HSOR NEWS
The evidence behind your decisions

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OPTIMISATION MODELLING AND ITS USE IN PACKING MEDICATIONS

INSIDE THIS ISSUE

Optimisation and the DOC framework: Decision, Objective, Constraint

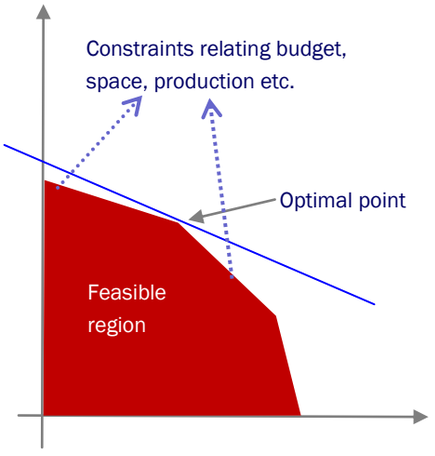
In Operations Research, "Optimisation" has a precise meaning. We use it to address problems with a large number of options and constraints and choose the best option among many possibilities. This conceptual analysis is guided with a structured framework - DOC. With proper models and tools, we can use 'optimisation' technique to achieve significant cost savings.

Also in this issue, try our quiz below and win a prize!

The DOC framework

1. **Decision:** these are the "actionable items", e.g., how many units to buy, who to assign to which job, which are the screening options I should do?
2. **Objective function:** is the total "cost" or "value" function. It can be a weighted sum of a few measures, which we want to either minimise or maximise. E.g. total cost of ownership, 'quality' of my life.
3. **Constraint:** can be physical limitations, or rules that we cannot violate. E.g. personal or department budget, wound cleaning done before dressing.

The diagram on the right is an illustration of a simple optimisation problem. There are a few lines (constraints) that bound the "feasible" region. Then the line that cuts the feasible region and is furthest away from the origin (0,0) gives the optimal point! Sounds familiar from school? A "real" problem will have many more decision variables and constraints. One may try using Excel Solver but most likely we need special software to deal with them.



A case study: How optimisation helps in dispensing and pack sizing?

When a hospital pharmacy moves to automation, some dispensed drug items will be pre-packed into a few pack-sizes. E.g. a drug might have pre-packed sizes of 30, 50, and 90. At dispensing, when a patient needs 120 tablets, he should be given 30+90 (2 boxes), instead of 4x30 (4 boxes). Using the second option (having more boxes) means greater inconvenience to the patients, higher packing cost and longer time to pick the boxes. The choice of boxes can be seen as a "packing" problem.

1. **Decision: type and number of boxes to be used;**
2. **Objective function: minimise total boxes used;**
3. **Constraint: the patient gets his amount of medications from the pre-packed boxes.**

The above problem is brought to a higher level: what are the "best" combinations of pre-pack sizes such that the "system" is "optimal" to all the patients? One may start listing all combinations exhaustively – this is an exhausting enumeration approach. E.g., if we need to choose 6 pack-size from 45 possible pack-sizes, that will be 8.1 million possibilities (equivalent to buying all Toto combinations). For each combination, the "packing" engine (the earlier optimisation problem) has to be performed on all prescription records. Then we need to compare the "performance" for all the 8.1 million combinations to find the best one!

Complete enumeration will be almost impossible. An elegant way to describe and formulate the problem is to use the DOC framework again! This problem is more complicated than the packing problem, but the optimisation framework and the algorithms result in much more efficient searches.

HSOR and TTSH Pharmacy have been working on this project to ensure we optimise the machines and processes, thereby saving costs and providing the most efficient service to our patients.

In practice, more considerations exist. The operations research specialist will translate these "business / operational" requirements into mathematical equations. Through state-of-the-art solver, many large problems can be handled.

Win our Quiz!

A patient needs 68 tablets of vitamin Z. Three box sizes are available: 14, 21, and 30. The pharmacy can dispense at most 5 more (free) tablets than what is asked, and the patient will not take less than 68 (i.e. he should be getting between 68 to 73 tablets). What boxes should be used so that we will use *least* number of boxes and meet the requirements?

The first 3 correct answers will receive a $10 voucher !
Send to the following email before 8 Dec 2012:
kiok_liang_teow@nhg.com.sg

Summary

Optimisation is a powerful tool that is widely applicable in many settings and has the potential to reduce cost, clarify our intent and exploit the limits. Can you identify one problem that can be solved with this tool?

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