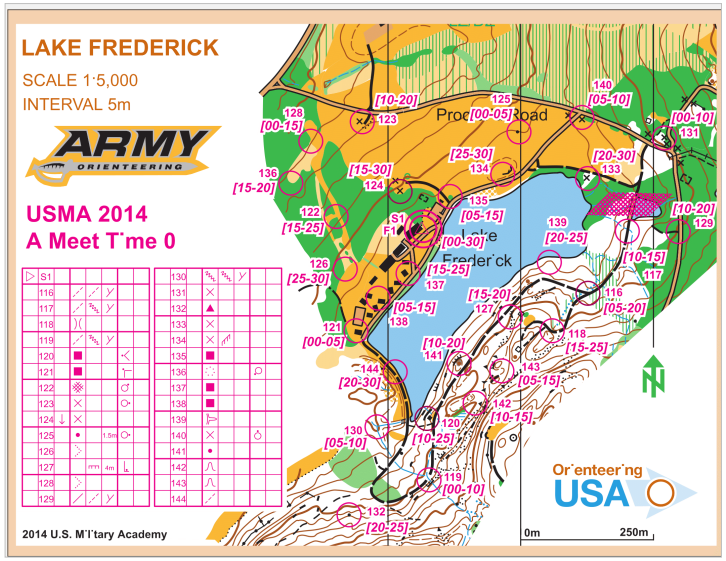
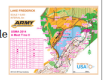


The Time-O Problem

Orienteering is the sport of cross-country navigation - competitors must navigate to a series of checkpoints (called controls) using a map and compass. An orange-and-white flag marks the location in the terrain. Controls typically must be visited in a particular order, and the goal is to navigate to a certain sequence of controls as quickly as possible.

In contrast to point-to-point events, controls in a score-o event have associated point values and may be visited in any order. However, there is a time limit - the task is to select which controls to visit (and in what order) so as to maximize your score within the specified time limit. A penalty is assessed for each minute (or part of a minute) overtime.



In the novelty time-o variant, there is an additional constraint that each control is only available during a particular time window. Visiting a control outside of its time window incurs no penalty, but also gains no points. The map shows a sample scenario; click on it to see a larger version. Controls are shown with purple circles and the start/finish is marked with a double purple circle. The three-digit label by each circle is the control code (so you can verify that you've arrived at the right flag) and the time window (in minutes) is shown in brackets. In this event, all controls were worth 1 point.

The following assumptions will be made for this problem:

- The start and finish are at the same location.
- The penalty is a fixed number of points per minute, specified as part of the problem input.

A few other notes:

- There are no restrictions on the direction of travel between controls, but the speed of travel in one direction may be very different from the other direction. (e.g. going in the uphill direction vs the downhill direction)
- There is no penalty for visiting a particular control more than once (or outside its time window), but only one visit (within the time window) counts for scoring.
- Travelling between controls is assumed to always occur at the runner's maximum pace, but it is allowed to stop and wait for any length of time at a control. (It might be advantageous to arrive at a control early and wait for its time window to open.)

The task: Given a list of controls with their point values and available time windows, the overall time limit and overtime penalty (points per minute), and the time it takes to travel between each pair of controls (including the start and finish), find which controls to visit and in what order so as to maximize your score.