MIDTERM GUIDE

The exam is open book and open note, and focuses on material covered in the lectures, labs, assignments, and additional readings. The exam questions will require you to demonstrate a good understanding of the key concepts and the ability to analyze a particular situation and apply your knowledge.

Material Covered: The first half the class concentrates on the following three modules:

1. Data Representations,
2. Introduction to C,
3. Introduction to x86-64 Assembly

Hence, the midterm exam will cover all materials contained in Lectures 2-23. Topics covered in the lectures are listed in detail below:

Data Representations
- Lecture 2: A Tour of C Programs, Bits & Bytes
  bits and bytes, hexadecimal, integer representations, unsigned integers

- Lecture 3: Representing and Operating on Integers
  signed integers, overflow, casting and combining types

- Lecture 4: Bits and Bitwise Operators
  bitwise operators, bitmasks, bit shift operators

- Lecture 5: Floating Point
  representing real numbers, fixed point, floating point

- Lecture 6: More Floating Point
  tiny floating point, floating point arithmetic, floating point in C

Introduction to C
- Lecture 7: Chars and Strings in C
  characters, string, common string operations (comparing, copying, concatenating, substrings)

- Lecture 8: More Strings in C, Pointers
  searching in strings, points

- Lecture 9: Strings in Memory
  printing the value of a pointer, strings in memory

- Lecture 10: Arrays and Pointers
  pointers and parameters, double pointers, arrays in memory, arrays of pointers

- Lecture 11: The Stack and The Heap
  pointer arithmetic, the stack, the heap and dynamic memory, realloc

- Lecture 12: Other Heap Allocations, realloc
  calloc, strdup, freeing the memory with free, realloc, stack vs. heap

- Lecture 13: Generics
  generic swap, generic pitfalls, generic array swap

- Lecture 14: Function Pointers
  generic bubble sort, function pointers

- Lecture 15: More Function Pointers, const
  generic printing, counting matches, function pointers as variables, generic C standard library functions, const

- Lecture 16: Structures
  struct, generic stack

- Lecture 17: Compiling C programs
  what really happens in GCC, make and makefiles

Introduction to x86-64 Assembly

- Lecture 18: Introduction to x86-64
  gcc and assembly, looking at an executable, registers, the mov instruction

- Lecture 19: Data Movement
  operand forms, data and register sizes, mov and data sizes

- Lecture 20: Arithmetic and Logic Operations
  the lea instruction, logical and arithmetic operations, reverse engineering assembly code

- Lecture 21: Assembly Execution and %rip
  executing instructions, the program counter register (%rip),

- Lecture 22: x86-64 Control Flow
  direct and indirect jump operations, control mechanics (condition codes, the cmp and test instructions), implementation of if statements in assembly

- Lecture 23: More Control Flow
  implementation of while and for loops in assembly, other instructions that depend on condition codes (the set and cmov instructions)