Competitive Programming

Bruno Monteiro

It is a competition where your team solve *algorithmic* problems

Humuhumunukunukuapua'a

Teams are made up of three undergraduate students, and the winner is whoever solves the most problems (and makes fewer mistakes while trying to solve them)

The main competition is the ICPC

Brazilian Finals 2019

BOCA | ICPC-LATAM - Latin America - Regional 2022 | SCORE | RUNS | TASKS | CLARIFICATIONS | STATISTICS | contest not running

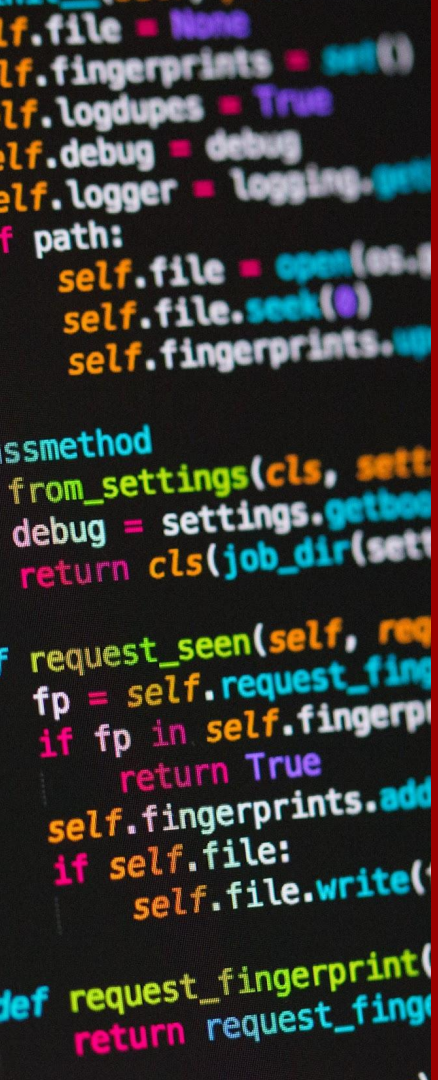
Available scores:
Brasil

#	User/Site	Name	A	B	C	D	E	F	G	H	I	J	K	L	M	Total
1	teambrbr005/BR	[UFRJ] Lebenslangerschicksalsschatz	1/117	1/156	1/48	1/21	1/29	1/269		2/206	1/54		1/295	1/83	1/133	11 (1431)
2	teambrbr002/BR	[UFMG] Humuhumunukunukuapua'a	2/127	2/237	1/99	1/11	2/49		1/254	1/176	1/36	1/-	1/191	1/148	2/106	11 (1514)
3	teambrbr001/BR	[UNICAMP] Você beijaria Matheus Leal Viana?	1/140	1/122	1/198	1/6	2/90	1/83		1/237	1/101		2/270	1/-	1/59	10 (1346)
4	teambrbr003/BR	[UNICAMP] Inimigos do Hungaro	2/80	1/260	1/46	1/17	2/54	1/-		1/104	1/62		3/141	9/-	1/29	9 (873)
5	teambrbr008/BR	[IME] 12k Club	1/44		1/86	1/12	1/19	2/-	1/201	1/166	1/32	1/-			1/61	8 (621)
6	teambrbr011/BR	[UnB] FLAMENGO	1/65		2/140	1/14	1/37			1/201	1/79		1/-	2/274	1/107	8 (957)
7	teambrbr006/BR	[USP] MWNWMWNNWMWNWN	1/129		3/126	1/27	2/112	8/-		1/-	1/79		3/272		1/39	7 (884)
8	teambrbr019/BR	[UFCG] A ascensão e queda do buldogue francês	2/169			1/13	1/78			3/252	2/91		1/144		1/104	7 (931)
9	teambrbr009/BR	[UnB] RockLee não manda WA	1/161		2/291	1/15	1/80			2/-	1/69			1/238	1/120	7 (994)
10	teambrbr007/BR	[USP/São Carlos] o de sempre	1/-		1/69	1/14	2/148			2/298	1/30		2/287		1/116	7 (1022)
11	teambrbr004/BR	[UFPE] Desculpa, Beto	2/161	1/289	2/218	1/15	3/169			3/-	1/92		2/-		1/167	7 (1191)
12	teambrbr015/BR	[UDESC] Como Treinar o Seu João	11/-		2/142	1/12	1/74				1/57			3/267	2/127	6 (759)

Scoreboard of the Brazilian Finals 2022

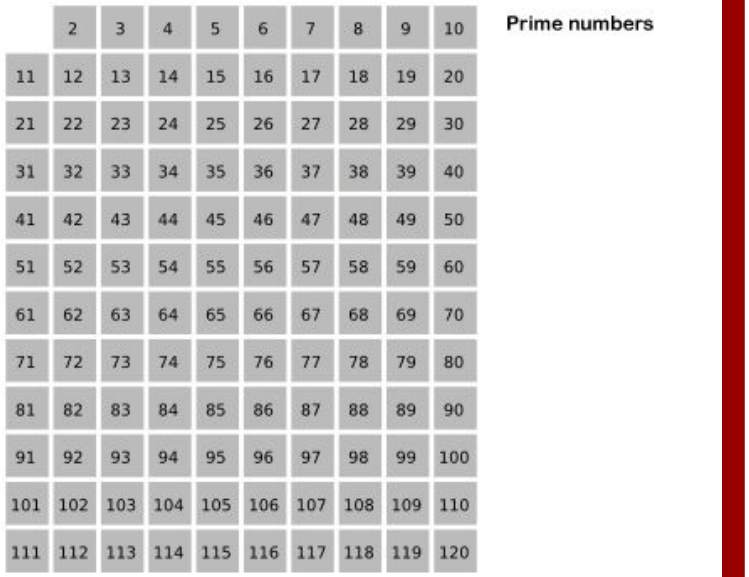
make a gif.com

COMPETIDOR
COMPETIDOR



How are the problems?

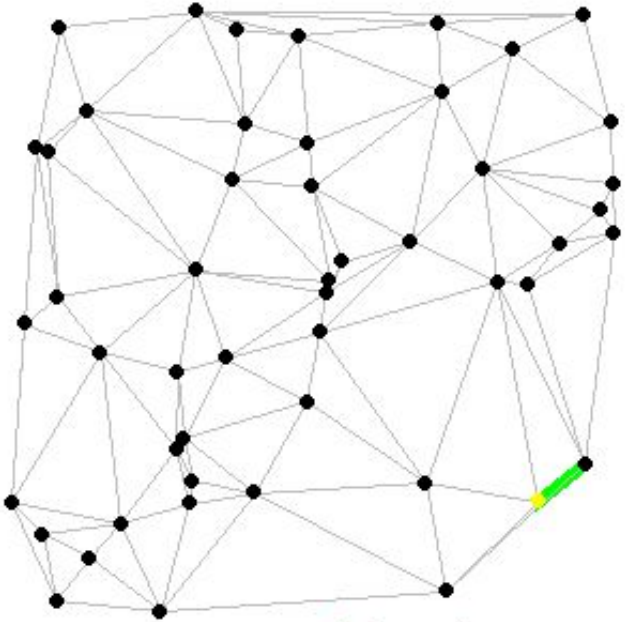
You'll use computer science fundamentals and math, but also get to think outside the box, designing clever, optimized solutions for tough problems



	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120

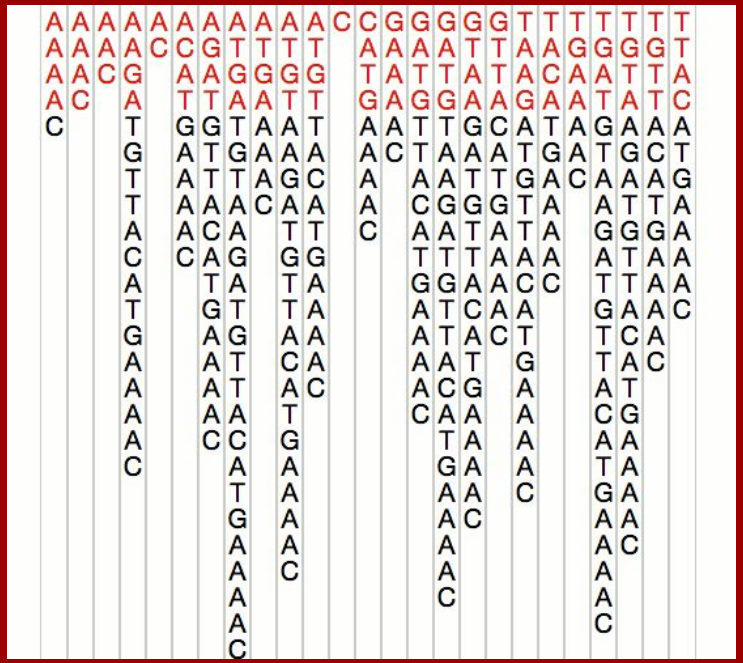
Math

- Primality testing
- Factoring
- Quick exponentiation
- Solving equations



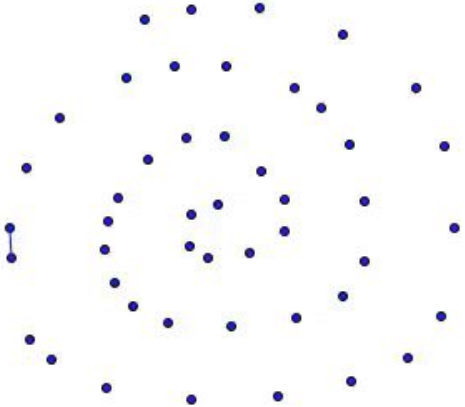
Graph Theory

- Distance
- Traveling salesman problem
- Labirinth



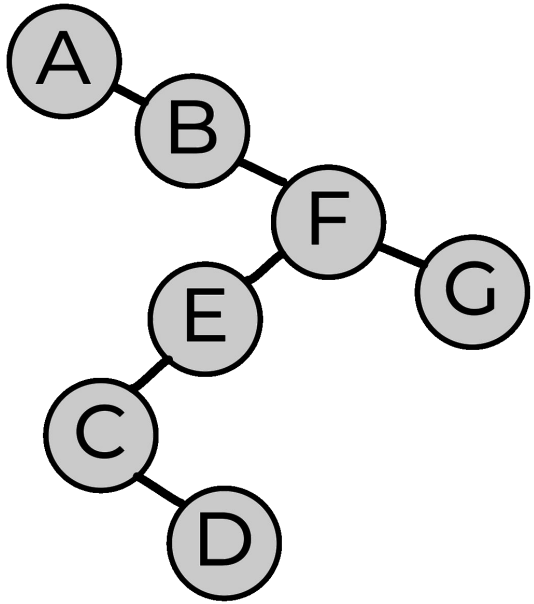
Strings

- Similarity between strings
- Pattern search
- Palindromes



Computational Geometry

- Convex-hull
- Area of a polygon
- Intersection of shapes



Data structures

- Representation of sets
- Efficient storing and retrieval of information
- Keeping data sorted

ITMO University

Others

- Game Theory
- Dynamic Programming
- Implementation Problems

Why participate?

Google Code Jam 2017

It's a more exciting way to learn and dive deeper into important computer science and math topics

Travel and friendships!

Brazilian Finals 2023

Travel and friendships!

ICPC World Finals 2019
Moscow - Russia

Travel and friendships!

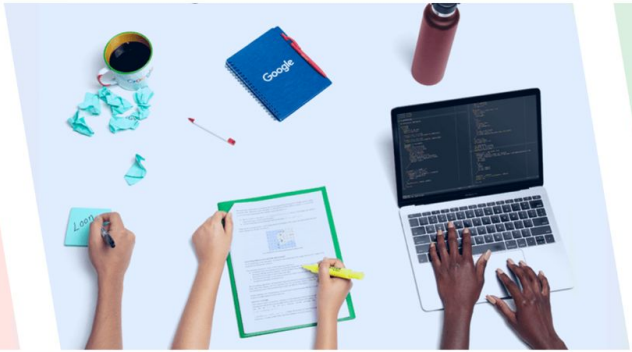
ICPC World Finals 2019
Moscow - Russia

Travel and friendships!

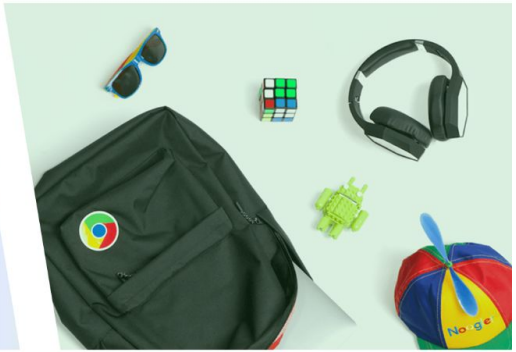
ICPC World Finals 2023
Astana - Kazakhstan

Google

code jam



hash code



kick start

This is a skill highly valued by many companies

Google

code jam hash code kick start

This is a skill highly valued by many companies

FACEBOOK

HACKER CUP

This is a skill highly valued by many companies

Patrocinadores

amazon

IBM

HUAWEI

JET BRAINS

This is a skill highly valued by many companies

Viagens e amigos!

Time [UFMG] Rábalabaxúrias
Final Nacional 2019
Campina Grande

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Time [UFMG] Rábalabaxúrias
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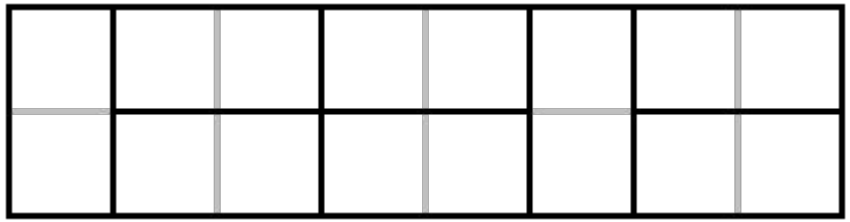
Example Problem

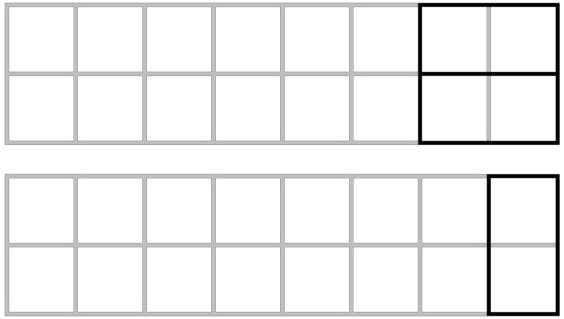
Given a 2×N rectangular board and N domino tiles of size 2×1, determine how many ways can you tile the board. The dominoes can be placed either vertically or horizontally

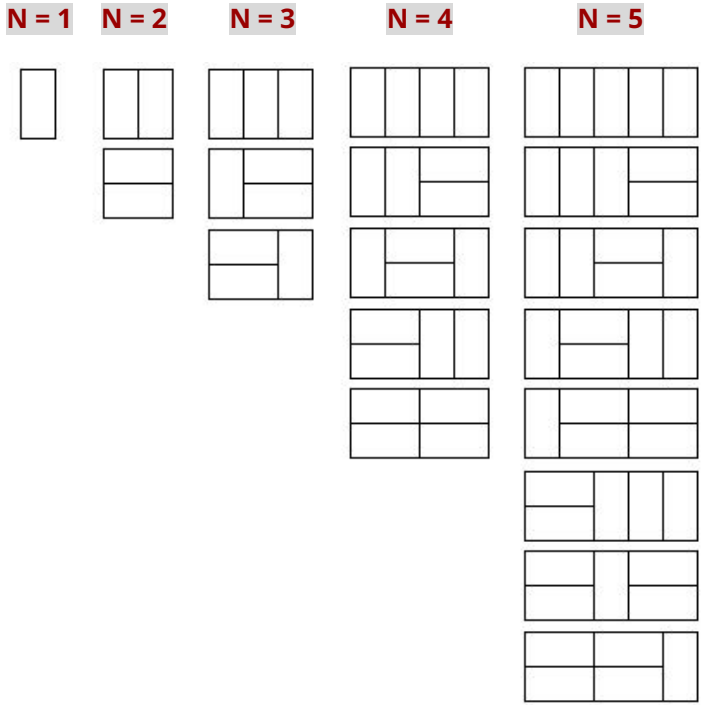


Example Problem for N = 8

Exemplo de Problema

Given N, how many ways can you tile the board?





Exemplo de Problema

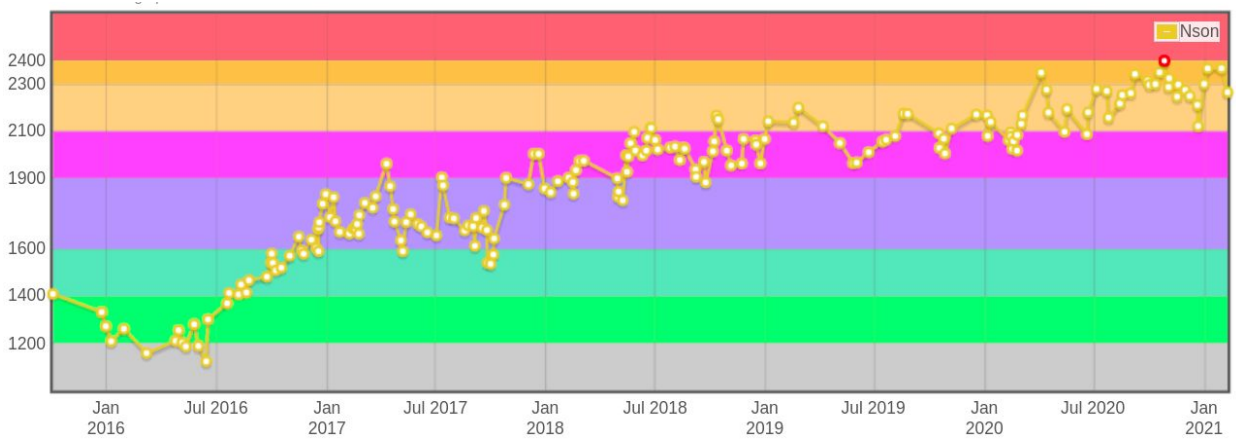
```python
n = int(input())
f_n = 1
f_n_minus_1 = 1
for i in range(2, n+1):
    nxt = f_n + f_n_minus_1
    f_n_minus_1 = f_n
    f_n = nxt
print(f_n)
```

$$F(n) = F(n-1) + F(n-2)$$

$$F(1) = 1 \qquad F(2) = 2$$

Many people think they are not good enough

- No one's born knowing this stuff
- It takes a lot of practice!
- The earlier you start, the better



ACM-ICPC
World Finals
May 19, 2016
Phuket Thailand
2016 World Finals Phuket
acm International Collegiate Programming Contest
IBM
BAYLOR UNIVERSITY
SIPA
CAT
cisco
Upsilon Pi Epsilon Honor Society
Phuket Province
Association for Computing Machinery
Host University
ICPC 2016 Phuket
ICPC and CLI Headquarters
National Taiwan University
Rice University
Saratov State University
The University of Tokyo
How to participate?
ICPC World Finals 2016
Phuket - Tailândia

How to train competitive programming?

- Practice ICPC-style team contests and individual competitions (CodeForces, AtCoder, etc.).
- Upsolving: After contests, solve problems you couldn't complete during the competition

2010-2011 Summer Petrozavodsk Camp, Andrew Stankevich Contest 38 (ASC 38)

Final standings

Double click (or ctrl+click) each entry to view its submission history

Standings

#	Who	=	Penalty	A	B	C	D	E	F	G	H	I	J
1	Wunderzeit: s-quark, zhj, dhh1995	9	1267	+ 00:09	+ 00:53	+ 03:20	+ 01:07	+ 00:25	+1 04:31	+ 04:43	+ 01:55		+3 02:44
2	SPbSU ITMO 1 (Isenbaev, Kapun, Melnikov)	9	1301	+ 01:09	+ 00:57	+ 04:34	+ 02:15	+ 00:34	+1 02:56	+2 02:55	+1 03:28	-13	+1 01:13
3	ThinkingBear: Leo_Yu, Eternal_Answer, ACMonster	9	1454	+ 00:35	+ 00:26	+ 04:08	+2 01:54	+ 00:21	+ 04:32	+7 04:52	+ 01:16		+2 02:30
4	Scrambled Eggs: theodor.moroianu, livlivi, bicsi	9	1476	+ 00:52	+ 00:58	+ 02:08	+2 00:41	+ 00:49	+4 04:56	+7 04:27	+ 02:58		+1 02:07
5	PECaveros: eddy1021, paulwang, akaiNeko	8	987	+1 00:27	+ 00:45	+ 01:07	+ 00:19	+ 00:11	-8	+8 03:45	+ 02:21		+5 02:52
6	RNS3	8	1048	+ 00:45	+ 00:52	+2 04:44	+ 00:29	+ 00:39		+1 03:59	+ 02:39		+ 02:21
7	kuviman	8	1062	+ 01:01	+ 01:25	+ 03:16	+1 00:48	+ 00:26		+1 04:02	+2 02:45		+ 02:39
8	bcw0x1bd2: meteor, step5, darkhh	7	622	+ 01:07	+1 00:57	+1 02:21	+ 00:19	+ 00:11	-11	-17	+1 00:56		+3 02:31
9	UW0: Rzepa, Grzmot, kostka	7	776	+ 01:42	+1 00:17	+ 02:06	+1 01:19	+1 00:19		-3	+ 02:29		+ 03:44
10	[UFMG] Summergimume?: brunomont, Emaneru, bernardo_amorim	7	850	+1 00:21	+2 00:46	+2 03:57	+ 01:18	+ 00:27		-6	+3 02:38		+2 01:23
11	l_0l_1: Nekosyndrome, lnsuyn, fenzhang	7	862	+2 00:33	+ 00:47	+ 01:56	+ 01:17	+ 00:43	-1	-6	+ 03:00		+3 04:26
12	Tresteana: freak93, klamathix	7	865	+ 01:48	+1 00:56	+2 04:06	+2 00:52	+ 00:37		-5	+2 03:00		+1 00:26
13	Everlasting: ZhouYuChen, Flandre_Scarlet, Bobgy	7	870	+1 01:02	+ 01:19	+ 03:45	+1 00:20	+1 00:49		-2	+ 04:07		+ 02:08
14	MSU ST (Fedorov, Kaluzhin, Rogulenko)	7	920	+ 00:28	+ 00:52	+ 03:03	+ 01:52	+ 00:47	-2	+2 02:27			+3 04:11
15	Time do fim de semana: Lebossle, Emiso, fmota	7	962	+ 00:43	+2 02:44	+2 04:00	+ 00:57	+ 00:38			+ 02:00		+2 03:00

www.codeforces.com

COMPETITIVE PROGRAMMING
//Where Computer Geeks become Gladiators