

# Control Structures

Prof. Evan Chang  
Meeting 17, CSCI 3155, Fall 2009



## Announcements

- HW5 due tonight at 11:55pm
- Check your grades on the moodle through HW4 and Midterm 1
  - mean 71.5, median 69.71, 3<sup>rd</sup> quartile 76.57, max 94
  - 80 A, 68 B, 62 C, 57 D
- Project 1, time spent, avg 19.3 hrs? (whole project or after checkpoint?)
  - more template, examples, test cases
- Keep things in perspective
  - 1 out of ~10 homeworks (25%), drop lowest

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## More Compassion

- Make up by redoing the project in the language of your choice
  - complete (everything must work)
  - write a 1-2 paragraphs comparing your lang with SML using concepts from the class
    - "Lang X is better because I already know it" is not good enough.
  - demonstrate through interview with me and Chenyu before Fall Break
- Note: SML concepts from the project may still appear on exams

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## Project Discussion

## GC Review

## Garbage Collection

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## Garbage Collection: Reference Counting

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## Garbage Collection: Reference Counting

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## Garbage Collection: Reference Counting

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## Garbage Collection: Mark-and-Sweep

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## Garbage Collection: Mark-and-Sweep

- Leaks still exist with *GC*.
- Why?

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## Garbage Collection: Mark-and-Sweep

- Leaks still exist with *GC*.
- Why?
  - `p = new LL();`
  - `p->next = new LL();`
  - // What if p is never used again after this point?

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## Garbage Collection: Mark-and-Sweep

- What does "mark-and-sweep" collection assume in order to do the marking?

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## Expressions

## Operand Evaluation Order

- Want to evaluate



- What is the order by which we evaluate arguments  
Order matters - when you have side-effects  
When order does not matter, we have referential transparency

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$fun\ g\ () = 3$   
 $fun\ f\ () = g\ ()$

## Operand Evaluation Order

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## Operand Evaluation Order

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## Operand Evaluation Order

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## Short-Circuit Evaluation

- What is it? What is an example?

e.g. (false)  $0 * (progname \& 5) \rightarrow 0$   
 $0 * g() \rightarrow 0$  (g never gets called)  
(not typical with arithmetic)

(C) false && ??  $\rightarrow$  false  
true ||

are short-circuiting (left-to-right)

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## Short-Circuit Evaluation

- How could we test if an operator short-circuits?

• side-effect = printing to show what happens  
`return false; print(1);` && `print(2);`;

`false && infiniteLoop();`  
`segfault();`

`if (p != null && p->next != null) { ... }`

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## About your classmates

- Burned old furniture in a bonfire at aunt's house
- Takes random hikes in the middle of the night
- Previously an English major
- 2<sup>nd</sup> in campus-wide air guitar contest (and won an electric guitar)
- Plays the drums
- DJed at Church Nightclub

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## Control Structures

## Conditionals

- if-then-else

`if (e1:bool) then (e2:'a') else (e3:'a')` (SML)

`if (e) stmt1 else stmt2` (C, C++, Java, C#)

"two-ways to proceed"

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## Multiway Branches

(C)

```
switch (e) {  
  case const1: stmt1;  
  ...  
  case constn: stmtn;  
  [default: stmt;]  
}
```

Roughly,  
`if (e == const1) { stmt1; }`  
`else if (e == const2) { stmt2; }`  
`else { stmt; }`

What are the semantics?

(last not quite)

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## Multiway Branches

(C)

```
switch (e) {  
  case const1: stmt1; break;  
  ...  
  case constn: stmtn; break;  
  [default: stmt;]  
}
```

Design choices and C's choice?

fall-through — Yes ;  
exhaustive checking — No  
what can stmt1... be? — anything

switch (e) {  
 default: ;  
 if (—)  
 case3: ;  
}

what happens when  
no match?  
Anything

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## Multiway Branches

Java or C#?

```
switch (e) {  
  case const1: stmt1;  
  ...  
  case constn: stmtn;  
  [default: stmt;]  
}
```

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## Multiway Branches

Discuss and come up with an example of where you might prefer to use a "switch" versus an "if" and/or vice versa

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## Multiway Branches: SML

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## Loops

for (expr1; expr2; expr3) { ... } (C)

FOR i := low TO high BY step DO ... END

foreach (var in list) { ... } (C#)

- What is different? Give an example or explain what you can do in C but not the others (pros and cons?)

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## Guarded Commands

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## **Guarded Commands**

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## **Guarded Commands**

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## **For Next Time**

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- Reading
- Online discussion forum
  - $\geq 1$  substantive question, comment, or answer each week
- Work on HW5

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