BAPC 2009 Preliminary Rounds

The Solutions

2008-10-03

F. Box Village

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$$\text{print} \left\lceil \frac{n}{\lfloor d/d_1 \rfloor \cdot \lfloor w/w_1 \rfloor} \right\rceil ;$$

D. Family Politics

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- Circuit satisfiability, NP-Hard.
- Brute force: try all possible inputs (children)

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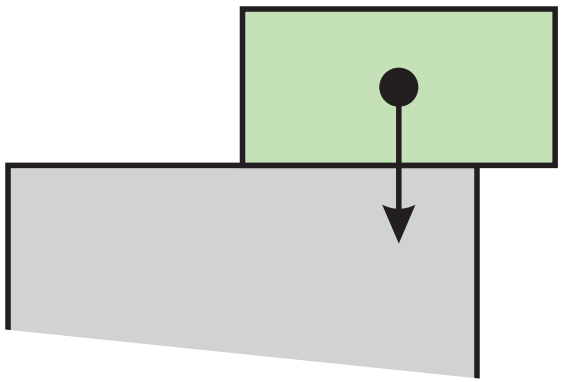
- Breadth first search 4 times (depending on team)
  1. crossing only grass
  2. crossing grass and flower beds
  3. crossing grass and gates
  4. crossing grass, gates and flower beds

G. Typechecker

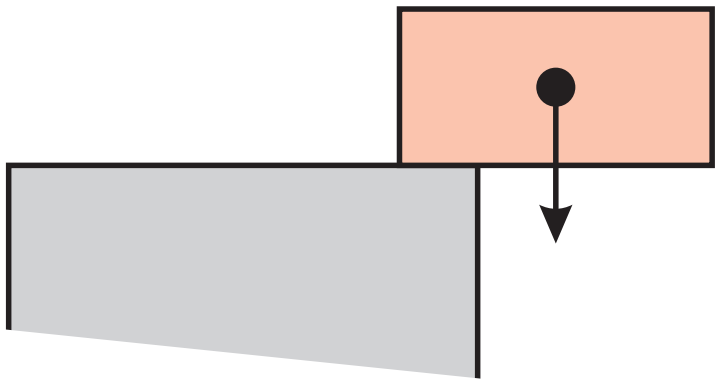
- An exercise in parsing.
- Calculate return types starting at the leafs.
- If a matching overload exists, use it.

C. Brick Stacking

- A stack is stable if its center of mass is supported.



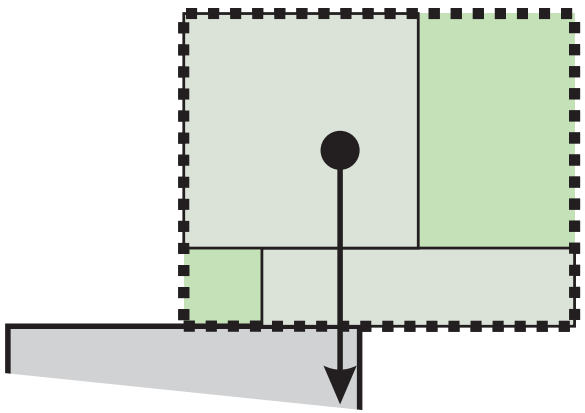
stable



unstable

C. Brick Stacking

- A stack is stable if its center of mass is supported.
- Work from the top down, fusing stable stacks together.



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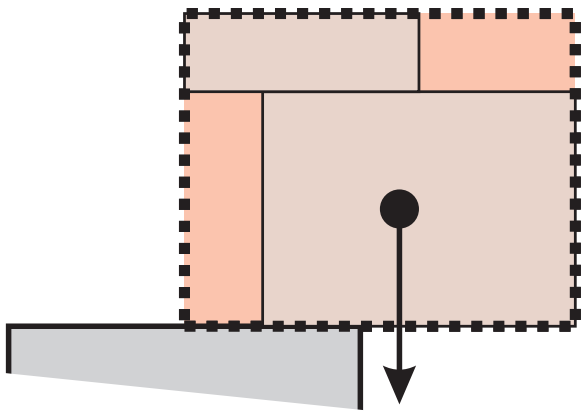

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- Solve $2 \cdot a \cdot \text{scale}^2 + 3 \cdot p \cdot \text{scale} = \text{material}$.

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  3. then it is the opponent's turn.
  4. if the opponent has a P, your R will be killed, as well as your next penguin.
  5. if the opponent has something else, only your R will be killed.

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$N(i, p)$ is number of penguins needed when starting with p.

$$N(i) = \min_p N(i, p)$$

$$N(i, p) = \begin{cases} N(i+1, p) & \text{if } p \text{ beats opp}(i) \\ N(i+1)+2 & \text{if opp}(i+1) \text{ beats } p \\ N(i+1)+1 & \text{otherwise} \end{cases}$$

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- Dynamic Programming makes this fast (start from the back of the line)

G. Word Search Puzzle

- Built trie for dictionary.
- For each cell, search in all directions.
- Is there a match in the trie?
- Mark all found words.

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- Too slow! $O(\#\text{items-in-box}^3)$ per item.

E. Box City

faster code

for each y in 0, $\langle$bottom of previous items$\rangle$

1. find items vertically intersecting $[y; y + h)$ (only these matter for this y coordinate.)
2. find a horizontal interval of size w that doesn't intersect these items.
3. if found, then place item there.

See you at the BAPC

BAPC 2009
October 17
Groningen