

MAL2040: Sample Problem Statements

Instructor: Dr. Brahadeesh Sankarnarayanan

2025–26 (Semester II)

1 Structural Performance of Layered Beams

Lightweight structural elements are often constructed by combining multiple layers of material. The way in which these layers are arranged and bonded can influence how the structure behaves under load, but it is not always clear which aspects of construction are most important. The objective is to determine how different construction choices influence the mechanical behavior of such layered systems.

2 Water Transport in Porous Media

The movement of water through porous materials such as soil is central to many natural and engineered processes. This movement depends on both the properties of the material and the conditions under which the flow occurs. While general principles are known, the relative importance of different factors and their possible interactions are not always clear in practical settings. The aim is to examine how these conditions influence water transport behavior.

3 Organization and Performance of Queuing Systems

Queues are a common feature of service systems, from canteens to ticket counters. Their performance depends on how they are organized and how customers arrive and are served. Although certain arrangements are believed to be more efficient, the extent to which different structural and operational choices influence waiting experience is not always obvious. The study should explore how these choices affect queue performance.

4 Drying Processes with Competing Transport Mechanisms

Drying processes occur in many everyday and industrial contexts and are governed by multiple underlying mechanisms. Depending on the conditions, different processes may dominate, leading to behavior that is not easily predicted from simple intuition. It is not always clear how environmental conditions and material properties combine to influence drying. The goal is to identify how these factors influence the drying process and whether distinct regimes of behavior emerge.

5 Thermal Response of Construction Materials

Materials used in construction are often selected based on how they respond to changes in temperature over time. This behavior influences comfort and energy efficiency, yet it is not always clear how different materials and conditions affect thermal response in practice. The objective is to compare how different materials respond to thermal changes under realistic conditions.

6 Human Reaction Time

Human reaction time is an important aspect of performance in many real-world tasks, including driving, sports, and human-machine interaction. It is influenced by both physical and cognitive factors, but the relative importance of these influences is not always clear. The task is to investigate how different conditions influence reaction time and whether consistent patterns can be observed.

7 Human Mobility in Campus Environments

Movement across a campus or urban environment occurs under a variety of conditions and constraints. Factors such as the mode of movement, the environment, and the physical state of the individual may all influence performance. While these effects are intuitively understood, their relative importance and possible interactions are not always clear. The aim is to understand how these conditions influence mobility in practice.

8 Performance of Electronic Devices

Modern electronic devices operate under a wide range of usage and environmental conditions. Their performance is influenced by both workload and external factors, and these influences may interact in non-obvious ways. It is not always clear how different operating conditions affect device behavior or whether certain combinations lead to unexpected outcomes. The study should determine how these factors influence device performance.

9 Typing Performance in Human-Computer Interaction

Text input is a common human-computer interaction task, and performance depends on both the input method and the conditions under which typing occurs. While it is generally believed that factors such as device and posture influence performance, the extent of these effects and their interactions are not always clear. The objective is to examine how different conditions affect typing performance.

10 Mental Arithmetic Performance

Mental arithmetic is influenced by both the nature of the task and the environment in which it is performed. Factors such as task complexity and external distractions may affect performance in ways that are not immediately obvious. The study should explore how these conditions influence speed and accuracy, and whether interactions between factors play an important role.