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
  
  unconditional and conditional jump instructions, 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)