For both the problems, program the algorithm to run on admiral in your choice of language from { C, C++, Java }, and submit the electronic copy.

1. [50 pt] A *contiguous subsequence* of a list S is a subsequence made up of consecutive elements of S. For instance, if S is

$$5, 15, -30, 10, -5, 40, 10$$

then $15, -30, 10$ is a contiguous subsequence but $5, 15, 40$ is not. Give a linear-time algorithm for the following task:

   - Input: A list of numbers $a_1, a_2, \ldots, a_n$.

   - Output: The contiguous subsequence of maximum sum (a subsequence of length zero has sum zero).

   For the preceding example, the answer would be $10, -5, 40, 10$, with a sum of 55.

   [Hint: For each $j \in \{1, 2, \ldots, n\}$, consider contiguous subsequences ending exactly at position j.]

2. [50 pt] You are going on a long trip. You start on the road at mile post 0. Along the way, there are n hotels, at mile posts $a_1 < a_2 < \cdots < a_n$, where each a_i is measured from the starting point. The only places you are allowed to stop at are at these hotels, but you can choose which of the hotels you stop at. You must stop at the final hotel (at distance a_n), which is your destination.

   You'd ideally like to travel 200 miles a day, but this may not be possible (depending on the spacing of the hotels). If you travel x miles during a day, the penalty for that day is $(200 - x)^2$. You want to plan your trip so as to minimize the total penalty – that is, the sum, over all travel days, of the daily penalties. Give an efficient algorithm that determines the optimal sequence of hotels at which to stop.

3. [50 pt] Present a backtracking algorithm to solve the 0/1 knapsack optimization problem using the variable tuple size formulation. Program this algorithm. Run this on the following data: $p = \{11, 21, 31, 33, 43, 53, 55, 65\}$, $w = \{1, 11, 21, 23, 33, 43, 45, 55\}$, $m = 110$, and $n = 8$. Make sure that you put this data into a file that can be specified as a command line parameter.

What to handin

Handin a hardcopy of all the sources, readme, makefile(s), and results. Create your programs in a directory called *username*.4 where *username* is your login name on admiral. Once you are done with everything, remove the executables and object files, and issue the following commands:

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% cd
% ~bhatias/bin/handin cs5130 4
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