

Purdue University

Purdue Frosted Entropy

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Contest (1)

template.cpp

14 lines

```
#include <bits/stdc++.h>
using namespace std;

#define rep(i, a, b) for(int i = a; i < (b); ++i)
#define all(x) begin(x), end(x)
#define sz(x) (int)(x).size()
typedef long long ll;
typedef pair<int, int> pii;
typedef vector<int> vi;

int main() {
    cin.tie(0)->sync_with_stdio(0);
    cin.exceptions(cin.failbit);
}
```

.bashrc

3 lines

```
alias c='g++ -Wall -Wconversion -Wfatal-errors -g -std=c++17 \
-fsanitize=undefined,address'
xmodmap -e 'clear lock' -e 'keycode 66=less greater' #caps = <
```

.vimrc

6 lines

```
set cin aw ai is ts=4 sw=4 tm=50 nu nob bg=dark ru cul
sy on | im jk <esc> | im kj <esc> | no ; :
" Select region and then type :Hash to hash your selection.
" Useful for verifying that there aren't mistypes.
ca Hash w !cpp -dD -P -fpreprocessed \| tr -d '[[:space:]]' \
 \| md5sum \| cut -c-6
```

hash.sh

3 lines

```
# Hashes a file, ignoring all whitespace and comments. Use for
# verifying that code was correctly typed.
cpp -dD -P -fpreprocessed | tr -d '[[:space:]]' | md5sum |cut -c-6
```

troubleshoot.txt

52 lines

Pre-submit:

Write a few simple test cases if sample is not enough.
Are time limits close? If so, generate max cases.
Is the memory usage fine?
Could anything overflow?
Make sure to submit the right file.

Wrong answer:

Print your solution! Print debug output, as well.
Are you clearing all data structures between test cases?
Can your algorithm handle the whole range of input?
Read the full problem statement again.
Do you handle all corner cases correctly?
Have you understood the problem correctly?
Any uninitialized variables?
Any overflows?
Confusing N and M, i and j, etc.?
Are you sure your algorithm works?
What special cases have you not thought of?
Are you sure the STL functions you use work as you think?
Add some assertions, maybe resubmit.
Create some testcases to run your algorithm on.
Go through the algorithm for a simple case.
Go through this list again.
Explain your algorithm to a teammate.
Ask the teammate to look at your code.
Go for a small walk, e.g. to the toilet.
Is your output format correct? (including whitespace)

Rewrite your solution from the start or let a teammate do it.

Runtime error:

Have you tested all corner cases locally?
Any uninitialized variables?
Are you reading or writing outside the range of any vector?
Any assertions that might fail?
Any possible division by 0? (mod 0 for example)
Any possible infinite recursion?
Invalidated pointers or iterators?
Are you using too much memory?
Debug with resubmits (e.g. remapped signals, see Various).

Time limit exceeded:

Do you have any possible infinite loops?
What is the complexity of your algorithm?
Are you copying a lot of unnecessary data? (References)
How big is the input and output? (consider scanf)
Avoid vector, map. (use arrays/unordered_map)
What do your teammates think about your algorithm?

Memory limit exceeded:

What is the max amount of memory your algorithm should need?
Are you clearing all data structures between test cases?

Techniques (A)

techniques.txt

159 lines

Recursion
 Divide and conquer
 Finding interesting points in $N \log N$
 Algorithm analysis
 Master theorem
 Amortized time complexity
 Greedy algorithm
 Scheduling
 Max contiguous subvector sum
 Invariants
 Huffman encoding
 Graph theory
 Dynamic graphs (extra book-keeping)
 Breadth first search
 Depth first search
 * Normal trees / DFS trees
 Dijkstra's algorithm
 MST: Prim's algorithm
 Bellman-Ford
 Konig's theorem and vertex cover
 Min-cost max flow
 Lovasz toggle
 Matrix tree theorem
 Maximal matching, general graphs
 Hopcroft-Karp
 Hall's marriage theorem
 Graphical sequences
 Floyd-Warshall
 Euler cycles
 Flow networks
 * Augmenting paths
 * Edmonds-Karp
 Bipartite matching
 Min. path cover
 Topological sorting
 Strongly connected components
 2-SAT
 Cut vertices, cut-edges and biconnected components
 Edge coloring
 * Trees
 Vertex coloring
 * Bipartite graphs (\Rightarrow trees)
 * 3^n (special case of set cover)
 Diameter and centroid
 K'th shortest path
 Shortest cycle
 Dynamic programming
 Knapsack
 Coin change
 Longest common subsequence
 Longest increasing subsequence
 Number of paths in a dag
 Shortest path in a dag
 Dynprog over intervals
 Dynprog over subsets
 Dynprog over probabilities
 Dynprog over trees
 3^n set cover
 Divide and conquer
 Knuth optimization
 Convex hull optimizations
 RMQ (sparse table a.k.a 2^k -jumps)
 Bitonic cycle
 Log partitioning (loop over most restricted)
 Combinatorics

template .bashrc .vimrc hash troubleshoot techniques

Computation of binomial coefficients Pigeon-hole principle Inclusion/exclusion Catalan number Pick's theorem Number theory Integer parts Divisibility Euclidean algorithm Modular arithmetic * Modular multiplication * Modular inverses * Modular exponentiation by squaring Chinese remainder theorem Fermat's little theorem Euler's theorem Phi function Frobenius number Quadratic reciprocity Pollard-Rho Miller-Rabin Hensel lifting Vieta root jumping Game theory Combinatorial games Game trees Mini-max Nim Games on graphs Games on graphs with loops Grundy numbers Bipartite games without repetition General games without repetition Alpha-beta pruning Probability theory Optimization Binary search Ternary search Unimodality and convex functions Binary search on derivative Numerical methods Numeric integration Newton's method Root-finding with binary/ternary search Golden section search Matrices Gaussian elimination Exponentiation by squaring Sorting Radix sort Geometry Coordinates and vectors * Cross product * Scalar product Convex hull Polygon cut Closest pair Coordinate-compression Quadtrees KD-trees All segment-segment intersection Sweeping Discretization (convert to events and sweep) Angle sweeping Line sweeping Discrete second derivatives Strings Longest common substring Palindrome subsequences	Knuth-Morris-Pratt Tries Rolling polynomial hashes Suffix array Suffix tree Aho-Corasick Manacher's algorithm Letter position lists Combinatorial search Meet in the middle Brute-force with pruning Best-first (A*) Bidirectional search Iterative deepening DFS / A*
Data structures LCA (2^k -jumps in trees in general) Pull/push-technique on trees Heavy-light decomposition Centroid decomposition Lazy propagation Self-balancing trees Convex hull trick (wcipeg.com/wiki/Convex_hull_trick) Monotone queues / monotone stacks / sliding queues Sliding queue using 2 stacks Persistent segment tree	