CS 354 - Machine Organization & Programming
Thursday, November 7, 2019

Midterm Exam (~18%): TONIGHT Thursday, November 7th, 7:15 - 9:15 pm

- **Lec 1 (2:30 pm):** room 3650 of Humanities
- **Lec 2 (4:00 pm):** room B10 of Ingraham Hall
- UW ID required
- #2 pencils required
- closed book, no notes, no electronic devices (e.g., calculators, phones, watches)
- see “Midterm Exam 2” on course site Assignments for topics

Project p4b (~4%): DUE at 10 pm on Wednesday, November 13th

Last Time

Instructions - Arithmetic and Shift
Instructions - CMP and TEST, Condition Codes
Instructions - SET
Instructions - Jumps
Encoding Targets
Converting Loops
---------- END of Exam 2 Material ----------

Today

The Stack from a Programmer’s Perspective
The Stack and Stack Frames
Instructions - Transferring Control
Exam Mechanics

Next Time

More Stack Frames
Read: B&O 3.7.3 - 3.7.5

The Stack from a Programmer's Perspective

Consider the following code:

```
int inc(int index, int size) {
   int incindex = index + 1;
   if (incindex == size) return 0;
   return incindex;
}

int dequeue(int *queue, int *front,
         int rear, int *numitems, int size) {
   if (*numitem == 0) return -1;
   int dqitem = queue[*front];
   *front = inc(*front, size);
   *numitems -= 1;
   return dqitem;
}

int main(void) {
   int queue[5] = {11,22,33};
   int front = 0;
   int rear = 2;
   int numitems = 3;
   int qitem = dequeue(queue, &front, rear,
         &numitems, 5);
   ...
```

What does the compiler need to do to make function calls work?

-
-
-
-
-
-

The Stack and Stack Frames

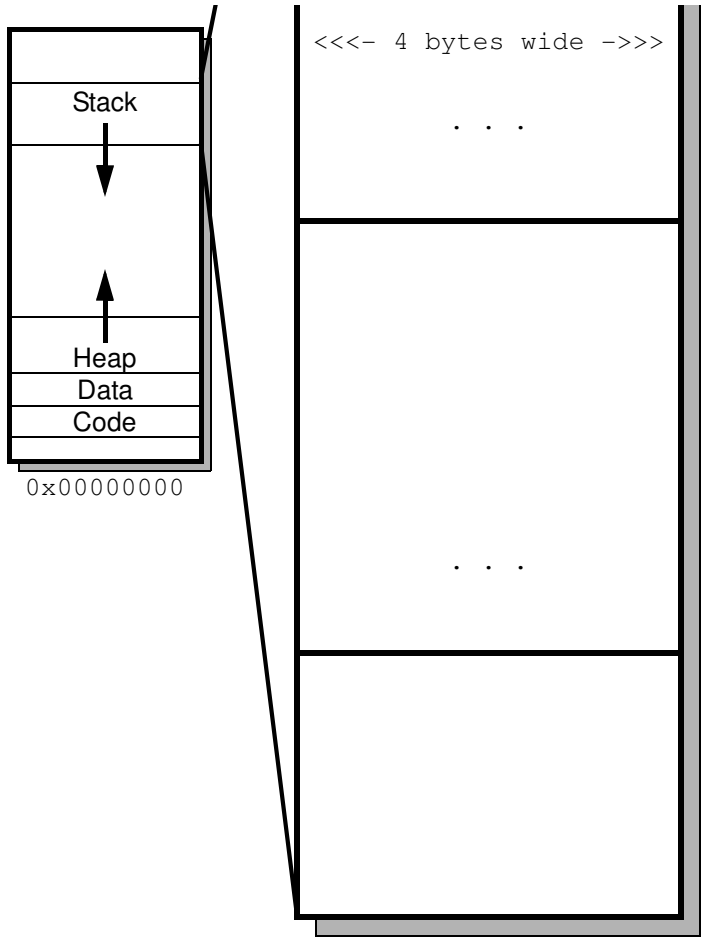
Stack Frame

IA-32:

%ebp

%esp

Stack Layout



- *A Callee's args*

  → What is the offset from the %ebp to get to a callee's first argument?

  → When are local variables allocated on the stack?

Instructions - Transferring Control

Flow Control

function call:

```
call *Operand
```

```
call Label
```

steps (for both forms of call)

1.

2.

function return:

```
ret
```

step

1.

Stack Frames

allocate stack frame:

free stack frame:

```
leave
```

steps

1.

2.