Intro to Competitive Programming

MCPC Workshop

Outline

What's the Competitive Programming

Briefly speaking, it is to solve programming problems:

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- Fast

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Briefly speaking, it is to solve programming problems:

- Fast
- Correctly

What's the Competitive Programming

Briefly speaking, it is to solve programming problems:

- Fast
- Correctly
- Elegantly

Outline

Get lowest bit

The straightforward way:

```
def lowb(x):
  p = 0
  while x:
    # if p-th digit is 1, return 2^p
    if x & 1: return 1<<p
    x >>= 1 # x = x / 2
    p += 1
  return 0
```

Get lowest bit

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  while x:
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    if x & 1: return 1<<p
    x >>= 1 # x = x / 2
    p += 1
  return 0
```

In competitive programming:

```
def lowb(x):
  return x & (-x)
```

Prime Sieve

The straightforward way:

```
def primes(n):
  p = []                    # empty prime list at beginning
  for i in range(2,n+1):    # is i a prime?
    f = False
    for j in range(2, i):   # any divisor in [2, i-1]?
      if i % j == 0:
        f = True
        break
    if not f:               # no divisor
      p.append(i)           # yeah, it's a prime!
  return p
```

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```

$2 + 3 + 2 + 5 + \ldots \approx O(\frac{n^2}{logn})$ (https://oeis.org/A088821)

Prime Sieve

More efficient way:

```
def primes(n):
  f = [0] * (n+1)           # set f[0]=0, f[1]=0, ... f[n]=0
  p = []                    # empty prime list at beginning
  for i in range(2, n+1):   # is i a prime?
    if not f[i]:            # not sieved by any value
      p.append(i)           # yeah, it's a prime!

    j = 2                   # sieve:
    while j*i <= n:         # 2*i,
      f[j*i] = True         # 3*i,
      j += 1                # ...
  return p
```

Prime Sieve

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def primes(n):
  f = [0] * (n+1)            # set f[0]=0, f[1]=0, ... f[n]=0
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      j += 1                 # ...
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$\frac{n}{2} + \frac{n}{3} + \ldots + 1 \approx O(nlogn)$ (Harmonic sequence)

Prime Sieve

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  for i in range(2, n+1):     # is i a prime?
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    for j in p:               # let j be a known prime
      if j * i > n: break     # reach the upper bound
      f[j * i] = True         # sieve j * i
      if i % j == 0: break    # guarantee j is the minimum divisor
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Prime Sieve

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Each number is only sieved by it's minimum divisor once.

Prime Sieve

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It's linear!

$A + B$

The straightforward way:

```python
def func(a, b):
  return a + b
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def func(a, b):
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In competitive programming:

```python
from datetime import datetime
from time import sleep

def func(a, b):
  s = datetime.now()
  sleep(a)
  sleep(b)
  e = datetime.now()
  return e.second - s.second
```

$A + B$

The straightforward way:

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def func(a, b):
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In competitive programming:

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```

~~Creative!~~

Outline

Why

Why do we do Competitive Programming?

An Imagination

- You want to be a top-class programmer 😎.

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- There are lots of choices: 😱

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An Imagination

- You want to be a top-class programmer 😎.
- There are lots of choices: 😱
  - Web full stack, Mobile dev, Database, Big data, Machine learning . . .
- Oh, you choosed *Web full stack* 😃.
- What is going to happend next...? 😯

An Imagination

You...

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You...

- may find a nice online resource. 😀

An Imagination

You...

- may find a nice online resource. 😀
- follow the instructions. 😀

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- may need hours to set up environment. 🕖🕘🕒

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- finally finish your first demo before sleep. 😐

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You...

- may find a nice online resource. 😀
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but what can you still remember in the next day, or next week? 😳

Reflection

Reflection

- We are distracted by those *working skill*s,

Reflection

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- It's not too late to pick up these in future career (≥ 30 years),

Reflection

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- but we only have two to four years in university.

Reflection

- We are distracted by those *working skill*s,
- It's not too late to pick up these in future career ($\geq$ 30 years),
- but we only have two to four years in university.
- Looking for a more efficient way?

Why

Compeititve programming is most efficient way to:

Why

Compeititve programming is most efficient way to:

- improve coding skill

Why

Compeititve programming is most efficient way to:

- improve coding skill
- improve problem solving skill

Why

Compeititve programming is most efficient way to:

- improve coding skill
- improve problem solving skill
- develop insight in computer science

Why

Compeititve programming is most efficient way to:

- improve coding skill
- improve problem solving skill
- develop insight in computer science

There is another story...

Another Story

- You want to be a top-class programmer.😎

Another Story

- You want to be a top-class programmer.😎
- Someone suggests you to do Competitive Programming.😉

Another Story

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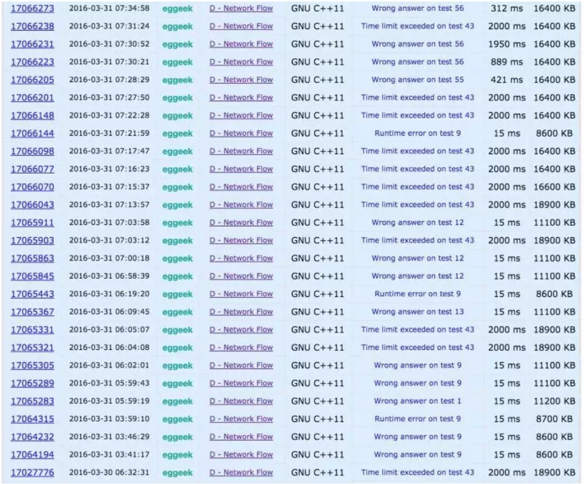
- What is going to happend next...? 😯

Another Story



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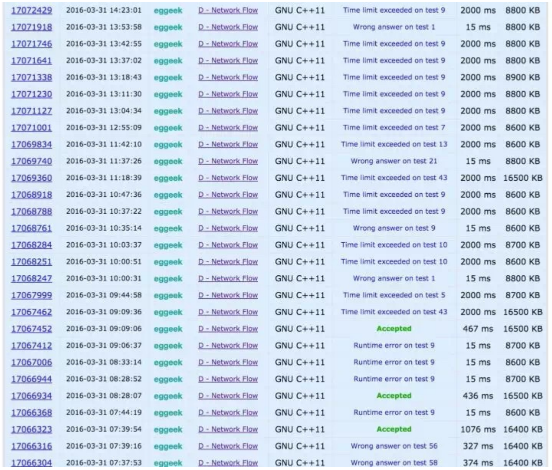
Practice!

Another Story



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17066934	2016-03-31 08:28:07	eggeek	D - Network Flow	GNU C++11	Accepted	436 ms	16500 KB
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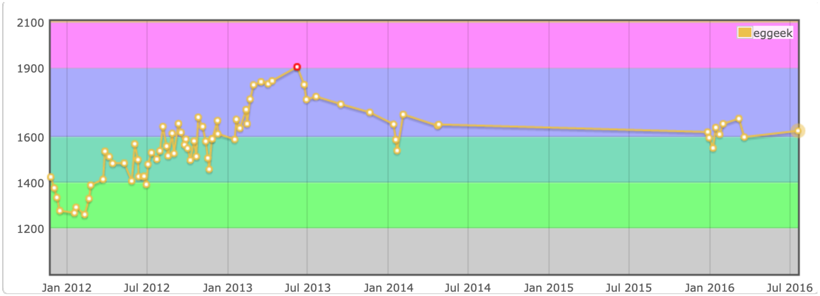
Keep practicing!

Another Story



Win and lose...

Another Story

Get rewarded!

Another Story

Make friends!

Why do we do Competitive Programming?

Why do we do Competitive Programming?

- IT IS FUN!

Why do we do Competitive Programming?

- IT IS FUN!
- Employment

Why do we do Competitive Programming?

- IT IS FUN!
- Employment
- Academia

Outline

How to start?

- USACO: `https://train.usaco.org/usacogate`
- Codeforces: `http://codeforces.com`
- Atcoder: `http://atcoder.jp`
- Google contests: `https://codingcompetitions.withgoogle.com`
- Facebook Hacker Cup: `https://www.facebook.com/hackercup/contest`

How to join us?

- Weekly training on Saturday.
  - Time: 12:00 to 17:00
  - Location: Lab 147, Rainforest walk 14
- Facebook: `https://www.facebook.com/groups/454114112027992/`
- Mailing list: `https://groups.google.com/forum/#!forum/monashicpc/join`

What will we do?

- Monash Collegiate Programming Contest (MCPC) on **24th August**.
- New Zealand Programming Contest (NZPC) on **7th September**.
- International Collegiate Programming Contest (ICPC) Regional Divisional (TBD).
- ICPC Regional Final (TBD).
- ICPC World Final (TBD, if only...).

Outline

End

Join Us!

Thank you!