CS2040C Lab Demos

Lab TA: (Louis) Tan Jun An

Email: junan.tan@u.nus.edu

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LAB DEMO 01

Lab TA Introduction & Expectations

My technical background

- NUS CS Major Year 4 (Algo, AI)
- Algo mods took: CS2020, CS3230, CS3233, CS4234
- TA'ed CS2010 and CS2040C previously

My expectations:

- Perfect attendance for all 11 Lab Demos
- Each of you contribute something in those 11 sessions
  - Answering my questions, presenting solutions, etc…
- The 3% participation points are somewhat subjective!*

Ice Breaking

When your name is called: stand up and say one sentence about yourself that is *very unique* about you!

Mooshak Online Judge System

We need *another* system for automatic grading

- Important URL: https://cs2040c.comp.nus.edu.sg/~mooshak/
- Instant grading!
  - Typical Online judge verdicts: AC(cepted), W(rong)A(nswer), T(ime)L(imit)E(xceeded), R(un)T(ime)E(rror), C(ompile)T(ime)E(rror), Invalid Function, Invalid Submission (NEW), Program Size Exceeded (NEW), Requires Reevaluation (NEW)
- Unless there are special cases, if you get your code AC (Accepted), you will get that amount of points as stated in the problem description
  - However, post-deadline penalty (e.g. your code are found to be a very similar copy of someone else's code) can still alter the score
    - $_{76}C_2$ pairwise comparison check is a "small" number

C++ Compiler used by Mooshak

We use C++11 standard

- You can use #include <bits/stdc++.h>
- You can use auto (range based loop)
- You can use lambda expression (e.g. as comparison function for sorting)
- You can use this kind of initialization: vector<int> A = {1,2,3};
- (no guarantee on C++14/17 stuffs, I think it won't compile)

The Problem Sets

CS2040C PSes (PS1-5) have subtask system

- Subtask A is always the easiest, but low -- non zero -- points
  - Everyone are expected to solve this
  - Algorithm mentioned in tutorial/lab demos (usually in tutorial)
- Subtask B (or also C) is/are CS2040/C standard, medium points
  - Majority are expected to solve this
  - Algorithm mentioned in tutorial/lab demos (usually in lab demos)
- The last Subtask is quite challenging, but low (or zero) point(s)
  - Minority are expected to solve this
  - No need to feel bad if you cannot solve this part, it is a teaser of what can be done at higher level, when you know more algorithms ☺
  - Recommended to attempt them, as they *can be tested* in tests.

C++ string

- **constructor or = operator**
- **at or [] operator**
- *+ (concatenation)*
- *==, < (comparison)*
- *find*
- *substr*
- *c_str*
- http://en.cppreference.com/w/cpp/string/basic_string

C++ STL vector

- **constructor**
- **at or [] operator**
- **push_back**, *pop_back*
- *insert, erase*
- *front, back*
- *begin, end*
- **assign**, *empty*, reserve, resize
- http://en.cppreference.com/w/cpp/container/vector

C++ STL algorithm

- **sort**, partial_sort, stable_sort
- *reverse*
- unique
- nth_element
- lower_bound, upper_bound
- *swap*
- random_shuffle
- **min, max**
- min_element, max_element
- http://en.cppreference.com/w/cpp/algorithm

PS1 Status (as of today :O)

Name	A	B	C
Group A 4 + 3	AC	AC	AC
Group B 3 + 3	AC	AC	
Group C 2 + 1	AC		
Group D 10 + 16			

Practice is important for these 5 PSes (15%) + end of semester PE (12%)

Don’t hesitate to contact TAs for more help if you need it

PS1 Discussion

- Number of operations that the server that hosts Mooshak can do in about 1s is approximately ~100M+
  - (you can 'test' the judge)
- A:
  - TC = 100, N = 500
  - O(TC * N^3) = **12,5**00,000,000, likely CMI*
  - **O(TC * N^2 $\log_2$ N)** = **2**24,144,607.11, "seems possible"
- B:
  - TC = 100, N = 3,000
  - O(TC * N^2 $\log_2$ N) = **10,3**95,672,106.84, likely CMI
  - **O(TC * N^2)** = **9**00,000,000, "seems possible"
- C
  - TC = 1, N = 20,000,000 :O… **O(N)**???

PS1 Discussion

- For PS1C, **fast I/O** is required
- scanf/printf is fast enough

- cin/cout is too slow by default
  - Add the following at the top of int main

```
int main() {
    ios::sync_with_stdio(false);
    cin.tie(0);
    …
    …
```

Hands-on 1:

- https://open.kattis.com/problems/sidewayssorting
- You have 15-20 mins to try coding an AC solution
- Lab TA will give gradual hints per 5m interval
- Full AC solution **will not** be given,
  the last hint will be something that is “near AC”