CS 444 - Compiler Construction **Winter 2020**

Lecture 18: March 11 , 2020

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18.1 Code Generation - x86 code generation

- Branching Instructions

```
jmp label ; sets eip to constant value
cmp eax, ebx ;  Check two values, result of comparison is stored in flags
je label ; ==
jne label ; !=
jg label ; > (Signed manner). jge, jl. jle are all also valid
ja label ; > (Unsigned manner) ja, jb, jbe are all also valid
```

- Call instructions

```
call label ; pushes eip on stack and sets eip to label
ret ; pops eip from stack
push eax
pop eax
int 0x80 ; system call
```

- Exiting
  - Set eax to 1
  - Set ebc with exit code
- Assembler Directives

```
dd 1234 ; .word (puts constant in machine language output)
db "hello" ; Output one byte for each character in the string
global label ; export label
extern label ; import label
section .text ; executable code
section .data ; readable and writeable data
```

18.2 Code Generation - Key Tasks

1. Plan data layout
   - Document
   - Write helper functions to generate code to access data
2. Generate code for each kind of ast node

18.3 Data in JOOS/Java

- Local variables (parameters)
- Objects
  - Instance field
  - type tag (pointer to class)
- Classes
  - static fields
  - pointers to method implementations
- Array
  - type tag
  - length
  - elements
- Primitives
  - 32 bit Integers
  - 16 bit Short
  - 16 bit Char
  - 8 bit byte
  - 1 bit boolean
  - 32 bit References to object

18.4 Storage options

- Constants
  - at labelled memory location (`dd 1234`)
  - as part of instruction (`mov eax, 42`)
- Registers
  - Limited number available in x86
- Fixed (labelled) memory addresses
- Stack - LIFO