Chapter 2: Data-Driven Decision-Making

# Applying a Heuristic

## Corresponding reading: Chapter 2, Page 4

### Purpose: Investigating the impact of applying a heuristic on the computation time.

1. Consider the radiation therapy treatment planning discussed in Chapter 2. Assume there are 30 coplanar candidate beams. If the physician wants to choose five beams, how many combinations are possible? (Hint: search “how many ways you can choose items out of items?”)
2. Given that the impact of adjacent beams is similar, a good heuristic to reduce the computation time is excluding configurations in which two or more beams of the five selected beams are adjacent. We want to find an upper bound on the number of possible configurations in which no two beams are adjacent.
   * Group each two adjacent beams into one group (beams 1 and 2 will be grouped together, beams 3 and 4 will be grouped together, etc.). How many groups will there be?
   * Given that choosing adjacent beams is not allowed, at most one beam in each group can be chosen. How many ways you can choose five beams from different groups of beams?
   * Comparing the number of possible configurations before and after grouping beams, calculate the percentage reduction in the number of possible configurations, and hence, the computation time.
3. Explain why the *actual* number of possible configurations in which no adjacent beams are chosen is indeed smaller than the number calculated above.

***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.*