

## MIDTERM EXAM GUIDE

The exam is a **closed book and notes exam**, and focuses on material covered in the lectures, labs, and assignments. But you are allowed to have **two A4 sized copy sheets** during the exam (you can use both sides of these sheets). 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 of 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 2-14. Topics covered in the lectures are listed in detail below:

Data Representations

- Lecture 2: Bits & Bytes, Representing and Operating on Integers  
*bits and bytes, hexadecimal, integer representations, unsigned integers, signed integers, overflow, casting and combining types*
- Lecture 3: Bits and Bitwise Operators  
*bitwise operators, bitmasks, bit shift operators*
- Lecture 4: Floating Point  
*representing real numbers, fixed point, floating point, tiny floating point, floating point arithmetic, floating point in C*

Introduction to C

- Lecture 5: Chars and Strings in C  
*characters, string, common string operations (comparing, copying, concatenating, substrings)*
- Lecture 6: More Strings in C, Pointers  
*searching in strings, points, printing the value of a pointer, strings in memory*
- Lecture 7: Arrays and Pointers  
*pointers and parameters, double pointers, arrays in memory, arrays of pointers, pointer arithmetic*
- Lecture 8: The Stack and The Heap  
*the stack, the heap and dynamic memory, realloc, calloc, strdup, freeing the memory with free, stack vs. heap*
- Lecture 9: Realloc, Memory Bugs  
*realloc, memory leakage, and other errors common when working with pointers*
- Lecture 10: void\*, Generics  
*generic swap, generic pitfalls, generic array swap*
- Lecture 11: Function Pointers  
*generic bubble sort, function pointers, generic printing, counting matches, function pointers as variables, generic C standard library functions*

- Lecture 12: const, Structures  
*const, struct, generic stack*
- Lecture 13: Compiling C programs  
*what really happens in GCC, make and makefiles*

#### Introduction to x86-64 Assembly

- Lecture 14: Introduction to x86-64, Data Movement  
*gcc and assembly, looking at an executable, registers, the mov instruction, operand forms, data and register sizes, mov and data sizes*
- Lecture 15: Arithmetic and Logic Operations  
*the lea instruction, logical and arithmetic operations, reverse engineering assembly code*