Solutions – IDI Open 2017

April 22nd 2017

Saving For Retirement, Author: Torbjørn Morland

- $((B_r - B) * B_s)/(A_s + 1 + A)$

Solved by 50 teams
First solution after 6 minutes

Square Peg In A Round Hole, Author: Torbjørn Morland

- A square can be treated as a circle with radius $\frac{s_i}{\sqrt{2}}$
- Make a sorted list of circular houses and (converted) square houses
- Greedily fill the plots, starting with the smallest plot

Solved by 38 teams
First solution after 21 minutes

Johnny Applesack, Author: Torbjørn Morland

- From each toll booth, do as many 1 km trips as we can, picking up K apples and dropping off $K - 1$ apples right before the next one
- Keep doing this until you run our of apples

Solved by 32 teams
First solution after 22 minutes

Lava, Author: Karl Johan Sande Heimark

- This task is about finding the shortest path from A to B
- Different rules apply to Elsa and the father
- Can be solved using BFS or Dijkstra

Solved by 10 teams
First solution after 63 minutes

What's In It For Me, Author: Karl Johan Sande Heimark

- Establish trivial bounds for ingredients based on stated limits
- An item cannot have a higher max than the one before or lower minimum than the one after
- For each ingredient, try all percentages in this interval
- Make new bounds on other ingredients based on this, and check if it is possible to reach 100 with that solution

Solved by 8 teams
First solution after 91 minutes

Toys, Author: Karl Johan Sande Heimark

- Also known as the Josephus problem
- Can be solved with the following recurrence (DP)
- $f(T, K) = (f(T-1, K) + K) \mod T$
- $f(1, K) = 0$

Solved by 5 teams
First solution after 132 minutes

Toys, Author: Karl Johan Sande Heimark

- This problem had the lowest accuracy (5/61)
- Naive implementations time out
- Problem originally had $T \leq 10\,000\,000\,000$
- Solution to this left as an exercise to the reader

Solved by 5 teams
First solution after 132 minutes

Travelling Delivery Person, Author: Torbjørn Morland

- Truck direction will impact cost to next delivery
- Therefore run Floyd-Warshall over all locations *and* directions
- $$dp(l_i, dir) = \min_{d_j = dirs} \left(dp(l_{i-1}, d_j) + minPath(\{l_{i-1}, d_j\}, \{l_{i-1}, dir\}) \right)$$

Solved by 3 teams
First solution after 270 minutes

Fencing Lessons, Author: Torbjørn Morland

- Make a convex hull over the trees (f.ex. via Jarvis March) to find total length of fence
- Then use DP similar to Knapsack 0-1 to find the optimal tree choice.

Solved by 3 teams
First solution after 198 minutes

Poetry Tower, Author: Torbjørn Morland

- If a set of n words work, all permutations will work (just change order of the blocks). There are $n!$ different permuations.
- Since $M <= 8$, can try all possible set of words (at most 2^8)
- Check if we can make a poem with the words through bipartite matching:
  - Make a vertex for all blocks and all letters in the words
  - Make an edge between a block vertex and a letter vertex iff we can use the block to show the letter

Solved by 2 teams
First solution after 156 minutes

Johnny5 And The Exploding Oil Cans, Author: Torbjørn Morland

- Each oil can represents five events; a point scored where it is, and oil spill in the neighboring cells
- Find score with DP, where state is (last can you picked up, amount of energy you have)
- Make a list of events sorted by time, including starting position with starting energy
- For each event, and amount of energy you can have:
- Iterate over all events after that one, and update dp for that state if you can reach it

Solved by 1 team
First solution after 291 minutes