You may bring one page of notes, front and back.

Questions will be in short-answer format with partial credit for partial answers.

Questions will require you to read and write C and IA32 (32-bit x86) code.

Topics:
- Number formats: decimal, hex, binary
- Integer representations: unsigned, 2s compliment – to/from decimal
- Bitwise operations in C: and, or, not, xor, logical/arithmetic shifts
- IEEE 754 single-precision floating-point representation: to/from decimal
- Data-transfer instructions: movl, pushl, popl
- Arithmetic instructions: addl, shll, shr1, sarl, andl, orl, xorl, leal
- Control instructions: cmpl, j* instructions
- Labels, with j* instruction in IA32, goto statement in C
- Functions: %eip (program counter), %ebp, %esp, return address, call, ret
- Arrays: storage in memory, lookup calculation (single dimension only)

Sample questions:
1. [5] What is the decimal value of the byte 0xA1, interpreted as an 8-bit (signed) int? Show your work:

2. [15] What is the bit value of 3.25 encoded as an IEEE 754 single-precision floating-point number? Show your work:

3. [10] Write IA32 code which uses a single leal instruction to calculate the result of \( x = 4 \times x + y + 12 \) assuming that \( x \) is in %eax and \( y \) is in %ecx. Comment your code:

4. [25] Consider the following C code:

```c
int sum(int start) {
    int result = 0;
    do {
        result += start;
        --start;
    } while (start);
    return result;
}
```

a. (10) Rewrite the code (in C) to use a label and goto statement rather than a loop. Comment your code:

b. (15) Convert your C code from part A above into IA32, ensuring that register use is correct with respect to the IA32 register conventions. Comment your code: