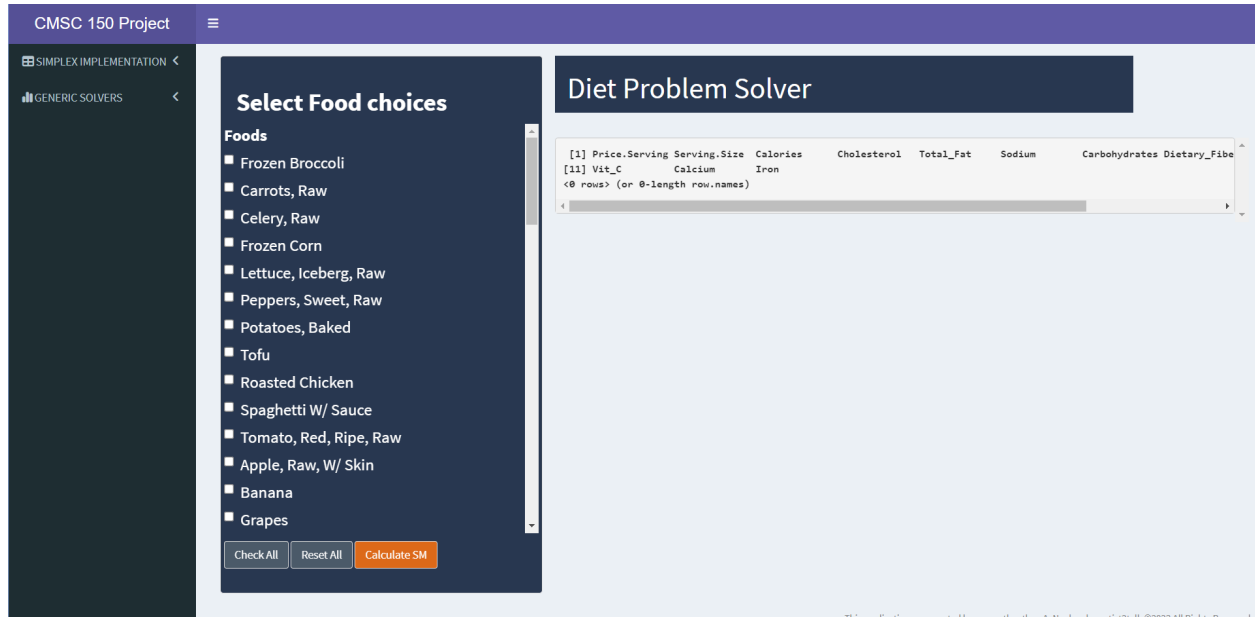


```
11 source("../ALRNOCHE_150PROJECT/NocheQSI_project.R") #import QSI and PR
12 source("../ALRNOCHE_150PROJECT/NochePR_project.R")
13
14 library(shiny) #import shiny, shinydashboard, shinyMatrix, shinythemes, and DT features
15 library(shinydashboard)
16 library(shinyMatrix)
17 library(shinythemes)
18 library(DT)
19
20 data_sm = read.csv("../ALRNOCHE_150PROJECT/Nutritional values for the foods.csv",
21                   header = T, row.names = 1, sep = ",") #import simplex csv file
22
23 #define ui for the application
24 ui <- dashboardPage(skin = "purple",
25                   dashboardHeader(title = "CMSC 150 Project"), #change dashboard page skin and name dashboard header
26                   dashboardSidebar(
27                     sidebarMenu(
28                       menuItem("SIMPLEX IMPLEMENTATION", tabName = "SM", icon = icon("table"), #make menu items and subitems
29                             menuSubItem("Diet Problem Solver", tabName = "min", icon = icon("minimize"))
30                       ),
31                       menuItem("GENERIC SOLVERS", tabName = "QSI&PR", icon = icon("chart-simple"),
32                             menuSubItem("Quadratic Spline Interpolation", tabName = "QSI", icon = icon("timeline")),
33                             menuSubItem("Polynomial Regression", tabName = "PR", icon = icon("timeline"))
34                       )
35                     )
36                   ),
37                   )
38
```

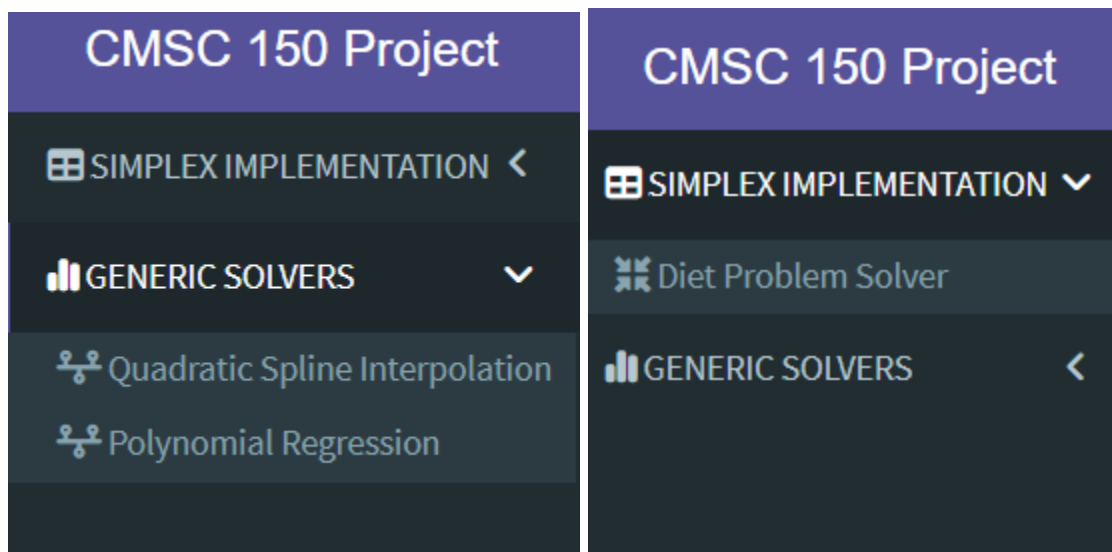


Features

1. Upon opening the app, the Diet Problem solver can be seen. Notice that the sidebar menu can also be seen.



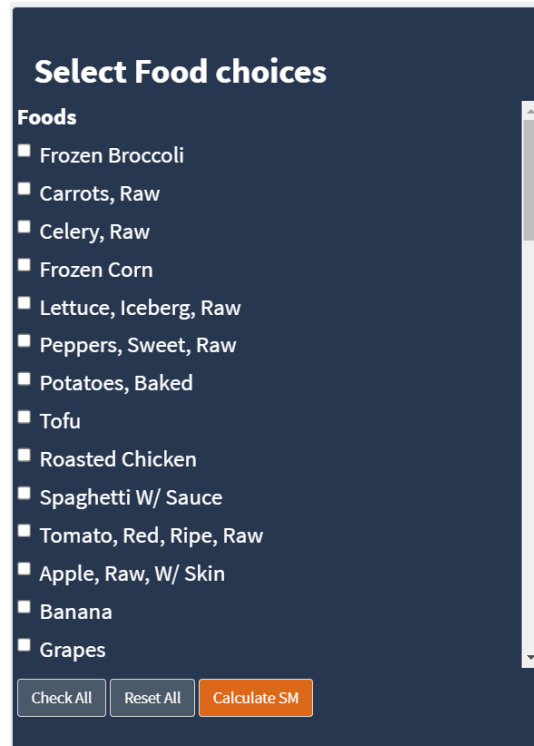
2. To navigate the other pages with corresponding solvers, the user may select any of the dropdown-like menus. Notice that there are 3 available options.



Instructions

Diet Problem Solver

1. Diet Problem Solver features user parameters, such as **checkbox options** and **check all, reset all, and calculate SM buttons**.

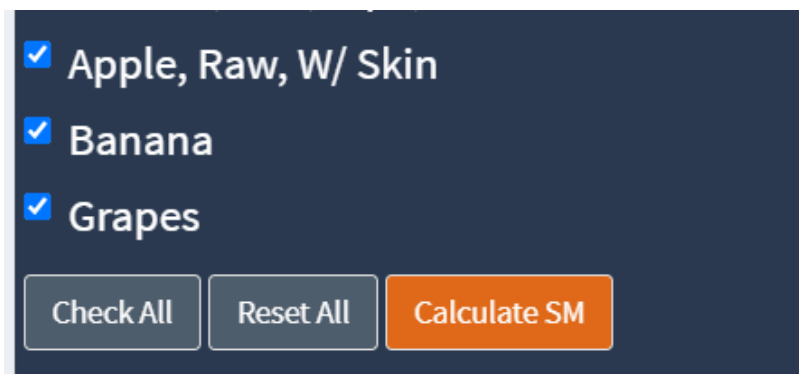


Select Food choices

Foods

- ☐ Frozen Broccoli
- ☐ Carrots, Raw
- ☐ Celery, Raw
- ☐ Frozen Corn
- ☐ Lettuce, Iceberg, Raw
- ☐ Peppers, Sweet, Raw
- ☐ Potatoes, Baked
- ☐ Tofu
- ☐ Roasted Chicken
- ☐ Spaghetti W/ Sauce
- ☐ Tomato, Red, Ripe, Raw
- ☐ Apple, Raw, W/ Skin
- ☐ Banana
- ☐ Grapes

2. The user is required to tick any **checkboxes** to generate the initial tableau when ticking the **calculate SM** button. For the ease of users, **check all** and **reset all** buttons can be used to select all options or untick all options, respectively.



☒ Apple, Raw, W/ Skin

☒ Banana

☒ Grapes

3. An output can be seen on the right, which showcases how many foods were selected among the food choices.

Diet Problem Solver

****You have selected 3 food/s to consider for your diet.****

	Price.Serving	Serving.Size	Calories	Cholesterol	Total_Fat	Sodium	Carbohydrates	Dietary_Fiber	Protein	Vit_A
Apple, Raw, W/ Skin	0.24	1 Fruit, 3/Lb, Wo/ Rf	81.4	0	0.5	0.0	21.0	3.7	0.3	73.1
Banana	0.15	1 Fruit, Wo/Skn &Seeds	104.9	0	0.5	1.1	26.7	2.7	1.2	92.3
Grapes	0.32	10 Fruits, Wo/Rf	15.1	0	0.1	0.5	4.1	0.2	0.2	24.0
	Calcium	Iron								
Apple, Raw, W/ Skin	9.7	0.2								
Banana	6.8	0.4								
Grapes	3.4	0.1								

4. Upon selecting the number of foods that generate a **feasible solution**, clicking the **'Calculate SM'** button will generate the **initial tableau**, along with the **solution and cost breakdown by food**, the **optimized menu**, a **filter tab for the iteration number**, and the **pivot row** and **pivot column**. It will also display the **tableau for the assigned iteration**.

Diet Problem Solver

****You have selected 20 food/s to consider for your diet.****

	Price.Serving	Serving.Size	Calories	Cholesterol	Total_Fat	Sodium	Carbohydrates	Dietary_Fiber	Protein
Frozen Broccoli	0.16	10 Oz Pkg	73.8	0.0	0.8	68.2	13.6	8.5	8.1
Carrots, Raw	0.07	1/2 Cup Shredded	23.7	0.0	0.1	19.2	5.6	1.6	0.9
Celery, Raw	0.04	1 Stalk	6.4	0.0	0.1	34.8	1.5	0.7	0.3
Frozen Corn	0.18	1/2 Cup	72.2	0.0	0.6	2.5	17.1	2.0	2.1
Lettuce, Iceberg, Raw	0.02	1 Leaf	2.6	0.0	0.0	1.8	0.4	0.3	0.1
Peppers, Sweet, Raw	0.53	1 Pepper	20.0	0.0	0.1	1.5	4.8	1.3	0.9
Potatoes, Baked	0.06	1/2 Cup	171.5	0.0	0.2	15.2	39.9	3.2	3.1
Tofu	0.31	1/4 block	88.2	0.0	5.5	8.1	2.2	1.4	9.1
Roasted Chicken	0.84	1 lb chicken	277.4	129.9	10.8	125.6	0.0	0.0	42.1

Initial Tableau

	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
	73.80	0.00	0.80	68.20	13.60	8.50	8.00	5867.40	160.20	159.00	2.30	-73.80	-0.00	-0.80	-68.20	-13.60
	23.70	0.00	0.10	19.20	5.60	1.60	0.60	15471.00	5.10	14.90	0.30	-23.70	-0.00	-0.10	-19.20	-5.60
	6.40	0.00	0.10	34.80	1.50	0.70	0.30	53.60	2.80	16.00	0.20	-6.40	-0.00	-0.10	-34.80	-1.50
	72.20	0.00	0.60	2.50	17.10	2.00	2.50	106.60	5.20	3.30	0.30	-72.20	-0.00	-0.60	-2.50	-17.10
	2.60	0.00	0.00	1.80	0.40	0.30	0.20	66.00	0.80	3.80	0.10	-2.60	-0.00	-0.00	-1.80	-0.40
	20.00	0.00	0.10	1.50	4.80	1.30	0.70	467.70	66.10	6.70	0.30	-20.00	-0.00	-0.10	-1.50	-4.80
	171.50	0.00	0.20	15.20	39.90	3.20	3.70	0.00	15.60	22.70	4.30	-171.50	-0.00	-0.20	-15.20	-39.90
	88.20	0.00	5.50	8.10	2.20	1.40	9.40	98.60	0.10	121.80	6.20	-88.20	-0.00	-5.50	-8.10	-2.20
	277.40	129.90	10.80	125.60	0.00	0.00	42.20	77.40	0.00	21.90	1.80	-277.40	-129.90	-10.80	-125.60	-0.00
	358.20	0.00	12.30	1237.10	58.30	11.60	8.20	3055.20	27.90	80.20	2.30	-358.20	-0.00	-12.30	-1237.10	-58.30
	25.80	0.00	0.40	11.10	5.70	1.40	1.00	766.30	23.50	6.20	0.60	-25.80	-0.00	-0.40	-11.10	-5.70

The Solution and Cost Breakdown by Food

Food	Servings	Cost(\$)
Frozen Broccoli	1.5	0.24
Potatoes, Baked	0.37	0.02
Tofu	1.63	0.5
Roasted Chicken	0.44	0.37
Wheat Bread	1.56	0.08
White Bread	10	0.6
Oatmeal Cookies	10	0.9

The Optimized Menu
The cost of this optimal diet is \$2.7115 per day.

Iteration Number
01

Check Iteration

Pivot Row (R2)

s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16	s17	s18	s19	s20	s21	s22	x1	x2	x3	x4	x5
23.70	0.00	0.10	19.20	5.60	1.60	0.60	15471.00	5.10	14.90	0.30	-23.70	-0.00	-0.10	-19.20	-5.60	-1.60	-0.60	-15471.00	-5.10	-14.90	-0.30	-0.00	-1.00	-0.00	-0.00	-0.00

Tableau of Iteration 1

88.05	0.00	5.50	7.98	2.16	1.39	9.40	0.00	0.07	121.71	6.20	-88.05	0.00	-5.50	-7.98	-2.16
277.28	129.90	10.80	125.50	-0.03	-0.01	42.20	0.00	-0.03	21.83	1.80	-277.28	-129.90	-10.80	-125.50	0.03
353.52	0.00	12.28	1233.31	57.19	11.28	8.08	0.00	26.89	77.26	2.24	-353.52	0.00	-12.28	-1233.31	-57.19
24.63	0.00	0.40	10.15	5.42	1.32	0.97	0.00	23.25	5.46	0.59	-24.63	0.00	-0.40	-10.15	-5.42
81.29	0.00	0.50	-0.09	20.97	3.69	0.30	0.00	7.88	9.63	0.20	-81.29	0.00	-0.50	0.09	-20.97
104.76	0.00	0.50	0.99	26.67	2.69	1.20	0.00	10.37	6.71	0.40	-104.76	0.00	-0.50	-0.99	-26.67
15.06	0.00	0.10	0.47	4.09	0.20	0.20	0.00	0.99	3.38	0.10	-15.06	0.00	-0.10	-0.47	-4.09
46.20	0.00	0.30	3.63	11.25	2.59	0.79	0.00	74.46	19.67	0.30	-46.20	0.00	-0.30	-3.63	-11.25
61.19	0.00	0.20	-0.33	15.30	3.07	1.19	0.00	69.61	52.14	0.09	-61.19	0.00	-0.20	0.33	-15.30
78.00	0.00	0.50	151.40	15.10	0.60	3.00	0.00	0.00	21.00	1.00	-78.00	0.00	-0.50	-151.40	-15.10
65.00	0.00	1.00	134.50	12.40	1.30	2.20	0.00	0.00	10.80	0.70	-65.00	0.00	-1.00	-134.50	-12.40
65.00	0.00	1.00	132.50	11.80	1.10	2.30	0.00	0.00	26.20	0.80	-65.00	0.00	-1.00	-132.50	-11.80
81.00	0.00	3.30	68.90	12.40	0.60	1.10	0.00	0.10	6.70	0.50	-81.00	0.00	-3.30	-68.90	-12.40
-1992.34	0.00	0.03	6.21	1.81	-24.48	-49.81	0.00	-48.35	-795.18	-9.90	2242.34	300.00	64.97	2393.79	298.19

Pivot Column (s8)

s8
5867.40
15471.00
53.60
106.60
66.00
467.70
0.00
98.60
77.40
3055.20
766.30
73.10
92.30
24.00

5. Notice that upon ticking **Reset All** button, the successful output of the initial tableau disappears. This is because there were no selected checkboxes.

Food W/ Toppings

- ☒ Taco
- ☒ Hamburger W/Toppings
- ☒ Hotdog, Plain

Check All **Reset All** Calculate SM

Select Food choices

- ☐ 3.3% Fat, Whole Milk
- ☐ 2% Lowfat Milk
- ☐ Skim Milk
- ☐ Poached Eggs
- ☐ Scrambled Eggs
- ☐ Bologna, Turkey
- ☐ Frankfurter, Beef
- ☐ Ham, Sliced, Extra lean
- ☐ Kielbasa, Pork
- ☐ Cap 'N Crunch
- ☐ Cheerios
- ☐ Corn Flakes, Kellogg's
- ☐ Raisin Bran, Kellg's
- ☐ Rice Krispies
- ☐ Special K
- ☐ Oatmeal
- ☐ Malt-O-Meal, Choc
- ☐ Pizza W/Pepperoni
- ☐ Taco
- ☐ Hamburger W/Toppings
- ☐ Hotdog, Plain

Check AllReset AllCalculate SM

Diet Problem Solver

	Price	Serving	Serving.Size	Calories	Cholesterol	Total_Fat	Sodium	Carbohydrates	Dietary_Fiber	Protein
[1] <0 rows> (or 0-length row.names)										

6. Clicking the **calculate SM** button without any selected checkboxes will render the error message, “Error! You have not selected any food/s for your diet!”

Error! You have not selected any food/s for your diet!

Check AllReset AllCalculate SM

Quadratic Spline Interpolation Solver (QSI)

Preparations

1. The user's csv files for QSI should not contain headers such as "**x**" and/or "**f(x)**." ****see reference pic for proper data formatting****

	A	B
1	9	4
2	15	6.1
3	16.5	2
4	20	2.3

Steps

1. Notice that the interface is almost similar to the Diet Problem Solver.

CMSC 150 Project

Upload CSV file:

Browse... No file selected

Enter x to estimate desired value:

0

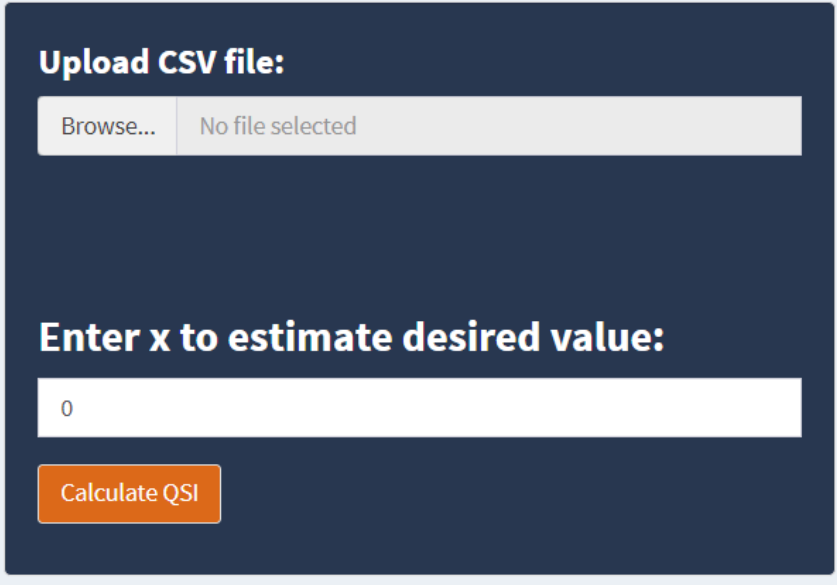
Calculate QSI

Quadratic Spline Interpolation

Resulting Equations with corresponding intervals:

Estimate of x at f(x):

2. The required fields include **upload CSV**, **numeric input for estimating x** and **calculate QSI** action button.



The screenshot shows a dark blue web interface. At the top, it says "Upload CSV file:". Below this is a light gray button labeled "Browse..." and a light gray text area that says "No file selected". Further down, it says "Enter x to estimate desired value:". Below this is a white input field containing the number "0". At the bottom, there is an orange button labeled "Calculate QSI".

3. To generate a successful output, the user **must satisfy** the following conditions:
- The CSV file should be properly formatted (**see #1 of Preparations for using QS**).
 - The CSV file **should not contain missing values**.
 - The CSV file **should have a proper number of data points to determine x and $f(X)$** .
 - Numeric input for estimating x **should be within** the interval of the given data points from the CSV file.
 - Numeric input fields (i.e., value for x) should have a value.

4. Upon successful input, if the user selects **Calculate QSI**, a successful output for the generated equations within intervals and the estimate of x will be generated on the right.

Resulting Equations with corresponding intervals:

Interval	Function at the given interval
[20, 9]	$-0.1545 * x + 5.3909$
[9, 16.5]	$-0.0149 * (x^2) + 0.1145 * x + 4.18$
[16.5, 15]	$1.5697 * (x^2) + -52.1788 * x + 435.6$

Estimate of x at f(x):

$f(10) = -0.0149 * (10^2) + 0.1145 * 10 + 4.18 \rightarrow 3.835$

5. Error messages will be shown if the user did not satisfy any of the conditions (see step 3).

Enter x to estimate desired value:

Calculate QSI

Error! unknown value x is missing.

Enter x to estimate desired value:

Calculate QSI

Error! Cannot compute values. Unknown x should be within interval of datapoints.

Upload CSV file:

Browse...

input_QSI.csv

Upload complete

Error! CSV file contains NA values.

Upload CSV file:

Browse...

No file selected

Enter x to estimate desired value:

0

Calculate QSI

Unexpected error! You did not complete and satisfy needed input.

Upload CSV file:

Browse...

Nutritional values for the foods.csv

Upload complete

Error! Cannot determine x and f(x) datapoints.

Enter x to estimate desired value:

0

Calculate QSI

Error! Cannot compute values.

Polynomial Regression Solver (PR)

Preparations

1. Similar to QSI, csv files for PR should not contain headers such as “x” and/or “f(x).”
*****see reference pic for proper data formatting*****

A	B
100	36
150	33.8
200	33
250	32.4
300	31.8
400	30.8
500	29.3
600	27.6
650	26.7
700	25.8
750	24.9
800	24.1
850	23.4
900	22.8
950	21.1
1000	21.4

Steps

1. Notice that the interface is also similar to the Quadratic Spline Interpolation Solver (QSI).

The screenshot shows a web application titled "CMSC 150 Project" in the top header. The interface is divided into two main sections. On the left, a dark blue sidebar contains three input fields: "Upload CSV file:" with a "Browse..." button and "No file selected" text; "Polynomial Degree:" with a text input containing "0" and a red error message "Error! Polynomial degree should not be less than 1!"; and "Enter x to estimate desired value:" with a text input containing "0". Below these is an orange "Calculate PR" button. On the right, a light blue main area has a dark blue header "Polynomial Regression". Below this header are two horizontal lines: the first is labeled "Generated Polynomial Function:" and the second is labeled "Estimate of x at f(x):".

2. The required fields include **upload CSV**, **numeric input for estimating x**, **Polynomial Degree** and **calculate PR** action button.

This is a close-up view of the dark blue sidebar from the previous screenshot. It highlights the "Upload CSV file:" section with its "Browse..." button and "No file selected" text. Below that is the "Polynomial Degree:" section, showing a text input with "0" and the red error message "Error! Polynomial degree should not be less than 1!". The "Enter x to estimate desired value:" section shows a text input with "0". At the bottom of this sidebar is the orange "Calculate PR" button.

3. To generate a successful output, the user **must satisfy** the following conditions:
- The CSV file should be properly formatted (*see Preparations for using PR*).
 - The CSV file **should not contain missing values**.
 - The CSV file **should have a proper number of data points to determine x and f(X)**.
 - Numeric input fields (i.e., value for estimating x and Polynomial degree) should have a value.
 - Polynomial degree should be greater than 0.
 - Value for x should be greater than or equal to (Polynomial degree + 1).
4. Upon successful input, if the user selects **Calculate PR**, a successful output for the generated equations and the estimate of x will be generated on the right.

Polynomial Regression

Generated Polynomial Function:

$f(x) = 39.7167 + -0.052 * x^1 + 1e-04 * x^2 + 0 * x^3 + 0 * x^4$

Estimate of x at f(x):

$f(101) = 39.7167 + -0.052 * 101^1 + 1e-04 * 101^2 + 0 * 101^3 + 0 * 101^4 \rightarrow 35.4848$

5. Error messages will be shown if the user did not satisfy any of the conditions (see step 3).

Polynomial Degree:

0

Error! Polynomial degree should not be less than 1!

Polynomial Degree:

Error! Polynomial degree value is missing!

Enter x to estimate desired value:

Error! x estimate is missing!

Upload CSV file:

Browse...

No file selected

Polynomial Degree:

Enter x to estimate desired value:

Calculate PR

Error! You did not satisfy required input!

Upload CSV file:

Browse...

Nutritional values for the foods.csv

Upload complete

Error! Cannot determine x and $f(x)$ datapoints.

Polynomial Degree:

1

Enter x to estimate desired value:

0

Error! x estimate should be greater than or equal to 2!

Calculate PR

Error! Regression is impossible to calculate!

Upload CSV file:

Browse...

input_Regression.csv

Upload complete

Error! CSV file contains NA values.

Limitations

1. Polynomial Regression (PR) can only accept user input up to 51 Polynomial degrees. In most calculations for PR, the generation of the equations can be at most 4 Polynomial degrees only (Chapra & Canale, 2010).

References

Chapra, S. C. (2010). *Numerical methods for engineers*. McGraw-hill.