Multi-fidelity modelling and optimisation for long-term capacity planning: ten month PhD review (ammendments)

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In this document I outline proposed ammendments to the initial draft of the 10-month review document. These suggestions are based on our discussion on 22nd October. They do not include all the ammendments which follow on from feedback received by email. I also list some potential topics of conversation for Friday 8th November.

1 Introduction

- Introduce the more general context of queueing models in long-term capacity planning, where the homeless care setting is one example.
- Introduce the distinction between long and short service times when discussing examples of long-term capacity planning

2 Literature Review

- include discussion of recent JOS paper on long-term bed modelling for critical care hosptial units
- include more references in Section 2.2.1 (Overview of SO methods)
- include GMIA extensions rapid GMIA and multi-fidelity GMIA (previously disccussed in Section 6).
- include discussion of current literature on multi-fidelity Bayesian optimisation.

3 Models of multi fidelity

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4 Deterministic optimisation with low-fidelity model

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5 Discussion of uncertainty

- discuss differences between problems with long and short service times: with long service times we are more interested in input uncertainty, and with short service times we are more interested in stochastic uncertainty.
- expand upon ideas for how input uncertainty could be incorporated into a future MFSO algorithm.
- discuss problem of SO in queueing settings: bad solutions have high stochastic uncertainty and therefore take a lot of simulation effort to eliminate.

6 Potential research contributions

- Expand upon and emphasize the suggested focus: to develop efficient MFSO methods for long-term capacity planning problems. To do this by building upon current MFSO methods and integer-ordered SO methods by incorporating information about the structure of these problems which is available from low-fidelity queueing models.

To discuss on 8th November, 2024:

- The proposed PhD problem is 'artificial' in the sense that in reality public-sector decision makers usually have a small number of potential plans for serious consideration. Discuss the implications of this on the proposed PhD direction.
- The proposed next steps address rather technical challenges. Discuss whether this is sufficient for a PhD.
- A meeting plan for my time in Lancaster: who to meet when and at what frequency.