

15-213 Recitation: Data Lab

Jan 31, 2022

Agenda

- Introduction
- Course Details
- Office Hours
- Data Lab
 - Getting started
 - Running your code
 - Reminders
- Looking ahead to Bomblab

Introduction

- Welcome to 15-213/14-513/15-513!
- Recitations are for...
 - Reviewing lectures
 - Discussing homework problems
 - Interactively exploring concepts
 - Previewing future lecture material
- Please, **please** ask questions!

Course Details

- How do I get help?
 - Course website: <http://cs.cmu.edu/~213>
 - Office hours
 - Piazza
 - *Definitely* consult the course textbook
 - **Carefully read the assignment writeups!**
- All labs are submitted on Autolab.
- All labs should be worked on using the **shark machines.**

Office Hours

- Queue link: <https://cmqueue.xyz/>
- Please locate the TA in the specified location!
- All in-person OH will be occurring in GHC on floor 5.
- OH Logistics will be on this post:
<https://piazza.com/class/kyd4rf0xtz745r?cid=137>

| Day | Time | Location |
|-----------|-----------|--------------------|
| Sunday | 2 - 8 pm | REMOTE |
| Monday | 6 - 8 pm | Carrel 1 |
| Tuesday | 6 - 8 pm | Carrel 1 |
| Wednesday | 6 - 8 pm | Carrel 1 |
| Thursday | 6 - 10 pm | Carrel 2 & 4 |
| Friday | 4 - 8 pm | Carrel 1 & Table 3 |
| Saturday | 2 - 8 pm | REMOTE |

OH Etiquette

- Office hours are for getting ideas on how to debug or better approach your homework!
- Please try to narrow down your problem area as much as possible to help TAs help you!
- **Write a description!** If you don't have a description, you may be frozen/removed from the queue. Make sure to use the tags!
- TAs will only spend 10 minutes per student and then you can rejoin the queue.
- We will close the queue early so everyone can be helped so please keep this in mind!

Data Lab: Getting Started

- Download the handout from autolab
 - Method 1:
 - `scp <path to datalab.tar>`
`<andrewid>@shark.ics.cs.cmu.edu:<my course directory>`
 - `ssh <andrewid>@shark.ics.cs.cmu.edu`
 - `cd` to the `datalab.tar` file
 - `tar -xf datalab.tar`
 - Method 2:
 - `autolab download 15213-s22:datalab`
 - `cd` into the `datalab` folder
 - `tar -xf datalab.tar`

Data Lab: Getting Started

- Upload `bits.c` file to Autolab for submission
 - `make submit`

Data Lab: Running your code

- `dlc`: a modified C compiler
- `btest`: runs your solutions on random values
- `bddcheck`: exhaustively tests your solutions
 - Checks all values, formally verifying the solution
- `driver.pl`: Runs both `dlc` and `bddcheck`
 - Exactly matches Autolab's grading script
 - You will likely only need to submit once
- For more information, **read the writeup**
 - Available under autolab as "**View writeup**"
 - **Read the writeup please!**

Data Lab: Reminders

- Casting between **int** and **long** is ok, in either direction
- Be aware of operations and their types!
 - **!** returns an **int** *even if the argument is a long*
- Good idea to append “L” suffix to every integer constant
 - $(1\mathbf{L} \ll 63)$ is not the same as $1 \ll 63$
 - $(!\mathbf{x} \ll 63)$ is not the same as $((\mathbf{long}) !\mathbf{x}) \ll 63$

Form Groups of 3 - 4

- Series of exercises
 - Operators
 - Puzzle

Questions?

- Remember, data lab is due this Thursday!
 - You really should have started already!
- Read the lab writeup!

Looking Ahead... Bomblab!!



What is Bomb Lab?

- An exercise in reading x86-64 assembly code.
- A chance to practice using GDB (a debugger).
- Why?
 - x86 assembly is low level machine code. Useful for understanding security exploits or tuning performance.
 - GDB can save you days of work in future labs (**Malloc**) and can be helpful long after you finish this class.

Downloading Your Bomb

- Here are some highlights of the write-up:
 - Bombs can only run on the shark machines. They fail if you run them locally or on another CMU server.
 - Each bomb is unique - if you download a second bomb, bad things can happen! Stick to only one bomb.
 - Bombs have six phases which get progressively harder.
 - Make sure to read the writeup for more tips and common mistakes you might make.

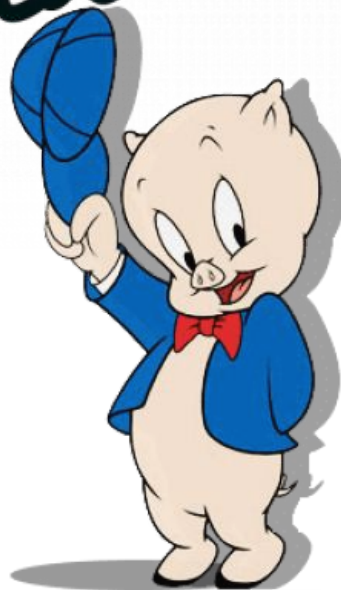
Detonating Your Bomb

- Blowing up your bomb automatically notifies Autolab
 - *Dr. Evil* deducts 0.5 points each time the bomb explodes.
 - It's very easy to prevent explosions using **break points** in GDB. More information on that soon.
- Inputting the correct string moves you to the next phase.
- Don't tamper with the bomb. Skipping or jumping between phases detonates the bomb.
- You have to solve the phases in order they are given. Finishing a phase also notifies Autolab automatically.

Bomb Hints

- **Dr. Evil** may be evil, but he isn't cruel. You may assume that functions do what their name implies
 - i.e. `phase_1()` is most likely the first phase. `printf()` is just `printf()`. If there is an `explode_bomb()` function, it would probably help to set a breakpoint there!
- Use the man pages for library functions.
 - Although you can examine the assembly for `snprintf()`, we assure you that it's easier to use the man pages (`$ man snprintf`) than to decipher assembly code for system calls.
- Most cryptic function calls you'll see (e.g. `callq ... <_exit@plt>`) are also calls to C library functions.
 - You can safely ignore the `@plt` as that refers to dynamic linking.

"That's all Folks!"



F21 Bomblab Slides

https://docs.google.com/presentation/d/1c9IVmK69sVndzX5_rZYaL-jj5uk_d3GI/edit?usp=sharing&oid=105056271954280155624&rtpof=true&sd=true