

Introducción a la Programación Competitiva

MSc. (c) Jhosimar George Arias Figueroa

jariasf03@gmail.com

State University of Campinas
Institute of Computing

Contenidos

- 1 Motivación
- 2 Objetivos
- 3 Tips Para Ser Competitivo
 - Análisis de Algoritmos
 - Tipos de Problemas
- 4 Sitios para Entrenar
 - Jueces Online
 - Veredictos en los jueces
 - Concursos Virtuales Online
- 5 Concurso Regional
- 6 Enlaces Importantes

Motivación

- Sirven de entrenamiento para problemas de la vida real.
- Conocer gente con los mismos intereses (algoritmos, computación, etc), de cualquier parte del mundo.
- Representar a tu país/universidad/colegio, viajar (a otros países o regiones).
- Conseguir trabajo en importantes empresas como Google, Facebook, etc.

Objetivos

Dado un problema, queremos:

- Resolverlo eficientemente usando algoritmos y estructuras de datos.
- Convertir nuestra solución en un programa.
- Hacerlo tan rápido como sea posible (bajo presión).
- Hacerlo correctamente (sin bugs).

Tips Para Ser Competitivo

- 1 Tipear tu solución rápida y correctamente.
- 2 Identificar rápidamente tipos de problemas.
- 3 Realizar análisis de algoritmos.
- 4 Ser experto en lenguajes de programación.
- 5 Ser experto en el arte de testear un código.
- 6 Práctica y Mas Práctica.
- 7 Trabajo en Equipo(Concursos en equipo).

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Análisis de Algoritmos

Dado el límite máximo para un problema, puede el actual algoritmo que he desarrollado resolverlo dentro del tiempo/memoria límite dado en el problema?

Pasos importantes:

- Ver las restricciones del problema.
- Pensar en el algoritmo mas simple que pueda resolver el problema.
- Realizar el análisis respectivo para convercernos que nuestro algoritmo es correcto antes de comenzar a tipear.

Regla de Oro: Lluvia de ideas de posibles algoritmos que puedan resolver el problema y escoger el mas simple.

1255 – Substring Frequency

A string is a finite sequence of symbols that are chosen from an alphabet. In this problem you are given two non-empty strings **A** and **B**, both contain lower case English alphabets. You have to find the number of times **B** occurs as a substring of **A**.

Input

Input starts with an integer **T** (≤ 5), denoting the number of test cases.

Each case starts with two lines. First line contains **A** and second line contains **B**. You can assume than $1 \leq \text{length}(\mathbf{A}), \text{length}(\mathbf{B}) \leq 10^3$.

Output

For each case, print the case number and the number of times **B** occurs as a substring of **A**.

Sample Input	Output for Sample Input
4	Case 1: 0
axbyczd	Case 2: 4
abc	Case 3: 2
abcabcabcabc	Case 4: 5
abc	
aabacbaabbaz	
aab	
aaaaaa	
aa	

Solución

```
void naiveMatching( string A , string B ){
    int n = A.length() , m = B.length();
    int i , j , respuesta = 0;
    for( i = 0 ; i <= n - m ; ++i ){
        for( j = 0 ; j < m ; ++j ){
            if( A[ i + j ] != B[ j ] )
                break;
        }
        if( j == m )
            respuesta++;
    }
    return respuesta;
}
```

Complejidad: $O(n * m)$

Peor Caso: $1000 * 1000 = 1000000$

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axbyczd	Case 2: 4
abc	Case 3: 2
abcabcabcabc	Case 4: 5
abc	
aabacbaabbaz	
aab	
aaaaaa	
aa	

Mejor Solución

Veamos el peor caso para el primer algoritmo:

$$O(n * m) = 10^6 * 10^6 = 10^{12}$$

Respuesta de juez: **Tiempo Limite Excedido**

Es necesario usar una mejor solución:

- Knuth-Morris-Pratt's (KMP)
- Suffix Array

Complejidades

Complejidades basicas para algoritmos iterativos y recursivos:

- Un algoritmo con **k** bucles anidados con alrededor de **n** iteraciones tiene una complejidad de **$O(n^k)$**

```
for( int a = 0 ; a < n ; ++a )  
    for( int b = 0 ; b < n ; ++b )  
        for( int c = 0 ; c < n ; ++c )  
            ...  
                for( int k = 0 ; k < n ; ++k )
```

Complejidades

- Si el algoritmo es recursivo con b llamadas recursivas por nivel y tiene L niveles, el algoritmo tiene una complejidad aproximada de $O(b^L)$ pero esto solo es un aproximado limite superior. La verdadera complejidad varia acorde a las acciones realizadas dentro de cada nivel.

Complejidades

n	Complejidad posible en el peor Caso	Posibles Algoritmos
≤ 10	$O(n!)$, $O(n^6)$	Permutation
≤ 15	$O(2^n \times n^2)$	DP TSP
≤ 20	$O(2^n)$, $O(n^5)$	DP + bitmask, Sumsets
≤ 50	$O(n^4)$	DP de 3 dimensiones + bucle $O(n)$
≤ 100	$O(n^3)$	Floyd Warshall
$\leq 1K$	$O(n^2)$	Bubble/Selection/Insertion Sort
$\leq 100K$	$O(n \log_2 n)$	Merge Sort, construcción de Segment Tree
$\leq 1M$	$O(n)$, $O(\log_2 n)$, $O(1)$	Binary Search, Query en un Segment Tree

Ejercicios

Tenemos n paginas web ($1 \leq n \leq 10^6$). Cada pagina web i tiene un ranking r_i . Se desea obtener las 10 primeras paginas con el mejor ranking.

Ejercicios

Tenemos n paginas web ($1 \leq n \leq 10^6$). Cada pagina web i tiene un ranking r_i . Se desea obtener las 10 primeras paginas con el mejor ranking.

Posibles soluciones:

- 1 Cargar todas las n paginas web con su ranking en memoria, ordenarlos en forma descendiente por el ranking de cada pagina y mostrar las 10 primeras paginas web.
- 2 Usar la estructura de datos cola de prioridad (un heap).

Cual es la mejor?

Ejercicios

Se pide determinar la ruta mas corta entre dos vertices en un árbol con $|V| \leq 10^5$ y $|E| \leq |V| - 1$. Cual de los siguientes algoritmos puede ser usado en un concurso de programación?

- 1 Breadth First Search (BFS)
- 2 Dijkstra
- 3 Bellman Ford
- 4 Floyd Warshall
- 5 Kruskal
- 6 Lowest Common Ancestor (LCA)

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- ➊ Breadth First Search (BFS) $O(|V| + |E|)$
- ➋ Dijkstra $O((|V| + |E|) * \log(|V|))$
- ➌ Bellman Ford $O(|V| * |E|)$
- ➍ Floyd Warshall $O(|V|^3)$
- ➎ Kruskal Minimum Spanning Tree

Ejercicios

Si al problema anterior se le pide hallar la ruta más corta pero dado un determinado número de consultas entre diferentes pares de vértices en el árbol. Cual de los siguientes algoritmos puede ser usado?

- 1 Breadth First Search (BFS)
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- 1 Breadth First Search (BFS) $O(|V| + |E|)$
- 2 Dijkstra $O((|V| + |E|) * \log(|V|))$
- 3 Bellman Ford $O(|V| * |E|)$
- 4 Floyd Warshall $O(|V|^3)$
- 5 Lowest Common Ancestor $\langle O(|V| * \log(|V|)), O(\log(V)) \rangle$

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Tipos de Problemas

- Ad hoc
- Data Structures
- Complete Search - Backtracking
- Divide & Conquer
- Greedy
- Dynamic Programming
- Graph
- Mathematics
- String Processing
- Computational Geometry
- Advanced Topics


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Universidad de Valladolid (UVA)


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Welcome to the UVA Online Judge


Here you will find hundreds of problems. They are like the ones used during programming contests, and are available in HTML and PDF formats. You can submit your sources in a variety of languages, trying to solve any of the problems available in our database.

See the new [Contest Rankings](#) section at the Live Rankings link.

Now you can use the new **Quick access, info and search** option on the left menu for and easier navigation. (The tool will be updated next days for a more complete information)

[Follow us on Twitter @UVaOnlineJudge !!](#)

Are you proud of your solutions? Do you have anything to show the rest of the problemsolvers? We're looking for people to help us in the publishing of a collection of books with solutions for the problems in the UVA Online Judge. More information [here](#).


Categorized set of problems



This book contains a collection of relevant data structures, algorithms, and programming tips written for University students who want to be more competitive in the **ACM International Collegiate Programming Contest (ICPC)**, high school students who are aspiring to be competitive in the **International Olympiad in Informatics (IOI)**, coaches for these competitions, and basically anyone who loves

From Baylor to Baylor

Now 25% off in paperback and available as a PDF download!

From Baylor to Baylor preserves the legacy of the ACM-ICPC World Finals. The book contains all the problems used during the 1991 to 2006 competitions, carefully typeset and formatted to the highest standard. Also, almost 100 figures



desafios de programación


Coming Contests
No contests scheduled

uHunt



uHunt

hunt problems that matter

uHunt is a complementary tool for [UVA online-judge](#) that keeps statistics, provide selections of problems to solve, and exposes a web API for other web developers to build upon it. See [a brief history of uHunt](#).

To submit your solution, use [UVA Quick Submit](#).

Your UVA username:

View

Search Problem Number:

Search

Clear

```
-- Users(7/159):1h
felix_halmi:1h
mgavind:2:1h
migue:1h
nasher:1h
nealzone:1h
seeva92:1h
uDebug:1h
```

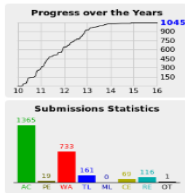
[Sign In]






```
nasher> Now it gives a compiler error on the judge, but not on
my computer ... thanks for looking
maru0001> what's wrong with UVA.....????????
yeasIntamim> Hello_world>>>.....Life is nothing but problem
solving :)
TurtieShip> Hello guys. I built a website to share solutions to
coding competitions, including UVA : http://codingyard.com/ Please
feel free to visit and leave feedbacks! :)
dibery> I visited some pages. Some fonts seemed to be not very
readable. (Like problem information block.)
TurtieShip> ah,,, thanks for the feedback! I will change the fonts
:)
milesstevenson> When you register, it would be nice if the
passwords were showed as a sequence of "*" characters rather
than the actual password
```

post your message here (max 255 chars)

Live Submissions (hide)										Show: 5 10 25 50 100				
#	Problem Title	User (username)	Verdict	Lang	Time	Best	Rank	Submit Time						
10090081	10038 Jolly Jumpers	discuss Rishiraj Surti (rishirajsurti)	Time limit	C++	3.000	0.000	-	31 secs ago						
10090080	10038 Jolly Jumpers	discuss Rishiraj Surti (rishirajsurti)	Time limit	C++	3.000	0.000	-	60 secs ago						
10090079	11057 Rational Billiard	discuss 关元长 (vjudge1)	Accepted	C++11	0.000	0.000	7	1 mins ago						
10090078	11802 Bafana Bafana	discuss 赵子龙 (vjudge3)	Accepted	ANSI C	0.000	0.000	524	1 mins ago						
10090077	11057 Rational Billiard	discuss 赵子龙 (vjudge3)	Accepted	C++11	0.000	0.000	6	1 mins ago						

Jhosimar George Arias Figueroa (Jariasf) statistics



Last Submissions			Show: 5 10 50 100 500 ALL				
Problem		Verdict	Lang	Time	Best	Rank	Submit Time
907 - Winterim Backpackin...	 discuss	Accepted	C++	0.015	0.000	285	2015-05-01 20:06
907 - Winterim Backpackin...	 discuss	Wrong answer	C++	0.016	0.000	-	2015-05-01 19:58
10050 - Hartals	 discuss	Accepted	C++	0.009	0.000	5146	2015-02-27 22:07
12859 - Fence the vegetables	 discuss	Accepted	C++	0.498	0.176	9	2014-11-22 16:30
12855 - Black and white ston...	 discuss	Accepted	C++	0.019	0.000	38	2014-11-22 01:20

Solved : 1045, Submissions : 2464

```
100 102 103 104 105 106 108 111 112 113 116 117 118 119 120 122 123 124 125 130 133 136 140 142 146 147 148 151 152 154 156 160 161 162 164 166
167 168 170 184 186 190 191 193 195 200 208 210 220 227 231 232 247 253 255 256 259 260 263 264 271 272 275 278 280 284 291 294 296 297 299 302
305 311 314 315 321 324 331 332 334 336 340 341 343 344 347 350 352 353 355 357 369 371 372 374 377 378 382 383 386 389 392 394 397 401 402 406
408 409 410 414 417 422 423 424 429 432 435 436 437 438 439 440 441 443 445 446 450 452 454 455 458 459 460 462 465 466 469 471 474 476 477
478 481 482 483 484 485 486 487 488 489 490 492 494 495 496 497 498 499 501 507 514 524 526 530 531 532 534 536 537 539 540 541 543 544 545 546
547 548 550 552 553 556 558 561 562 563 567 568 572 573 574 575 576 579 583 584 590 591 594 598 599 601 608 610 612 615 616 621 623 624 626 627
628 630 637 639 640 642 644 647 652 657 661 663 670 673 674 677 679 681 686 694 696 699 700 703 706 711 712 713 714 719 725 727 729 732 739 741
743 745 748 750 753 755 756 759 760 762 763 765 766 768 775 786 793 796 820 821 825 833 834 836 837 847 852 855 865 868 869 871 872 880 884 893
895 897 900 902 907 908 910 913 914 920 924 925 926 927 928 929 939 941 944 957 962 967 974 978 983 988 989 990 991 993 1047 1062 1103 1124 1152
1184 1194 1195 1197 1198 1200 1201 1203 1207 1208 1209 1210 1213 1223 1225 1227 1230 1234 1235 1237 1239 1241 1246 1247 1249 1260 1010 10000
10004 10005 10006 10007 10008 10009 10010 10013 10015 10016 10017 10018 10019 10020 10023 10026 10029 10034 10035 10036 10038 10041 10042 10044 10047 10048 10050 10054 10055 10058
```

ACM ICPC Live Archive


ACM-ICPC Live Archive

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Welcome to the ACM-ICPC Live Archive

Here you will find hundreds of problems used in the ACM-ICPC Regionals and World Finals. You can submit your sources in a variety of languages, trying to solve any of the problems available in our database.

New Live Archive platform

We have migrated the ACM-ICPC Live Archive to a new platform. The users of the UVa Online Judge will find it familiar. If you had previously set a nickname and a password in the old Live Archive, use those to log in. If you didn't have a nickname or it doesn't work, try with your user ID (including the two letters) as username. If your still not able to log in, use the 'Forgot login?' link to recover your username and get a new password in your registered email address. Once you are logged in, you will be able of changing your username, password and other contact info.

Now you can quickly search and access to the problem description without having to browse through the problem's categories. Just click on the [Quick access, info and search](#) option on the left menu, fill in the forms and have an easy navigation. (The tool will be updated next days for a more complete information)

Follow us on Twitter [@ICPCLiveArchive](#) !!

Book: From Baylor to Baylor

Now 25% off in paperback and available as a PDF download!

From Baylor to Baylor preserves the legacy of the ACM-ICPC World Finals. The book contains all the problems used during the 1991 to 2006 competitions, carefully typesetted and formatted to the highest standard. Also, almost 100 figures have been completely redrawn to improve their printed quality. Prefaced by William B. Poucher from Baylor University (Texas) and coordinated by Miguel A. Revilla from Universidad de Valladolid (Spain), this work is the definitive guide to 16 years of history of the International Collegiate Programming Contest, published thanks to the collaboration of the Competitive Learning Institute and the Competitive Infrastructure Initiative. This book is tribute to all the staff, contestants, judges and volunteers that made it possible.

Buy it paperback (25% off) [here](#).
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From Baylor to Baylor
1991-2006
ACM-ICPC World Finals



Programming Challenges
The Programming Contest Training Manual
Steven S. Skiena
Miguel A. Revilla

Coming Contests

No contests scheduled

TopCoder



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Competitive Programming



Test your **algorithm skills**.

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Competitive Programming at Topcoder

TopCoder Arena

The screenshot displays the TopCoder Arena interface. At the top, there's a navigation bar with links: Main, Lobbies, Options, Practice Rooms, Active Contests, and Help. The main header area includes the TopCoder logo, a Google logo, and a status bar showing 'COMPETITION ARENA > Lobby: Chat Room 1'. A message box states 'Single Round Match 582 has completed.' and a clock shows 'TOPCODER TIME 10:56:40 PM PET'. On the left, a 'RATING KEY' section lists various ratings and a 'Who's here' list shows users like jarlaf, Oasatyasai100, Oawdreader, Fans_Hu, kaylei, and halfcoder. A 'Chat Area' on the right shows a system message: 'System> jarlaf has entered the room.' At the bottom, there are 'Chat' and 'Find' buttons and a text input field.

[TOPCODER] Also try Software Design & Development

Main Lobbies Options Practice Rooms Active Contests Help

COMPETITION ARENA > Lobby: Chat Room 1

Single Round Match 582 has completed.

TOPCODER TIME
10:56:40 PM PET

Connection Status: ●

RATING KEY

- 2200+
- 1500-2199
- 1200-1499
- 900-1199
- 600-899
- NON-RATED
- ADMIN

Who's here [6]

- R Handle
- jarlaf
- Oasatyasai100
- Oawdreader
- Fans_Hu
- kaylei
- halfcoder

Chat Area

System> jarlaf has entered the room.

Chat Find

>>

Codeforce


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[HOME](#) [CONTESTS](#) [GYM](#) [PROBLEMSET](#) [GROUPS](#) [RATING](#) [API](#) [HELP](#) [TESTLIB](#) **5 YEARS!**


Educational Codeforces Round 5

 By [Edvard](#), [history](#), 36 hours ago, translation,

Hi, Codeforces!

Happy New Year! Holidays and 2015 year have passed and year 2016 is ahead. I wish you good luck in programming competitions and achieving all of your goals this year.



Educational Codeforces Round 5 will take place on [11 January 2016 at 18:00 MSK](#) for the first and second divisions. You can read about educational rounds [here](#) and [here](#).

<A year has passed, but paragraph remains unchanged.>

→ Pay attention

Before contest

[Codeforces Round #339 \(Div. 1\)](#)

2 days

Before contest

[Codeforces Round #339 \(Div. 2\)](#)

2 days



122 people like this. Be the first of your friends.

→ Top rated

#	User	Rating
1	tourist	3510
2	rng_58	3130
3	Petr	3079
4	TooDifficult	3020
5	subscriber	2971
6	vepifanov	2963
7	Egor	2958
8	Um_nik	2895
9	niyaznigmatul	2864
10	WJMZBMR	2853

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Otros Jueces

- USACO
- SPOJ
- LightOJ
- COJ
- TJU
- ZOJ
- Timus
- PKU
- URI
- CodeChef
- Muchos otros mas

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Veredictos en los Jueces

El objetivo al resolver un problema es obtener un: "Accepted (AC)".

Nuestra solución pasa satisfactoriamente todos los casos de prueba dados por el juez.

Sin embargo, podemos recibir los siguientes veredictos:

Presentation Error (PE)

Wrong Answer (WA)

Time Limit Exceeded (TLE)

Memory Limit Exceeded (MLE)

Runtime Error (RTE)

Compilation Error (CE)

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Virtual Judge

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Virtual Judge

Virtual Judge is not a real online judge. It can grab problems from other regular online judges and simulate submissions to other online judges. It aims to enable holding contests when you don't have the test data.

Currently, this system supports the following online judges:

POJ ZOJ UVALive SGU URAL HUST SPOJ HDU HYSBZ UVA CodeForces Z-Trening
Aizu LightOJ UESTC NBUT FZU CSU

Change Log:

- 2010-05-04 : Put into use.
- 2010-05-10 : Remember the last language selected.
- 2010-05-10 : Remember the OJ of the last problem selected.
- 2010-05-10 : Optimize the crawling of [ZOJ](#).
- 2010-05-10 : [HDU OJ](#) is added.
- 2010-06-01 : Host Virtual Judge on [Google Code](#).
- 2010-07-18 : Use [CKEditor](#) in problem editing.
- 2010-07-20 : Implement syntax highlighting in source viewing by using [SHJS](#).
- 2010-08-17 : Use AJAX pagination in problem list to avoid overload.
- 2010-08-17 : Post-contest submitting is enabled. Try it yourself :)
- 2010-10-07 : Refer to [this page](#), and this section will not update.

Virtual Online Contests - Ahmed Aly

A2 Online Judge by Ahmed Aly

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Ahmed Aly



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A ti, Milton Raúl y 15 193 personas más os gusta esto.

Sun, Jan 10, 2016, 03:42:40 UTC

Show contests only for this username (as owner and/or registrant):

Show

Running Contests

	Contest Name	Owner	Start Time	Duration	Registrants	Type		
1	23019 - CP3 - Ch02	ayman96	2015-12-10 11:30:00	30 days, 23 hrs and 59 mins (7 hrs and 47 mins)	1	Private		
2	23044 - Graph Traversal and others	disatoba	2015-12-11 19:00:00	30 days, 23 hrs and 59 mins (1 day, 15 hrs and 17 mins)	13	Public	Register or Watch	Standings
3	23117 - Coder:Dash Winter Training ACM	fabo3000	2015-12-16 22:00:00	28 days (3 days, 18 hrs and 18 mins)	2	Private		
4	23132 - De nuevo	jicote	2015-12-17 17:35:00	30 days, 6 hrs and 24 mins (6 days, 20 hrs and 17 mins)	4	Public	Register or Watch	Standings
5	23103 - tema_vacanta_11_12	costinbanu	2015-12-19 00:00:00	23 days (20 hrs and 18 mins)	4	Public	Register or Watch	Standings
6	23104 - tema_vacanta_10	costinbanu	2015-12-19 00:00:00	23 days (20 hrs and 18 mins)	6	Public	Register or Watch	Standings
7	23105 - tema_vacanta_9	costinbanu	2015-12-19 00:00:00	23 days (20 hrs and 18 mins)	7	Public	Register or Watch	Standings
8	23173 - JollyWinterCarns but not really a carn...	kronosueens	2015-12-21 15:00:00	20 days	18	Public	Register or Watch	Standings

Time for a new job?

Virtual Online Contests - Ahmed Aly

* Username	:	<input type="text"/>
* Real Name	:	<input type="text"/>
* Password	:	<input type="text"/>
* Email	:	<input type="text"/>
* Confirm Email	:	<input type="text"/>
* Country	:	<input type="text"/>
* Contest,Group,Team Invitation	:	<input type="text"/>
GCJ Nickname	:	<input type="text"/>
TopCoder Handle	:	<input type="text"/>
UVa User ID	:	<input type="text"/>
Live Archive User ID	:	<input type="text"/>
SPOJ Username	:	<input type="text"/>
<input type="checkbox"/> Is using SPOJ Brazil		
<input type="checkbox"/> Is using SPOJ Poland		
<input type="checkbox"/> Is using SPOJ Vietnam		
Codeforces Handle	:	<input type="text"/>
TJU User ID	:	<input type="text"/>
SGU User ID	:	<input type="text"/>
PKU User ID	:	<input type="text"/>
Timus User ID	:	<input type="text"/>
CodeChef Username	:	<input type="text"/>
ZOJ User ID	:	<input type="text"/>
URI User ID	:	<input type="text"/>

[How to get it?](#)
[How to get it?](#)
[How to get it?](#)
[How to get it?](#)
[How to get it?](#)
☒ Get email notifications for the new features

☒ Is interested in job opportunities (you might be contacted by some recruiters)

*** Required Information**

Concurso Regional



- Equipos formados por 3 miembros estudiantes.
- Lenguajes de Programación permitidos: Ansi C, C++ y Java.
- Sistema BOCA.
- Duración de 5 horas
- Usualmente de 8-10 problemas

Enlaces Importantes

- UVA: <http://uva.onlinejudge.org/>
- ICPC: <https://icpcarchive.ecs.baylor.edu/index.php>
- TopCoder: <http://community.topcoder.com/tc>
- CodeForces: <http://codeforces.com/>
- Virtual Judge Hust:
<http://acm.hust.edu.cn/vjudge/toIndex.action>
- Virtual Online Contests: <http://ahmed-aly.com/>
- uHunt: <http://uhunt.felix-halim.net>
- Blog: <http://jariasf.wordpress.com/>
- Competitive Programming book: <http://cpbook.net/>
- Visualgo: <http://visualgo.net/>