Monash Collegiate Programming Contest Editorial

Shizhe Zhao





Cast

- Coach: Shizhe Zhao
- Problem setters:
 - Ali Toosi, Monash
 - Jackson Goerner, Monash
 - Shizhe Zhao, Monash
- Tester:
 - Ali Khosravi, RMIT
 - Sublimation, Xidian University





Storage Room I/II

Author: Ali Toosi

• Constraint: $1 \le V \le 10^3$

■ Brute-force: try all possible *L*, *W*, *H*

Common mistakes:

- float-point error
- incomplete search
- bad pruning (3 nested loops)





Storage Room I/II

Author: Ali Toosi

- Constraint: $1 \le V \le 10^{12}$
- Observation:
 - assume $L \le W \le H$
 - thus $L \leq W \leq \sqrt{V}$
 - L, W must be divisor of V
 - #divisors of V in $[1, \sqrt{V}]$? Not too much!¹
 - Brute-force all possible *L*, *W* in divisors.





¹http://oeis.org/A066150

Fast and Furious I

Author: Shizhe Zhao

- Method 1: BFS status x, y, direction.
- Method 2: Greedy make |dx dy| as small as possible





Fast and Furious II

Author: Shizhe Zhao

- Dynamic programming: dp(x, y, step, d)
 - $dp(x, y, step, d) \rightarrow dp(x', y', step + 1, d')$
 - $step \leq 3 * (dx + dy) \approx 300$
 - memory cost: $50 * 50 * 300 * 4 = 3 * 10^6$

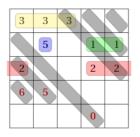


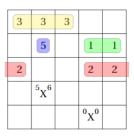




Hearty Frogger I/II

Author: Jackson Goerner

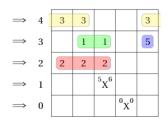


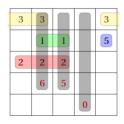


- Observation: change the frame of reference so that we can assume only Alice move, and she can take all hearts in left-up diagonal line.
- Thus, for version I, we can Brute-force all start and count values on left-up diagonal line.

Hearty Frogger I/II

Author: Jackson Goerner



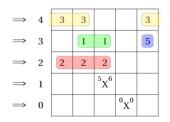


- For better visualization, we shift the *i*th row to right b i 1 position.
- For a spawn location (row, col, tl, tr), the best answer is $max(vert_sum(i)|i \in [l', r'])$.
- This is a range query problem assuming we already have the vert_sum from 0 to row.



Hearty Frogger I/II

Author: Jackson Goerner



3	3			3
	1	1		5
2	2	2		
	6	5		
			0	

- We can maintain such array by: processing rows from top to bottom, adding trucks on each row -
- which is a range updating problem
- Both range query and range updating can be handled by segment tree.

