Welcome

CS1101S Studio Session Week 13: *Web Development & Final Review*

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Overview

1. *Web development (optional)*
    - Overview
    - Basic knowledge - static page
    - Advance knowledge - dynamic page
2. Information security *(optional)*
    - Web security
3. Final review
    - What we have learned
    - To prepare for final examination

Web Development

Application software

Many engineers have dedicated their career to develop

- Desktop application
- Web application
- Mobile application
- ...

Web Development

What is the trend of this industry?

- ~~Desktop first?~~
- Web first?
- Mobile first?
- ...

Web Development

Answer

- Web first? Yes.
- Mobile first? Yes.
- ...

Result...

- The web goes mobile.

Web Development

How does the Internet work?

- Magic.
- A lot of magic.

Web Development

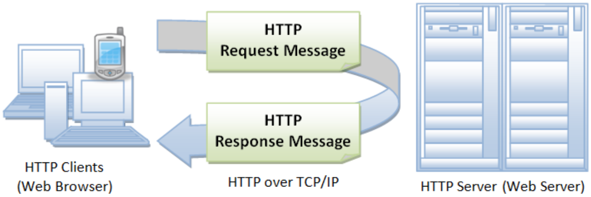
Before we go on...

- URL: Uniform Resource Locator
- HTTP: HyperText Transfer Protocol
- DNS: Domain Name System
- HTML: HyperText Markup Language
- CSS: Cascading Style Sheets
- ...

Web Development

Basic idea

- You enter an URL: request for something by its unqiue identifier.
- Translate using DNS and request reaches the server.
- Find the requested resources on the server and return.
- Render the resources in your browser.



Web Development

From the most basic - static webpage

You have three “weapons” with you as follows:

- HTML(5) for content
- CSS(3) for style
- JavaScript for action

Web Development

Your first webpage

```
<!DOCTYPE html>
<html>
<head>
    <title>My heading</title>
</head>
<body>
    <p>Hello, world!</p>
</body>
</html>
```

Instructions

- Save as ⟨*something*⟩ *.html* locally.
- Open it in the browser.

Web Development

Make it prettier - apply style on elements

Edit and save as ⟨*something*⟩ *.css* locally:

```
p {
  color: #00ffff
}
```

Use the CSS style defined just now

In ⟨*something*⟩ *.html*, modify it to become:

```
<head>
    <title>My heading</title>
    <link rel="stylesheet" type="text/css"
          href="something.css">
</head>
```

Web Development

Embed CSS style in HTML

Edit and save as ⟨*something*⟩ *.html* locally:

```
<!DOCTYPE html>
<html>
<head>
    <title>My heading</title>
</head>
<body>
    <p style="color: red;">Hello, world!</p>
</body>
</html>
```

Web Development

Embed JavaScript in HTML

Edit and save as ⟨*something*⟩ *.html* locally:

```
<!DOCTYPE html>
<html>
<head>
    <title>My heading</title>
</head>
<body>
    <p>Hello, world!</p>
    <button onclick="my_alert();">Click here</button>
    <script>
        function my_alert() {
            alert("Haha. This is interesting!");
        }
    </script>
</body>
</html>
```

Web Development

Dynamic webpage

- Our website should display customized content for every user.
- The return resources may vary even though you enter the same URL.

Solution

- Process the files before giving response to the users.
- Use server-side programming.

Web Development

Thanks to dynamic webpage ...

- The world of Internet has become so colorful.

Web Development

To make a dynamic webpage ...

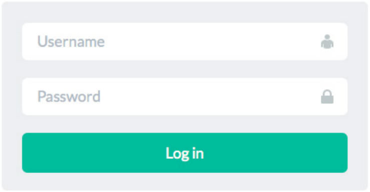
You need to learn the things below:

- Select a server-side programming language: *PHP*, *Ruby*, *Java*, ...
- Select a database engine:
  - SQL database: *MySQL*, *PostgreSQL*, *MariaDB*, ...
  - NoSQL database: *MongoDB*, *Redis*, *Firebase*, ...
- Select a server: *Apache*, *Tomcat*, *Nginx*, ...

Web Development

How to distinguish different users

- Prompt users to sign in when they visit the website.
- Save some informaton in `COOKIE` and `SESSION`.
- Whenever one user enters a URL, display the correct content based on the information stored in `COOKIE` and `SESSION`.
- Clear the `COOKIE` and `SESSION` when the user tries to logout.



Web Development

Recommended modules at SoC

- CS3216 Software Product Engineering for Digital Markets
  - *Paired with CS3217 to offer.*
- CS3226 Web Programming and Applications *(discontinued)*
  - *Last-time offered in AY2016/2017 Semester 2.*

Prestigious opportunity at SoC

- Computing for Voluntary Welfare Organisations (CVWO)

Web Development

What to expect at CVWO

- Build web-based administration system for VWOs (Voluntary Welfare Organisations) in Singapore.
- Get awesome hand-on experiences even since Year 1.
- Give back to the society using your CS knowledge.
- Receive a stipend of $????/month for 3 months.
- Claim 6MCs as SIP (Student Internship Program CP3200).
- Claim CIP hours (for foreign scholars).
- Priority on-campus housing.

Web Development

Last year - CVWO 10th Anniversary

Web Development

To join CVWO in Year 1 summer

- Obtain **really very good** grades in CS1101S, CS2030, CS2040.
- Do one or two assignments during December break.
- Apply in March and wait for inteview in April.
- Show strong programming skills and adequate project experiences.

Web Development

Looks attractive, isn't it?

- Of course!

However ...

- Not easy to get in, very competitive.
- Admit only 8 - 10 top students every year.

Not that hard as well ...

- Last year, two students from my Studio got into CVWO.

Overview

Web security

Web security

Web security

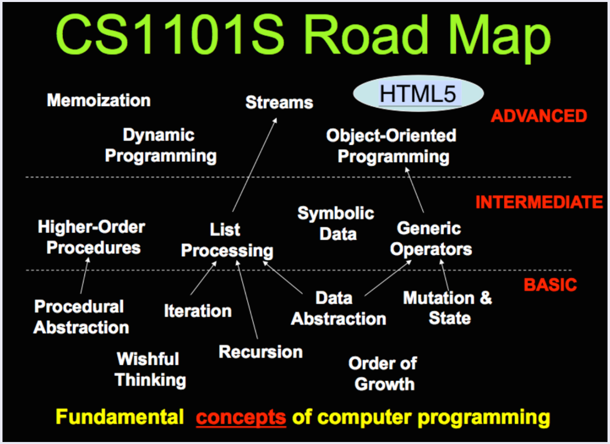
An interesting problem

- Click here `http://cs1101s.azurewebsites.net/web_sec/`

Overview

Final Review

Re-visit the CS1101S roadmap



Final Review

Things we have covered in this semester

- Components of programming language
- Wishful thinking/abstraction
- Recursion/iteration
- Higher-order programming
- Pair/list/tree processing
- Array & loop
- Data structure design
- Memoization/dynamic programming
- Literal object
- Stream
- Meta-circular evaluator
- ...

Final Review

Components of programming language

- Primitives:
  The smallest constituent unit of a programming language.
- Combination:
  Ways to put primitives together.
- Abstraction:
  The method to simplify the messy combinations.
  - To abstract data: use naming;
  - To abstract procedures: use functions.
  - Sometimes, naming and functions are combined together.

Final Review

Wishful thinking/abstraction

To make a good abstraction:

- Modularity:
  Separate multiple steps (and sub-steps).
- Readability:
  Easy for others to read and understand.
- Reusability:
  Provide a generic interface to be used commonly.
- Maintainability:
  Convenient to debug, refactor and deploy.

Final Review

Recursion

- Due to the top-down approach.
- Use substitution model to understand.
- Use pair/list/tree/stream processing.
- May give rise to recursive or iterative call (due to tail recursion).

Iteration

- Due to the buttom-up approach.
- Use environment model to understand.
- Use array and loop.

Final Review

Classical examples of recursion

Can they be solved using iteration as well?

- Factorial
- Square root
- Power function
- Fibonacci
- Greatest common divisor (GCD)
- Least common multiple (LCM)
- Hanoi tower
- Coin change
- Permutation / combination

Final Review

Higher-order programming

Why we can do higher-order programming:

- Functions are also constants or variables.
- They are not special.
- They just behave like normal constants or variables.

To use higher-order programming:

- Constants or variables can be functions.
- Parameters can be functions.
- Return values can be functions.

Final Review

Pair/list/tree processing

Up to now, the list library supports different kinds of functions:

- List builder: `list`, `build_list`, `enum_list`;
- List getter: `head`, `tail`, `list_ref`, `member`, `is_member`;
- List information: `is_list`, `is_empty_list`, `length`, `equal`;
- List modifier: `append`, `reverse`, `remove`, `remove_all`, `filter`, `map`, `for_each`;
- List converter: `accumulate`, `list_to_string`.

Final Review

Stream processing

Up to now, the stream library supports different kinds of functions:

- Stream builder: `stream`, `build_stream`, `enum_stream`, `integers_from`;
- Stream getter: `stream_tail`, `stream_ref`, `stream_member`;
- List information: `is_stream`, `stream_length`;
- List modifier: `stream_append`, `stream_reverse`, `stream_map`, `stream_for_each`, `stream_remove`, `stream_remove_all`, `stream_filter`;
- List converter: `list_to_stream`, `stream_to_list`, `eval_stream`.

Final Review

Data structure design

You should follow these principles:

- Understand the requirement before doing the actual design;
- Separate the interface from the implementation;
- Compare the advantage and tradeoff;
- Principle of last commitment.

Final Review

Memoization/dynamic programming

Use a table (literal object) to save all previously computed results:

```
function memoize(func) {
    const table = make_table();

    return function (x) {
        if (contains(x, table)) {
            return lookup(x, table);
        } else {
            const result = func(x);
            put(x, result, table);

            return result;
        }
    };
}
```

Final Review

Array, loop

- Array vs list
- Iteration (loop) vs recursion
  - `while` loop
  - `for` loop

Literal object

- Array vs literal object
  - Extension for table (memoization)?

Final Review

Meta-circular evaluator

- Add tags to differentiate various statements.
- Primitive data types/operators are self-evaluating.
- Use lists and literal objects to implement environment model.

- Basic evaluator?
- OOP evaluator?
- Lazy evaluator?
- Memoized evaluator?
- Tail recursion evaluator?

Final Review

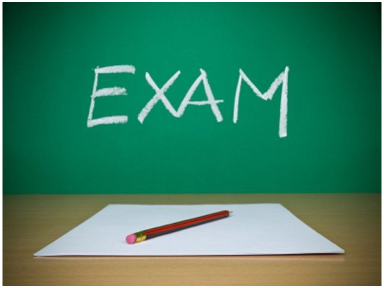
To prepare for the final examination

- Read all the materials distributed again;
- Do as many PYPs (past year papers) as possible;
- Summarize what you have learned;
- Be relaxed.

Final Review

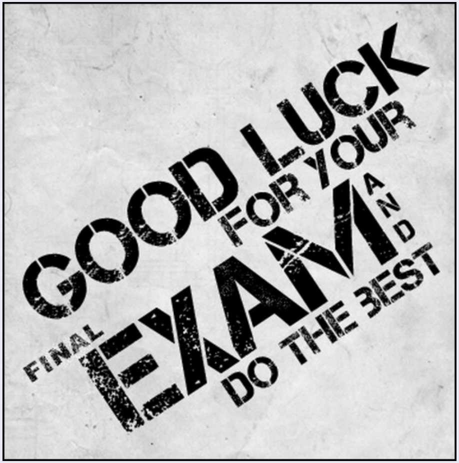
One weird thing about CS1101S final examination

- For most modules, the final will be much harder than the mid-term.
- However, CS1101S final may not be that difficult.
- ...



Good Luck

May the Source be with you!



End

The End

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