Slides by Andrew DeOrio

EECS 280

Programming and Introductory Data Structures

Midterm Exam Review

Exam time and location

- Wednesday, October 14th from 7pm to 8:30
  - *Michigan time (80 min exam)*
- Location – see email

Schedule

- Wednesday (day of exam) and Thursday (day after exam)
  - No lecture
- No lab this week
- All office hours following the exam are canceled

Policies

- Closed book
- Closed notes
- One "cheat sheet"
  - 8.5"x11", double-sided, hand-written, with your name on it
- No calculators or electronics
  - None needed
- Given under the engineering honor code

Engineering honor code

- Exams in the CoE are given under the honor code, which hold that students are honorable and trustworthy people
- No proctor
- Staff available outside for questions

- You must sign the honor pledge on the exam
  "I have neither given nor received unauthorized aid on this examination, nor have I concealed any violations of the Honor Code."

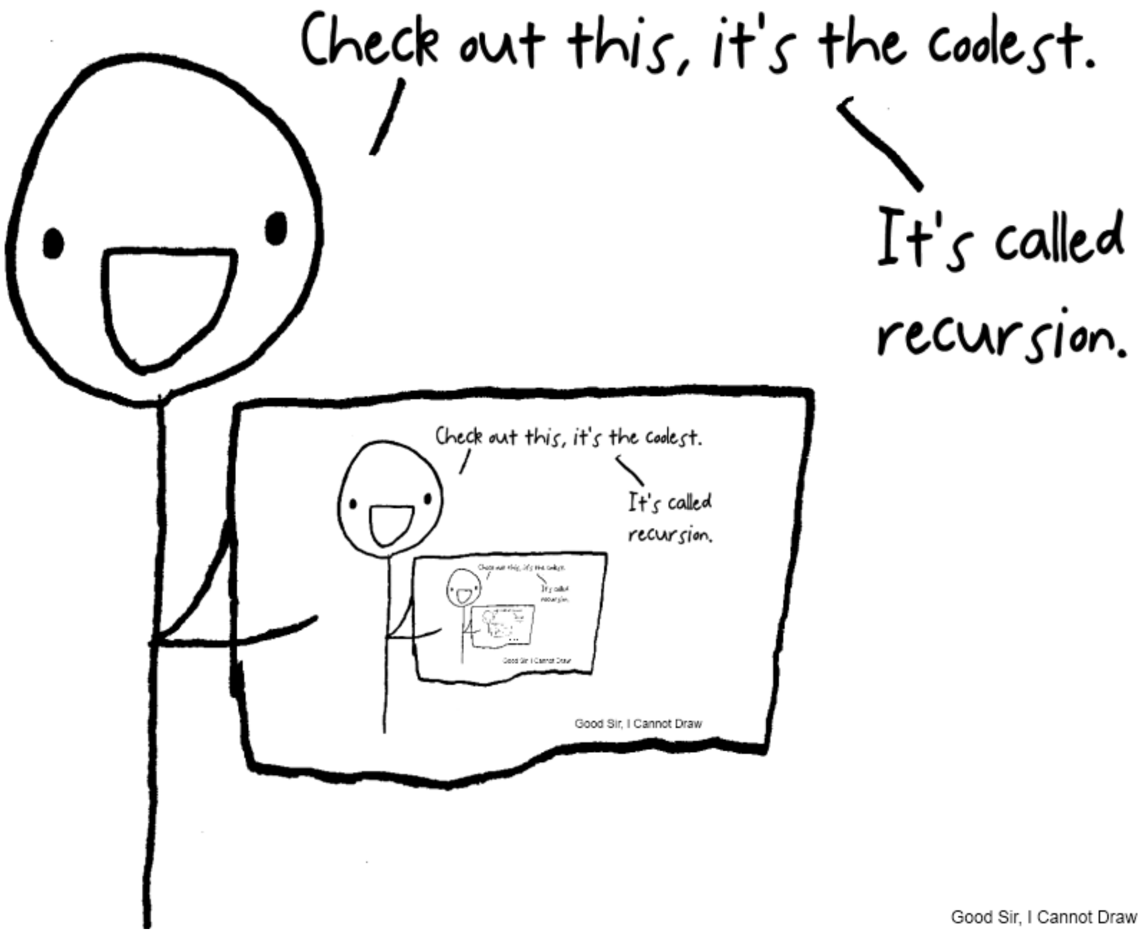
Study materials

- Practice exams posted on CTools / Google Drive
- Labs
  - Including optional exercises
- Lecture slides
  - Exercises from lecture
- Text book
- Study groups

Topics

- Everything we have covered up to and including Abstract Data Types
- Topics you should definitely study:
  - Recursion and tail recursion
    - Lists and trees (project 2)
  - Function pointers
  - Pointers and arrays
  - Strings and C-Strings
  - Structs

Recursion



http://icannotdraw.thecomicseries.com/

Group Exercise: pow(x, y)

- Write a tail-recursive version of the power function that returns x to the power of y. It needs a helper function - why?
- Here is a non-tail-recursive, but recursive version of this function:

```
int power(int x, int y) {
  if (y == 0) {
    return 1;
  } else {
    return x * power(x, y-1);
  }
}
```

- Before you begin, why isn't this tail recursive?

Function Pointers

- I couldn’t find anything funny about function pointers on the internet.

Exercise

```
bool all_of(list_t list, bool(*fn)(int)) {
  //EFFECTS: returns true if fn returns true for all

  if (list_isEmpty(list)) //base case
    return true;
  if (!fn(list_first(list))) //check current item
    return false;
  return all_of(list_rest(list), fn); //recurse
}
```

- Write these two functions. Use `all_of()` and helper functions

```
bool all_even(list_t list);
bool all_odd(list_t list);
```

Arrays and pointers

MAN, I SUCK AT THIS GAME. CAN YOU GIVE ME A FEW POINTERS?
0x3A28213A 0x6339392C, 0x7363682E.
I HATE YOU.

http://xkcd.com

Pointer Exercise: Code these

```
//REQUIRES: "a" points to an array of length "size"
//EFFECTS:  Returns a pointer to the first
//  occurrence of "search" in "a".
//  Returns NULL if not found.
int * find (int *a, unsigned int size, int search);

//REQUIRES: "s" is a NULL-terminated C-string
//EFFECTS:  Returns a pointer to the first
//  occurrence of "search" in "s".
//  Returns NULL if not found.
char * strchr (char *s, char search);
```

Do not use array indexing, e.g., `a[i]` or `*(a+i)`

Strings

ARRGH! MY MAP OF LISTS OF MAPS TO STRINGS IS TOO HARD TO ITERATE THROUGH! I'LL JUST ASSIGN EVERYTHING A NUMBER AND USE A *!#*!@ ARRAY

C strings vs. C++ strings

C++ string

```
#include <string>
const string hello =
"hello";
hello.length();
string s;

s = hello; //copy
if (a == b)
 // do something
```

C string

```
/* Write the C string
version here */
```

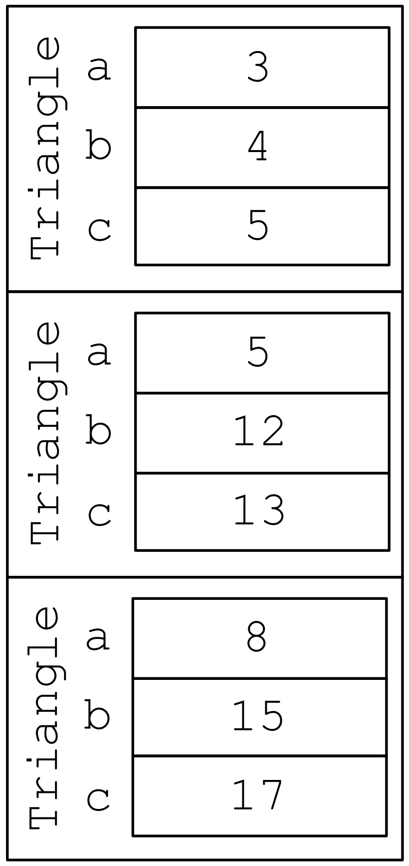
Compound Types

Exercise: arrays of structs

- Call `Triangle_area()` on each `Triangle` in the array using *traversal by pointer*

```
double Triangle_area(const Triangle *t);


const int SIZE = 3;
Triangle triangles[SIZE];
// initialization code ...
```


Triangle
a
3
b
4
c
5
Triangle
a
5
b
12
c
13
Triangle
a
8
b
15
c
17