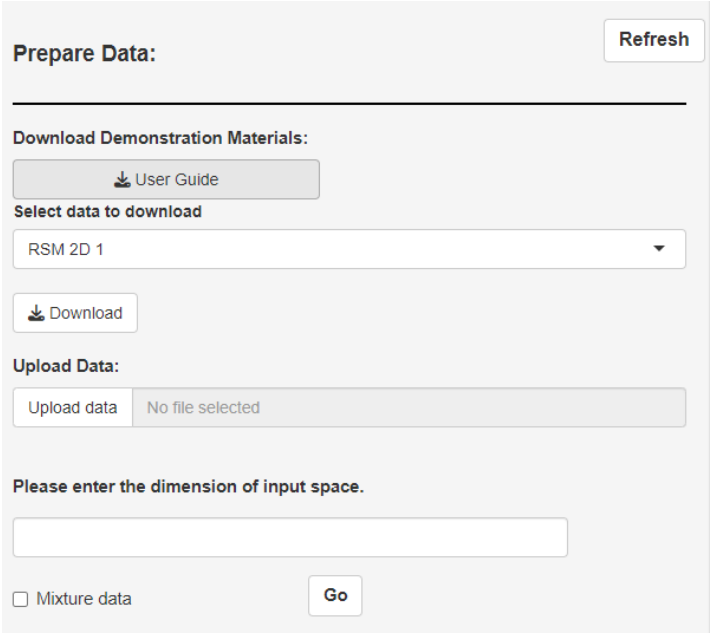
Quick Non-Uniform Space Filling (QNUSF) Designs Application User Guide

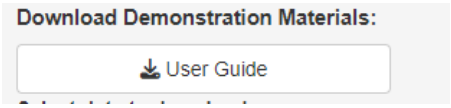
Section 1: Data Preparation

Section 1.1: Prepare Data

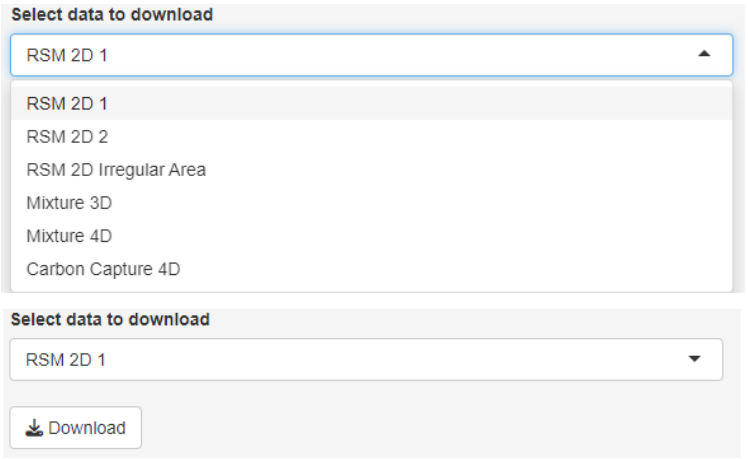


- In the ***Prepare Data*** section, you need to upload the test data as preparation for doing QNUSF next. When you need to test new data, please click "**Refresh**" button to refresh the app page.

Section 1.1.1: Download Reference Materials



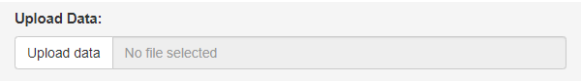
- You may also download this guide by clicking the "***User Guide***" button



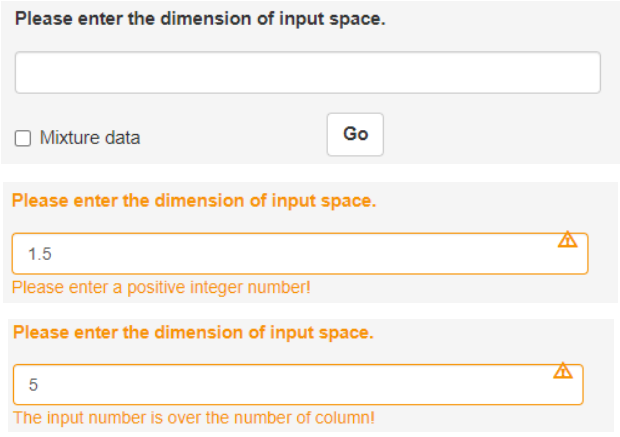
- You may download a sample data set by selecting the data you want below the "***User Guide***" button and then clicking "***Download***" button. The example data set consists of two groups of candidate data. Attached below is an image of the first few rows of the example data set.

	A	B	C	D
1	x1	x2	x3	weight
2	0	0	1	-1
3	0	0.0125	0.9875	-0.9875
4	0	0.025	0.975	-0.975
5	0	0.0375	0.9625	-0.9625
6	0	0.05	0.95	-0.95
7	0	0.0625	0.9375	-0.9375
8	0	0.075	0.925	-0.925
9	0	0.0875	0.9125	-0.9125
10	0	0.1	0.9	-0.9
11	0	0.1125	0.8875	-0.8875
12	0	0.125	0.875	-0.875
13	0	0.1375	0.8625	-0.8625

Section 1.1.2: Upload Data



- In ***Upload Data*** part, please click the ***Upload File*** button to upload a .csv file with your data. Please check that the data has the same format as the example data given above. The data set should contain two parts. The first part contains the n-dimensional input candidate set as n columns in the tables, and the second part contains **one column** of weights. The order should be {***input set***, ***weights***}.



- After the data set is uploaded, please use the textbox in ***input space*** section to enter the dimension of input space to let this application recognize input part candidate set and the weights. Please enter the number of columns for the input variables, which should be (dimension of input space) + 1 (for

weights). If the data is a mixture data, please click the checking box named "***Mixture data***". After all the above is done, please click the "***Go***" button, and then the application will populate the ***Data Visualization*** tab.

Section 1.2: Validate Data

Section 1.2.1: Instruction

Step:

1. Complete the Prepare Data section to generate the Data Visualization tab.
2. Complete the QNUSF section to generate the minimax and/or maximin designs

Notes:

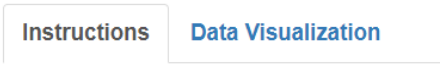
1. The uploaded data file must be a .CSV file. Meanwhile, the format must match the right example. The last column must be for the weights. After you upload a data file, please enter the number of columns for the input variables. Generally, the number columns in the file should be (dimension of input space) + 1 (for weights).
2. To start with new data, please click the 'Refresh' button to reset the environment.
3. For 1-D, 2-D & 3-D RSM, and 3-D & 4-D mixture examples, the visualization given is a contour plot. For 3-D RSM and 4-D mixture examples, the visualization is a sliced plot. For cases other than those listed, only the created design is provided (with no visualization).

For more details, please see User Guide (on left).

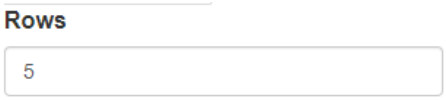
	A	B	C	D
1	x1	x2	x3	weight
2	0	0	1	-1
3	0	0.0125	0.9875	-0.9875
4	0	0.025	0.975	-0.975
5	0	0.0375	0.9625	-0.9625
6	0	0.05	0.95	-0.95
7	0	0.0625	0.9375	-0.9375
8	0	0.075	0.925	-0.925
9	0	0.0875	0.9125	-0.9125
10	0	0.1	0.9	-0.9
11	0	0.1125	0.8875	-0.8875
12	0	0.125	0.875	-0.875
13	0	0.1375	0.8625	-0.8625

- In the ***Instructions*** tab, the page shows the procedure of this application and some important notes. For more information, please read this guidebook.

Section 1.2.2: Data Visualization



- After inputting the dimensions of input space and response space, you can click the ***Data Visualization*** tab to view the data structure. The plots are available for lower dimensional cases (1d, 2d, and 3d RSM data; 3d and 4d mixture data).

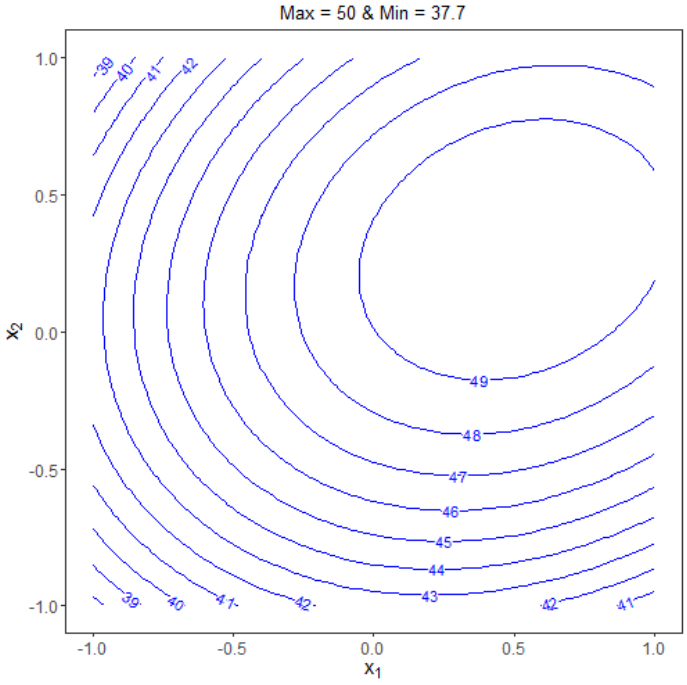


- Please enter the number of rows of the candidate set in ***Rows*** textbox. The default number is "**5**". After the number of "***Rows***" be entered, the table sample and plots (for special dimensional cases) will be shown on the page as below. Here the 2-dimensional entire space would be utilized as an example.

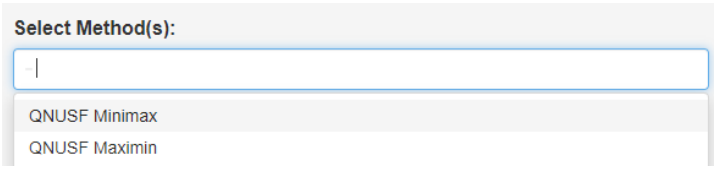
Rows

5

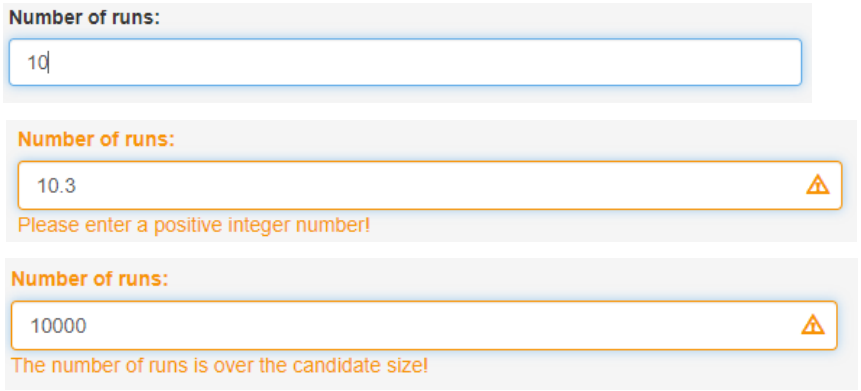
X1	X2	Weight
-1.00	-1.00	37.70
-1.00	-0.97	37.93
-1.00	-0.95	38.16
-1.00	-0.92	38.39
-1.00	-0.90	38.61



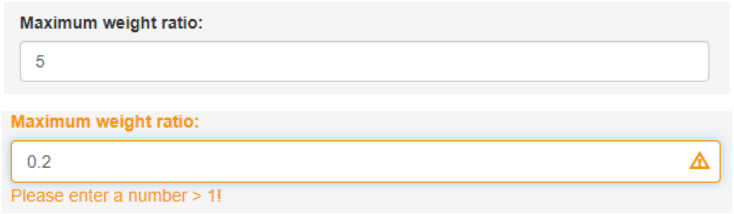
Section 2: QNUSF Designs



- After the candidate set is uploaded and the dimensions of input space and response space are entered, the method of space-filling designs needs to be selected with the ***Select Method(s)*** menu. There are two choices including minimax method and maximin method. You can choose both or either of them.



- Please use the ***Number of runs*** textbox to enter the number of runs in a design. The default number is "**10**". The number requires that it is a positive integer number, and it cannot be over the candidate set size. If a number is not a positive integer number or over the candidate set size, a warning message would be given as the above orange words.



Please use the ***Maximum weight ratio*** textbox to enter the maximum rate for scaling the weights between 1 and this maximum rate. The default number is "**5**". The number requires that it is more than 1. If a number is less than 1, a warning message would be given as the above orange words.

Section 2.1: Minimax

- If you select ***QNUSF Minimax*** from the ***Select Method(s)*** menu, enter a number in the ***Number of runs*** textbox, and enter a number in the ***Maximum weight ratio*** textbox, please click the ***Generate*** button to process QNUSF design.

Instructions | Data Visualization | Minimax

Minimax, N=20, MWR=5

Design Table | Decimal: 3 | download

Show 10 entries | Search:

	x1	x2	x3	weight	Scaled Weight
1	0.425	0.425	0.15	1.729	4.955
2	0.537	0.412	0.05	1.674	4.874
3	0.462	0.288	0.25	1.642	4.828
4	0.6	0.238	0.162	1.633	4.815
5	0.675	0.25	0.075	1.617	4.792
6	0.4	0.537	0.062	1.56	4.71
7	0.325	0.425	0.25	1.56	4.709
8	0.35	0.325	0.325	1.478	4.591
9	0.25	0.562	0.188	1.337	4.386
10	0.312	0.637	0.05	1.328	4.374

Showing 1 to 10 of 20 entries | Previous 1 2 Next

- After you click the ***Generate*** button, please click ***Minimax*** tab to check the result. In ***Minimax*** tab page, there is a ***Design Table*** given here. The title will show the method, number of runs in design, and the maximum weight ratio. For ***Decimal*** textbox, you can enter the number to show data with the number of decimal places. You can also click "***download***" button to download the design data. In the design table, we give the original weight values and scaled weight values (last column). If your data satisfies the plot condition (1d, 2d, and 3d RSM data; 3d and 4d mixture data), you will also get the related design plot below the design table. The following figure shows a result for a 3-dimensional mixture data case. You can also right-click the plot to save or copy the image.

Design Table

Decimal: 3

download

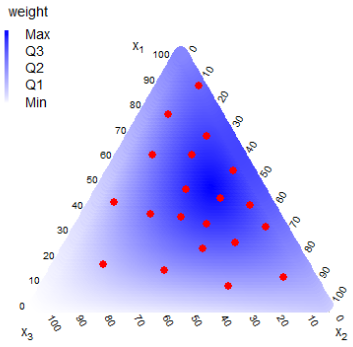
Show 10 entries

Search:

	x1	x2	x3	weight	Scaled Weight
1	0.425	0.425	0.15	1.729	4.955
2	0.537	0.412	0.05	1.674	4.874
3	0.462	0.288	0.25	1.642	4.828
4	0.6	0.238	0.162	1.633	4.815
5	0.675	0.25	0.075	1.617	4.792
6	0.4	0.537	0.062	1.56	4.71
7	0.325	0.425	0.25	1.56	4.709
8	0.35	0.325	0.325	1.478	4.591
9	0.25	0.562	0.188	1.337	4.386
10	0.312	0.637	0.05	1.328	4.374

Showing 1 to 10 of 20 entries

Previous 1 2 Next



Section 2.2: Maximin

- If you select ***QNUSF Maximin*** from the ***Select Method(s)*** menu, enter a number in the ***Number of runs*** textbox, and enter a number in the ***Maximum weight ratio*** textbox, please click the ***Generate*** button to process QNUSF design.

Maximin, N=20, MWR=5

Design Table

Decimal 3

download

Show 10 entries

Search:

	x1	x2	x3	weight	Scaled Weight
1	0.412	0.425	0.162	1.72	4.942
2	0.588	0.25	0.162	1.657	4.85
3	0.462	0.288	0.25	1.642	4.828
4	0.338	0.4	0.262	1.572	4.727
5	0.688	0.3	0.013	1.57	4.724
6	0.55	0.45	0	1.54	4.681
7	0.362	0.3	0.338	1.451	4.552
8	0.438	0.562	0	1.422	4.509
9	0.275	0.562	0.162	1.41	4.492
10	0.25	0.425	0.325	1.282	4.307

Showing 1 to 10 of 20 entries

Previous 1 2 Next

- After you click the ***Generate*** button, please click ***Maximin*** tab to check the result. In ***Maximin*** tab page, there is a ***Design Table*** given here. The title will show the method, number of runs in design, and the maximum weight ratio. For ***Decimal*** textbox, you can enter the number to show data with the number of decimal places. You can also click "***download***" button to download the design data. In the design table, we give the original weight values and scaled weight values (last column). If your data satisfies the plot condition (1d, 2d, and 3d RSM data; 3d and 4d mixture data), you will also get the related design plot below the design table. The following figure shows a result for a 3-dimensional mixture data case. You can also right-click the plot to save or copy the image.

Design Table

Decimal: 3

download

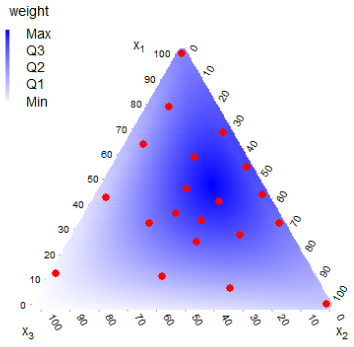
Show 10 entries

Search:

	x1	x2	x3	weight	Scaled Weight
1	0.412	0.425	0.162	1.72	4.942
2	0.588	0.25	0.162	1.657	4.85
3	0.462	0.288	0.25	1.642	4.828
4	0.338	0.4	0.262	1.572	4.727
5	0.688	0.3	0.013	1.57	4.724
6	0.55	0.45	0	1.54	4.681
7	0.362	0.3	0.338	1.451	4.552
8	0.438	0.562	0	1.422	4.509
9	0.275	0.562	0.162	1.41	4.492
10	0.25	0.425	0.325	1.282	4.307

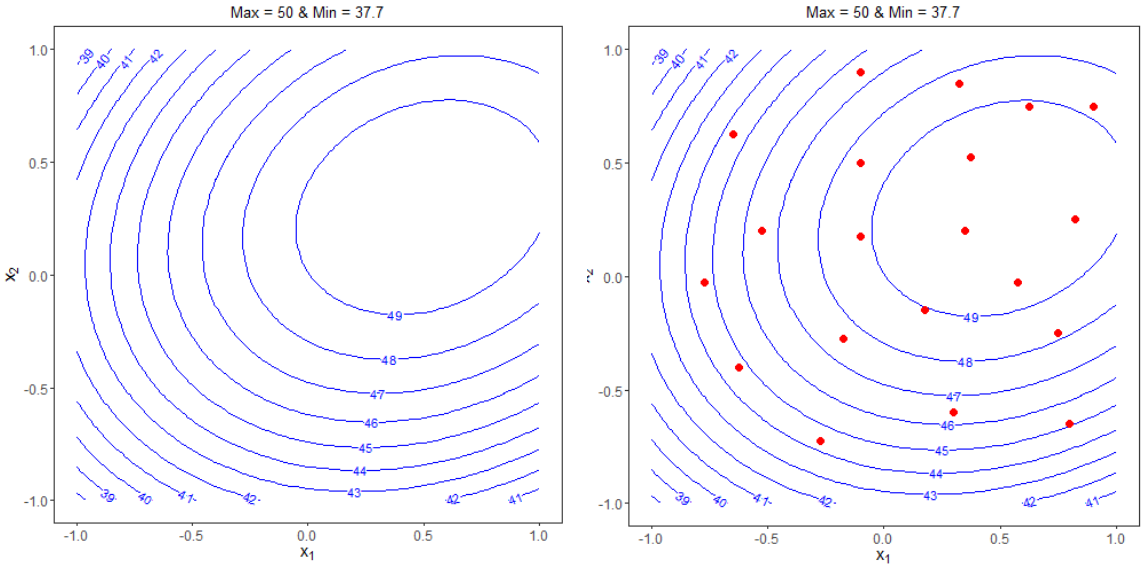
Showing 1 to 10 of 20 entries

Previous 1 2 Next

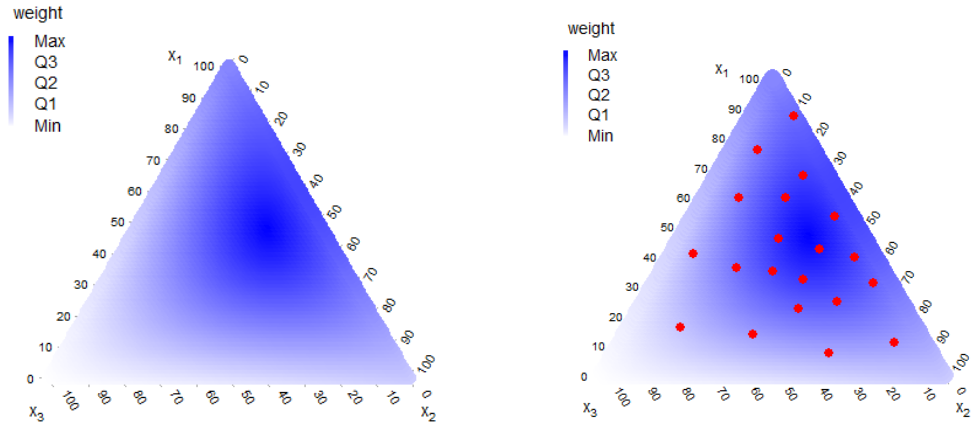


Section 3: Additional Explanation

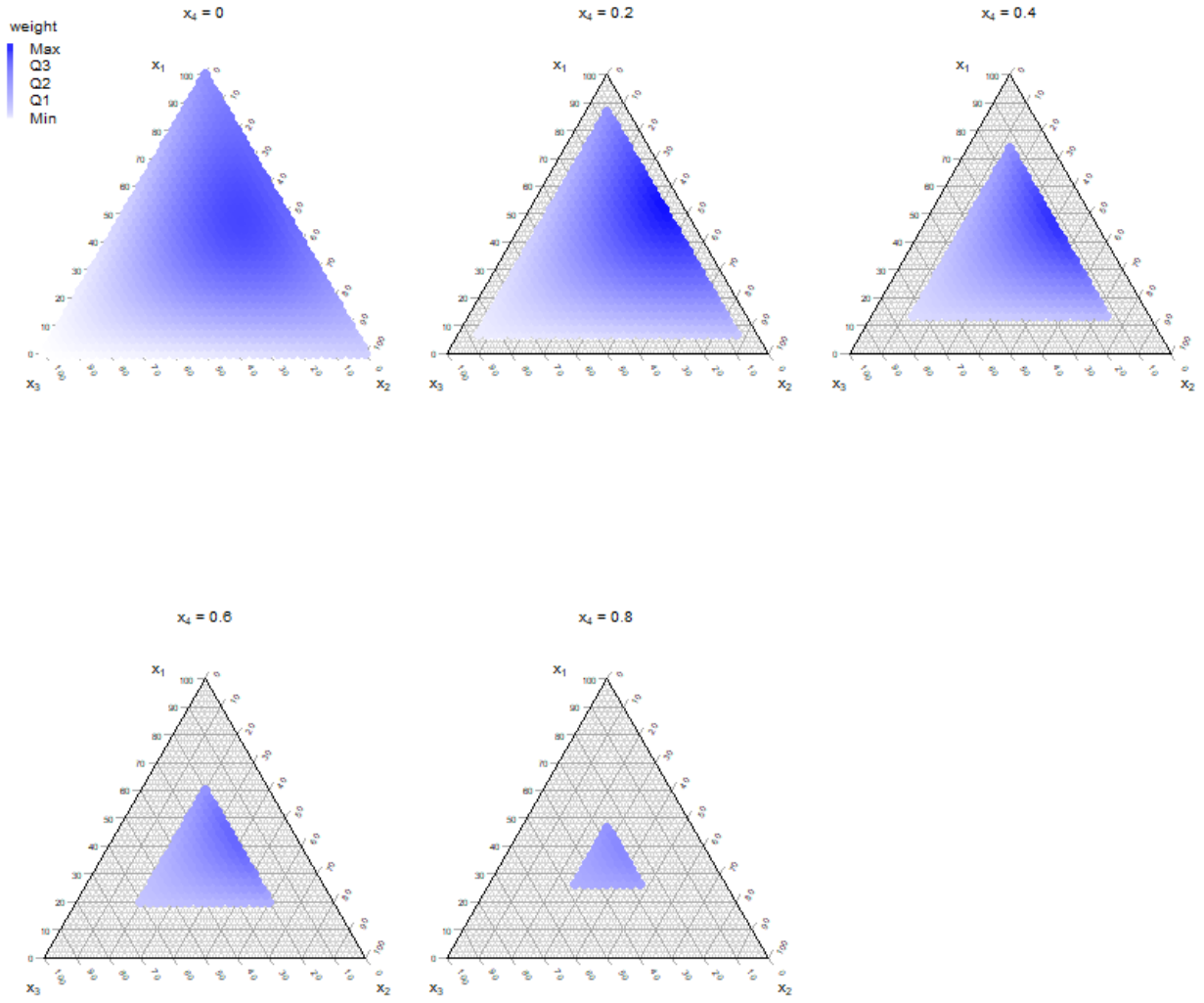
Section 3.1: Explanation for plots



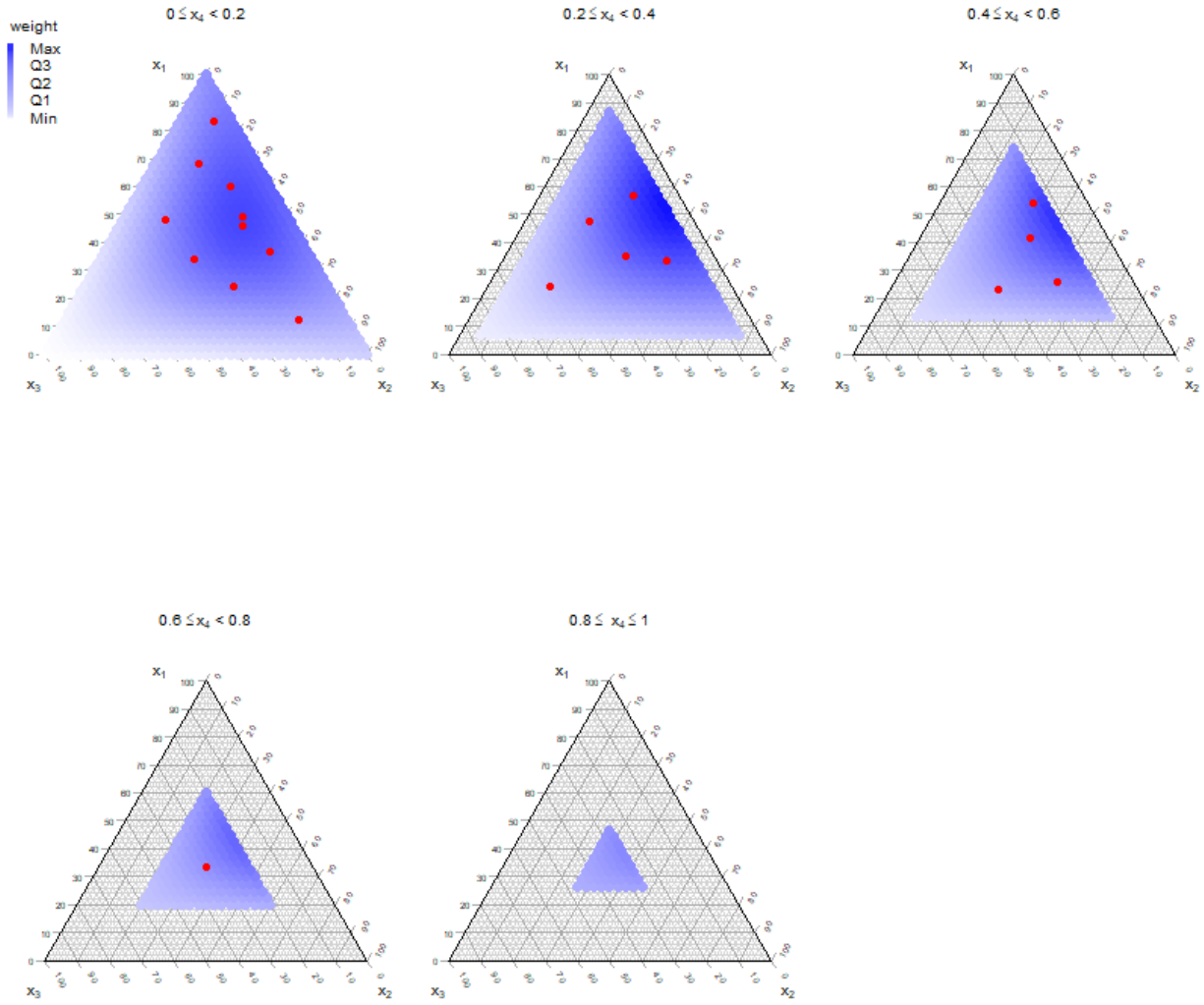
- For 2-D RSM data, we use contour plot to express the weight distribution. The main title will give you the maximum and the minimum of weights of the data. The deep blue means the high weight and light blue means the low weight. The red point in right plot represents the design point on this surface.



- For 3-D mixture data, we use ternary plot to express the weight distribution. The deep blue means the high weight and light blue means the low weight. The red point in right plot represents the design point on this surface.



- For 4-D mixture data, we also use ternary plot to express the weight distribution, but we use the sliced plot with specific 4th factor values. The deep blue means the high weight and light blue means the low weight. The red point in plot represents the design point in the space between two specific 4th factor values.


weight
Max
Q3
Q2
Q1
Min
0 ≤ x4 < 0.2
0.2 ≤ x4 < 0.4
0.4 ≤ x4 < 0.6
0.6 ≤ x4 < 0.8
0.8 ≤ x4 ≤ 1
x1
x2
x3