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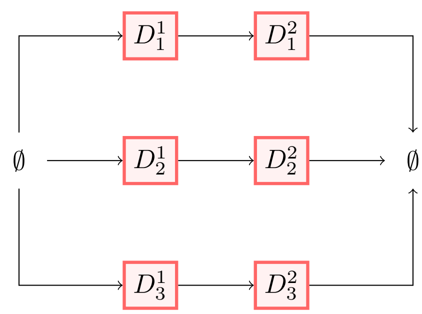
1 Optimal Resource Allocation in Healthcare

The concept of optimal resource allocation in healthcare revolves around the strategic distribution of limited resources such as medical personnel, facilities, equipment, and financial funds to meet the demands of patient care, research, and administrative functions. Striking the right balance between supply and demand is essential not only for managing healthcare costs but also for enhancing patient outcomes and overall system performance. This project will focus on the optimal allocation of surgeries using a rule based model.



This diagram represents the flow of patients through a hospital. Here we consider 3 diseases, D_1, D_2, D_3, each with two stages of severity, e.g. D_1^1, D_1^2, giving us 6 types for our patient objects. Patients arrive in the first stage of a disease according to a Poisson process, after some time progress to the next stage, and then at some point are removed from the system. In addition to our patient object, we have another basic object, interventions. We model these as also arriving according to a Poisson process. There are two types of interventions, I^1, I^2, which represent treatments to patients in the first and second stage of illness respectively. We model the interaction of interventions and patients with the following counting rules.

$$D_j^1 + I^1 \to \emptyset \quad \forall j \in \{1,2,3\}$$
$$D_j^2 + I^2 \to D_j^1 \quad \forall j \in \{1,2,3\}$$

The project will begin by analysing this system using techniques from the course as well as queuing theory. We will explore how varying different rate parameters affects system performance. We will then explore how policies can be implemented, and how they affect performance. There are many interesting avenues to explore after this, for example when interventions can have different outcomes with different probabilities. Finally, we will apply the model to real world data, and compare our model to current state of the art resource allocation models.