# Solutions – IDI Open 2016

April 16th 2016

# Pizza Crust, Author: Torbjørn Morland

- $100 \cdot \frac{(R-C)^2}{R^2}$

Solved by 72 teams
First solution after 5 minutes

# Time Travelling Temperatures, Author: Torbjørn Morland

- This task is about finding where two lines cross
- A is $y = x$
- B in $y = Yx + X$
- If Y equals 1, it is either impossible or all good
- Otherwise: $-\frac{X}{Y-1}$

Solved by 63 teams
First solution after 5 minutes

# Bing It On, Author: Magne Vikjord

- Trie data structure
- len(w) lookup, insertion
- Example input on blackboard
- Or you could just use a map

Solved by 48 teams
First solution after 22 minutes

# Palindrome Names, Author: Torbjørn Morland

- Solution without being allowed to add to the end:
- Count the number of positions where `name[i] != name[-i - 1]`
- Make sure you stop at the right place
- Solution to problem:
- `min([i + palindromeCost(name[i:]) for i in range(len(name))])`

Solved by 40 teams
First solution after 13 minutes

# Lucky Numbers, Author: Torbjørn Morland

- BFS: try adding a digit to all $n-1$ digit lucky numbers
- Turns out no lucky number is longer than 25 digits
- Could precompute all answers

Solved by 28 teams
First solution after 25 minutes

# What Does It Mean, Author: Karl Johan Sande Heimark

- Dynamic programming
- Iterate i from 0 to the length of the name
- For all words $w$ with $k$ meanings that end at position i in the string:
- `dp[i] += dp[i - len(w)] * k`
- Whatch out for integer overflow, use modular arithmetics

Solved by 25 teams
First solution after 31 minutes

# Get Off My Lawn, Author: Karl Johan Sande Heimark

- Let's say you want to see if $R$ is long enough for a chain
- Check how far away wall is. If $< R$, $\pi \cdot R^2$
- Otherwise it gets complicated :(
- Find size of circle sector that intersects with wall
- Find out how much of that sector is on the other side of the wall
- Subtract that area
- Profit

Solved by 18 teams
First solution after 53 minutes

# Get Off My Lawn, continued

- See blackboard along with this
- distance to line: $d = \frac{abs(x_2 y_1 - y_2 x_1)}{\sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}}$
- $\alpha = 2 \cdot cos^{-1}(\frac{d}{R})$
- $sector = \frac{\alpha \cdot \pi \cdot R^2}{2\pi} = \frac{\alpha \cdot R^2}{2}$
- $sectorOnOtherSide = sector - \frac{2 \cdot \sqrt{R^2 - d^2} \cdot d}{2}$
- $area = \pi \cdot R^2 - (\frac{\alpha \cdot R^2}{2} - \sqrt{R^2 - d^2} \cdot d)$

# Get Off My Lawn, continued

- How to find R?
- Binary search will do it
- Limits so small that you can do linear search

# Memory Game, Author: Torbjørn Morland

- Dynamic programming
- State: How many cards are left, how many of them do we know
- Let's say we have $N$ cards left, of which we know $K$
- Let's call the number of unknown cards left $n$. $n = N - K$. These are the cards you will be drawing from.
- Let's call the the number of unknown cards that do not have a match in the known cards $m$. $m = n - K$.

Solved by 12 teams
First solution after 61 minutes

# Memory Game, continued

- p1: Probability of drawing two matching unknown cards: $\frac{m}{n} \cdot \frac{1}{n-1}$
- p2: Probability of drawing two different unknown cards: $\frac{m}{n} \cdot \frac{m-2}{n-1}$
- p3: Probability of drawing a card we have seen before: $\frac{K}{n}$
- p4: Probability of drawing first an unknown, then a known: $\frac{m}{n} \cdot \frac{K}{n-1}$

# Memory Game, continued

- This gives the following value for dp[N][K]
- $p1 * (1 + dp[N-2][K])$
  $+p2 * (1 + dp[N][K+2])$
  $+p3 * (1 + dp[N-2][K-1])$
  $+p4 * (2 + dp[N-2][K])$
- This can be simplified a bit, but shows what the approach looks like

# Building Fences, Author: Torbjørn Morland

- Let's say you want to see if you can make the fence $L$ meters tall
- Try to make as many posts of lenght $L$ as you can from each pole
- If you get more than $N$, you are good
- Binary search for $L$
- Make sure you handle it properly if the pole divides evenly into $L$ length posts

Solved by 9 teams
First solution after 93 minutes