

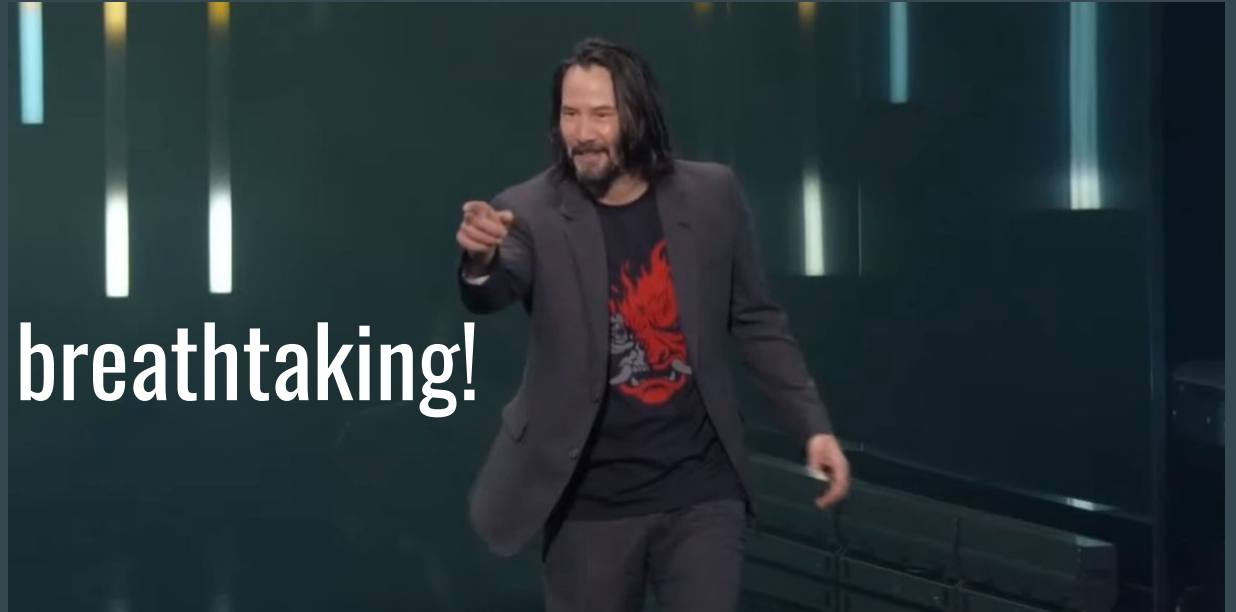
# Alberta Collegiate Programming Contest

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2019

**Good job everyone! - Judges :)**

**You're all breathtaking!**



# Statistics

# % of teams solving a problem: estimated and actual

Problem	Tony	Martin	Shaheed	Actual
Common Interests	30%	25%	10%	33%
Grenade	20%	1%	1%	36%
Voting	5%	0%	1%	0% :(
Zion's Grocery Store	90%	90%	99%	88%
Androids Frontline	30%	40%	40%	33%
Hans Vick	90%	95%	90%	82%
High Table	50%	30%	60%	56%
Zencrypted Zessages	50%	65%	55%	66%

# Quickest Time To Solve a Problem

Problem	Time (min)
Common Interests	66
Grenade	102
Voting	N/A
Zion's Grocery Store	7
Androids Frontline	102
Hans Vick	6
High Table	82
Zencrypted Zessages	7

**Solutions**

**Not going to go over details or take questions.  
Come to the next CPC meeting!**

# Common Interests

- Data Structures
- Author: Wenli Looi





# Common Interests

- Given everyone's interests, determine if 2 people have a common interest.
- Brute force is too slow.
- However you can show it will work if you do the following 2 things:
  - Memoize the answers: If the same query shows up again, return the cached answer.
  - When checking if 2 people have common interests, loop through the person with fewer interests and check if they are present in the other person.

# Grenade

- Geometry
- Author: Tony Cai



# Grenade

- Given  $n$  circles, each with radius  $r$ , determine if it's possible add another circle with radius  $r$  that intersects with all  $n$  circles
- There's a solution iff  $n$  circles with radius  $2r$  overlaps at some area
- One way is to check if there exists an intersection point between any two circles which is contained within all  $n$  circles

# Voting

- Combinatorics
- Author: Tony Cai



# Voting

- Problem is asking for number of ways to pick  $m$  subsets from a set of  $n$  elements, where each subset has size  $k$ , such that the intersection of all subsets is empty
- Let  $f(i, j)$  = number of configurations such where the intersection of  $m$  subsets (each with  $i$  elements) have  $j$  elements
- $f(i, j)$  = total number of ways to choose  $m$  subsets of size  $i$  - (ways to choose 1 intersecting element) \*  $f(i-1, j-1)$  - (ways to choose 2 intersecting elements) \*  $f(i-2, j-2)$  - ...
- Can be solved with dynamic programming (memoizing only on  $i$ , as  $j$  is implied from  $i$ )

# Androids Frontline

- Graph
- Author: Martin Tran

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# Androids Frontline

- Basic graph traversal
- Notice that any nodes with units essentially mean that all of that node's neighbours are directly connected.

# Hans Vick

- Greedy
- Author: Martin Tran





# Hans Vick

- Simple greedy problem.
- Sort by highest number of remaining rounds in magazines.

# High Table

- Tree
- Author: Modan Han



# High Table

- Construct tree, for all defects, traverse subtree.
- Can stop when visiting an already defected vertex. Otherwise will TLE.

# Zion's Grocery

- Implementation
- Author: Shaheed Ebrahim



# Zions Grocery Store

Get the last 3 numbers of each SKU -> Add them up -> Mod by 5

# Zencrypted...

- Implementation
- Author: Modan and Shaheed



# Zencrypted Zessages

Kind of annoying, but it's just implementation!

Shouldn't construct new strings every every split/concat, will TLE. Instead read/print from string in place, or use better things like `StringBuilder` in Java or `"".join()` in Python.

Also shouldn't linearly search for next start point, will TLE. Sort input pairs or similar.

**Thanks to everyone that participated, and  
thanks to everyone who helped working on  
this contest!**



<https://www.arcurve.com/join>

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