Chapter 3: Art of Optimization

# Multi-Objective Optimization

## Corresponding reading: Chapter 3, Page 1

### Purpose: Conducting sensitivity analysis in a multi-objective optimization problem.

1. Consider the multi-objective optimization problem discussed in Checkpoint 3.3. The data is given in the following table. Rank the plans according to the weighted average dose to the healthy organs (lowest to greatest). Make sure to include your calculations.

|  |  |  |  |
| --- | --- | --- | --- |
| **Organ** | **Heart** | **Spinal cord** | **Kidney** |
| Weight | 0.6 | 0.3 | 0.1 |
| Plan 1 | 100 Gy | 40 Gy | 50 Gy |
| Plan 2 | 80 Gy | 50 Gy | 30 Gy |
| Plan 3 | 110 Gy | 30 Gy | 10 Gy |

1. The best plan according to the current weights is Plan 2. Change the weights so that Plan 1 becomes the best plan (make sure weights sum to 1).
2. Change the weights so that Plan 3 becomes the best plan (make sure weights sum to 1).
3. Reset the weights to the base values in the above table. Assume the weight of kidney must remain at 0.1 (therefore the weights of heart and spinal cord must sum to 0.9). If you gradually reduce the weight of heart and increase the weight of spinal cord, at some point, the best plan will no longer be Plan 2. Find that point at which the best plan switches. Hint: You can use the Goal Seek tool in Excel as well.

***Note:*** *Understanding the case and what you need to do is PART OF THE CASE. If you do not understand a specific part, or are not sure what you should do, you need to review the corresponding reading section in the text before asking for help. You might also need to do some search on the internet. That is all part of the case and your learning process.*