# Data Structure
## Homework: Priority Queue
### May 29, 2025

Problem: Using heaps to implement a priority queue for scheduling patients visiting an emergency room.

Patients are usually taken care of on a first-come-first-serve basis in an emergency room. However, patients with a critical condition will be given a higher priority to receive medical service. Suppose 30 patients come to an emergency room with the arrival time and associated priorities as listed in the file "Scheduling for ER Patients.csv". In this excel file, the first column, "Patients", lists the patient ID. The second column, "arrival time", records the arrival time of each patient (in time unit). The third column, "priority", provides the priority of each patient, where "1" has the highest priority and "3" has the lowest. The arrival time of patient 1 is 0, which means that patient 1 will be treated immediately after arrival. It is assumed that the treatment time for a patient with priority "1", "2", and "3" is 7, 5, and 3 units of time, respectively.

Please implement a priority queue based on heaps to schedule the medical service for the 30 patients visiting the emergency room. In this homework, you are required to:

- Use C++ to write the codes,
- Write your own heaps-related codes, e.g., heapify (copying the heaps-related codes from the internet or using AI tools to generate the codes is not allowed),
- Write a report (not in your C++ programs or the program outputs), which
  a. clearly describes (not in pseudo code) your algorithm, and
  b. shows the service SEQUENCE and TIME of the 30 patients,
- Submit your C++ code, which can be easily executed by TAs to verify your report.