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

You may bring a calculator this will not be required.

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

Questions will require you to read and write C and x86 code.

Topics:

- Integer number representations: unsigned, 2s compliment
- Bitwise operations in C: and, or, not, xor, shifts
- IEEE 754 single-precision floating-point representation: encoding, decoding
- Pointers: C and x86
- Data transfer instruction: movl, pushl, popl
- Arithmetic instructions: addl, subl, shll, shr, sarl, andl, orl, xorl, leal
- Conditional instructions: cmpl, j* instructions,
- Labels, with j* instruction in x86, goto statement in C
- Call stack: %ebp, %esp, call, ret
- Arrays and structs: storage in memory

Sample questions:

1. (10) What is the hex value of 1.5 encoded as an IEEE 754 single-precision floating-point number? Show your work:

2. (5) Briefly explain why explicit pointers are required in C but not in Java and Python:

3. (10) Write x86 code which will branch to L1 if and only if the values in %eax and %ebx are equal. Explain your answer:

4. (10) Write x86 code which uses leal instructions to calculate the result of $x = 5 \times x + y + 12$ assuming that $x$ is in %eax and $y$ is in %ebx. Explain your answer:

5. (10) Write a C function which takes an unsigned in $x$ as an argument and returns $16 \times x$ without using addition or multiplication. Explain your answer: