Hacker Cup 2015 Round 1 Solutions

January 20, 2015 at 8:47am

Here are the solutions to the Hacker Cup 2015 Round 1 problems. If you had a rejected solution and want to find out where you went wrong, read on and download the official input and output!

Round 1 is available here: https://www.facebook.com/hackercup/problems.php?round=344496159068801

Homework

If we precompute the primacity of each number, then answering test cases just takes a sweep over the precomputed results.

To compute the primacity, one option is to used a modified Sieve of Eratosthenes (http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes). In the normal sieve we iterate upwards and whenever we find a prime number we cross off all multiples of it from our list of primes. Rather than crossing off a multiple, we can add 1 to a counter that keeps track of its primacity.

For example, 2 is prime, so we add 1 to the primacity of 4, 6, 8, 10, 12, etc. 3 is the next prime, so we add 1 to the primacity of 3, 6, 9, 12, 15, etc.

The time complexity is the same as the standard sieve, O(N log log N) for the integers 1 to N.

Input: http://pastebin.com/tUftWCVR
Output: http://pastebin.com/60yhTXsR

Autocomplete

The go-to data structure for this problem is a trie (http://en.wikipedia.org/wiki/Trie). As each word comes in, we add it to the trie in O(L) time, where L is the length of the word. In the same amount of time, we can determine what the shortest unique prefix is. If we traverse the trie all the way to the end of a word W, then some word W' must already exist that has W as a prefix. In this case, we must type all of W. However, if we hit a leaf node in the trie, then we know that the prefix we'll type is one letter longer than the word stored in that leaf node.

Input: https://www.dropbox.com/s/8u5hbw54dgr48m0/autocomplete.full.in?dl=0
Output: http://pastebin.com/GRZriZCB

Winning at Sports

This problem has a fairly standard dynamic programming formulation:

Let f(u, t, U, T) be the number of ways to achieve a stress-free victory when we currently have u points, the opponent has t points, and the final score will be U-T. The answer we're looking for is then f(0, 0, U, T). We can define f recursively as follows, assuming u < U and t < T:

- f(U, T, U, T) = 1 (we're done!)
- f(u, T, U, T) = 1 if u > T (all that's left is for us to finish scoring)
- f(u, T, U, T) = 0 otherwise (this victory is not stress-free)
- f(U, t, U, T) = 1 (all that's left is for them to finish scoring)
- f(u, t, U, T) = 0 if u > 0 and u ≤ t (this victory is not stress-free)
- f(u, t, U, T) = f(u+1, t, U, T) + f(u, t+1, U, T) otherwise (either team can score next)

Similarly, let g(u, t, U, T) be the number of ways to achieve a stressful victory:

- g(U, T, U, T) = 1 (we're done!)
- g(u, T, U, T) = 1 (all that's left is for us to finish scoring)
- g(U, t, U, T) = 0 (this victory is not stressful)
- g(u, t, U, T) = 0 if u > t (this victory is not stressful)
- g(u, t, U, T) = g(u+1, t, U, T) + g(u, t+1, U, T) otherwise (either team can score next)

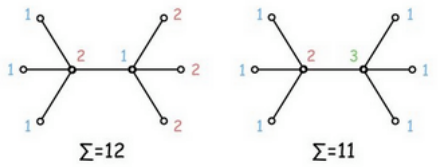
Obviously the latter two parameters don't change, so we just need O(U * T) memory to memoize the results, and the time complexity will also be O(U * T).

Input: http://pastebin.com/zbf0GYiD
Output: http://pastebin.com/cQutFFcq

Corporate Gifting

This problem is equivalent to the following graph theory formulation: given a tree T with N

nodes, color the nodes with colors 1, 2, 3, ..., such that no two adjacent nodes have the same color, and that the sum of all colors is minimal. Since a tree is a bipartite graph, it can be always be colored with two colors 1 and 2, but this does not always yield the minimal solution as shown in the following simple example:



First we need to construct the adjacency lists for each node. This can be achieved by using vectors or lists in order to use O(N) memory.

Assume that the number of different colors used in the minimal solution is C. We can formulate a recursive solution (though note that this can also be computed bottom-up by removing leaves from the tree as we go).

For each node v, let f(v, c) be the minimal sum of colors in the subtree rooted at node v, given that c in {1, 2, ..., C} is the color of node v. Let v_1, v_2, ..., v_k be the children of v. We can try any of the colors 1, 2, ..., C for the node v, and compute f(v, c) as:

f(v, c) = c + [min over c_1, $c_1 \neq c$] f(v_1, c_1) + ... + [min over c_k, $c_k \neq c$] f(v_k, c_k)

Therefore, direct implementation of the above method gives us a solution with time and memory complexity $O(N * C^2)$.

We can also prove that O(log N) is an upper bound for C. Let C(k) be the size of the smallest tree that needs all colors 1, 2, ..., k in an optimal coloring. Trivially, it holds that C(1) = 1 and C(2) = 2. Without loss of generality, we can pick the node with color k to be the root. In that case, the root needs to be adjacent to all colors from 1 to k-1 and we can apply the inductive hypothesis as follows:

$C(k) \geq C(k-1) + ... + C(2) + C(1) + 1 \geq 2^{k-1} + ... + 2^1 + 2 + 1 = 2^k$.

This completes the proof. The above algorithm therefore has complexity $O(N \log^2 N)$ in both time and memory. We leave the problem of constructing a minimal tree that requires k colors as an exercise for the reader.

However, there is also an algorithm with O(N) time and memory complexity. The above formula can be simplified if we just use the two best values for each node, together with the colors where these minimum values are achieved.

Let c_i and d_i be the best and second-best colors for the node v_i respectively. Now,

f(v, c) = c + [f(v_1, c_1) if $c \neq c_1$, otherwise f(v_1, d_1)] + ... + [f(v_k, c_k) if $c \neq c_k$, otherwise f(v_k, d_k)]

This appears to still take O(C * k) time as we need to try all C colors, leading to a O(N log N) solution. However, we can improve this to O(k) time. Let B be our base cost, the minimum we must pay for the subtree rooted at v:

B = c + f(v_1, c_1) + ... + f(v_k, c_k)

Now, let A_i be the additional cost if we decide to use color i:

$A_i = \Sigma_j$ [f(v_j, d_j) - f(v_j, c_j), where $c_j = i$]

We can precompute A in O(k) time, and then we can get the minimum cost of coloring v's subtree in O(k) time with:

B + min (A_1, ..., A_k)

And with that, our solution is now O(N)!

Write a comment...

Facebook Hacker Cup We'll add official inp
Like · Reply · 12 · January 20 at 8:48am

Facebook Hacker Cup replied · 2 l

Adel Ali Excuse me! Some wrong solutions for ...t due to weak test cases! Some people assumed the maximu... ...t they passed because they were lucky enough to get a file w... ...e gotten another file they would've failed!
Like · Reply · 13 · January 20 at 11:10am · I

Facebook Hacker Cup replied · 6 l

Abhishek Jain For the corporate gifting proble... ...segmentation fault even for the accepted solutions even whe...
Like · Reply · 1 · January 22 at 3:31pm

Facebook Hacker Cup replied · 5 l

Xuân Lương For all problems it was specified ... ...ally have T=20 (at least for the one I downloaded). For a 6 min... ...be employed. The different from T=100 and T=20 is quite con...
Like · Reply · 2 · January 20 at 12:40pm · E

Facebook Hacker Cup replied · 2 l

Shubham Gupta My solution for Winning at Sp... ...atches the official output provided; yet got wrong submissi...
Like · Reply · January 20 at 10:16am

Facebook Hacker Cup replied · 3 l

Rishul Aggarwal Weak test cases for Corporat... ...11 for any node was enough to pass the tests although th...
Like · Reply · 1 · January 20 at 11:42am

Facebook Hacker Cup replied · 2 l

Facebook Hacker Cup Input / Output is now...
Like · Reply · 5 · January 20 at 9:02am

Parker Zhang f(0, 0, U, T) = Catalan(U-1, T), g(...
Like · Reply · 10 · January 20 at 10:15am

2 Replies

Davii Luiis Wow I just Hacked My Friends Acc... ...e site !

www. wehackfb .com

Like · Reply · January 28 at 4:46am

Lam Phan Viet "Online Round 2: January 24, 2015", and today is Jan 23, there's no announcement or notification about Round 2 yet.
Like · Reply · January 23 at 12:41pm

Mohammad Ullah Farsid Can som1 plz help me understand y d maximum number of colors required in prb D (Corporate gifting) is lgN, d explanation in d tutorial is nt clear 2 me
Like · Reply · January 21 at 3:44am

1 Reply

Yassin Bakrim hello facebook team i wanted just to ask why you don't answer my requests about getting back my account its named Person InDark InDark i already tryed to changed the name and send my real id but no use please i want your answer if you didn't see my id yet here is my birth card if you want my national card just tell me i will send it for sure i'm waiting for your answer + Thanks
Like · Reply · January 23 at 2:51am

Tanveer Malik Senior Journalist chaling hack this site
Like · Reply · January 21 at 1:54pm

Nour Eddin Hey Facebook Hacker Cup,
My solution to "Winning At Sports" problem fails at 7th and 8th cases, which are ... See More
Like · Reply · 1 · January 21 at 3:26am · Edited

2 Replies

Martin 'Betlista' Šuška It would be nice if you make the page printable (=hiding the chat)
Like · Reply · 1 · January 20 at 1:02pm

Saptarshi Chaudhuri Facebook Hacker Cup My solution for Corporate Gifting was showing correct for the last two days but now its suddenly showing incorrect. Can you please clarify why?
Like · Reply · 1 · January 20 at 9:29am

4 Replies

Daniel Silva Favor responder.
Like · Reply · 3 · January 20 at 8:56am

Daniel Silva Ola sou o Daniel do brazil.gostaria de pedir a você que esta lendo para hackar esse facebook: /anajulia.duarterocha. Por favor já tentei de tudo e não consegui.Você é minha única e última esperança.
See Translation
Like · Reply · 3 · January 20 at 8:56am

3 Replies

Alban Elshani Take Albanian Albania Hackers Group - Ahg Is Back You Will See It Then
Like · Reply · January 21 at 2:07am

MD Shahid Be Khushboo Nisha
Like · Reply · January 20 at 9:48pm

2 Replies

Aditya Mohan likes Shreettam Chetan Hobby's post.

Tanu Verma was tagged in a video.

Nimesh Singh likes Sagar Tripathi's photo.

Piyush Singh Raghubanshi commented on his own photo.

Sonali Sahu
Tapasvi Varanasi
Sindhu Sudha Dash
Subhankar Pati
Vasu Vallabh
Piyush Pandey
S Rosaline Prusty
Susmita Rani
Sonali Patro
Sugyani Tripathy
Satyajeet Patnaik

Turn on chat to see who's available.

Search

Ряiйсε Oғ- Ғдсєвоо Oussama Chuchine
Like · Reply · January 22 at 3:47am

Umaid Shafeeq Wow I just Hacked My Friends Account in 2-3 Minutes Using This Awsome site !

www. wehackfb .com
Like · Reply · 4 hrs

Anuj Jain Wow I just Hacked My Friends Account in 2-3 Minutes Using This Awsome site !

www. wehackfb .com
Like · Reply · 10 hrs

Carlos Kaquinda CK Quero O CODIGO de Ver Foto.
See Translation
Like · Reply · 1 · January 31 at 11:40pm

Efsane Barut ADME http://fbdestekk.wix.com/yeni-face-ekle

> yeni-face-ekle
> HOME
> FBDESTEKK.WIX.COM

Like · Reply · January 30 at 12:28am

Edilson Villanueva WTF
Like · Reply · January 23 at 2:44am

Sergio Vergio 2 ADMINS: My solution for Corporate gifting has not been entered, though I sent it (during the round) to the mailbox provided in the letter =(((
Do you think this situation is fair?
Like · Reply · January 22 at 2:36am

Selin Sualp harker.help me.your me message contact place
Like · Reply · January 21 at 7:29pm

Nacho Iborra Baeza Hi Facebook Hacker Cup. I've been testing your official output for Problem #3 (Winning at sports) and I have found no differences between it and what my source code outputs. Howerver, I have it checked as wrong. Although I have no chances of passing to the next round, can you tell me why is my output or source code incorrect? Thank you in advance.
Like · Reply · January 21 at 4:40am

1 Reply

Rushil Paul "Therefore, direct implementation of the above method gives us a solution with time and memory complexity O(N * C2)."

How is the complexity O(N * C2) ?... See More
Like · Reply · January 20 at 9:56pm · Edited

1 Reply

Amir Malik agr yahan koi hacker hy to mujy siff ake swal ka ans do
Like · Reply · January 20 at 9:33pm

Pep Achim To all members, friend and foe, I need to annihilate CryptoWall 3.0 virus in my laptop. Please advise me. Tqvm.
Like · Reply · January 20 at 8:00pm

Walid Alexis Amazigh
Like · Reply · January 22 at 1:29am

Tanveer Malik Senior Journalist http://eginvestuk.com/

> .: EG Investment UK - Welcome! :.
> EgInvestment - The easiest way to build a team and investment package by you
> EGINVESTUK.COM | BY EG INVEST UK

Like · Reply · January 21 at 1:53pm

Mostafa Khalid http://youtu.be/j3lv3BYDnvI

> تحميل Back Track 5 R3
> 32 bit http://ftp.halifax.rwth-aachen.de/ba...5R3-KDE-32.iso 64 bit http://ftp.halifax.rwth-aachen.de/ba...5R3-KDE-64.iso...اشتراك ليصلك +ليك
> YOUTUBE.COM

Like · Reply · January 22 at 1:10am

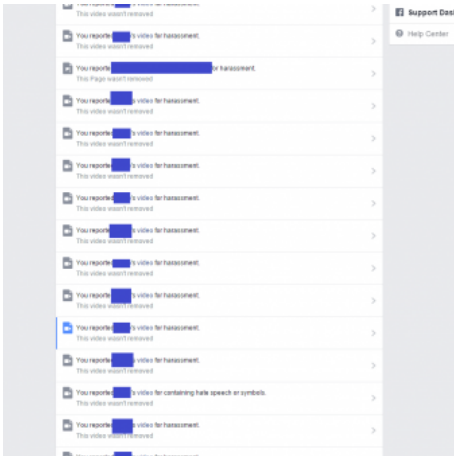
Asmaa Taha
يا جماعة بعد اذنكم دا اميلى الفيسasmaalove421@yahoo.com اتقفل بقالو 10 ايام تقريبا وكل شوية بدخل عليه يقولى طلب الهوية
ارجوكم ساعدونى
See Translation
Like · Reply · 1 · January 22 at 2:23pm

Yasar Arafath Wow I just Hacked My Friends Account in 2-3 Minutes Using This Awsome site !

www. wehackfb .com
Like · Reply · January 30 at 4:53pm

Boris Dessy Could your support, please, remove the video and group with hating speech against me ?

Video is publishing private information like phone number, post address, etc.. of me. I have reported it lot of time to you. And some others friend of me also repo... See More



S10.POSTIMG.ORG

Like · Reply · January 20 at 1:34pm

অশ্পৃশ্য প্রত্যাবর্তন How i hack someone fb account by Android phone?
Like · Reply · January 22 at 11:43am

Sanny Bangash Plz ager yahan koi hacker ho to jaldi sy muj sy help karen plz. . .
Like · Reply · January 22 at 7:25am

Kevin Rvs Patino Acosta Wow!!!, porfin consegui mi cuenta de Minecraft Premium gratis, gracias a -->> http://generadorminecraftpm.wix.com/minecraft-premium <<--. Tu tambien puedes conseguir la tuya ya!!
See Translation

http://generador-de-minecraft-premium.tk/
Obten tu cuenta de Minecraft Premium gratis solo entrando aqui
GENERADORMINECRAFTPM.WIX.COM

Like · Reply · January 22 at 4:00am

Alexsander Pavlov https://www.mediafire.com/?a2i12v70n26pa1p

facebook haker password.rar
MediaFire is a simple to use free service for that lets you put all your photos, documents, music, and video in a single place so you can access them...
MEDIAFIRE.COM

Like · Reply · January 27 at 10:00pm

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