1510 Course Review (**Winter 2017**)

- Hardware/software, computer architecture
  - motherboard, CPU, memory (disk, RAM, ROM), BUS, clock, slots
  - operating system
- Computer number systems and representation
  - decimal, binary, octal, hexadecimal
  - conversion between number systems
  - character representation (ASCII)
  - integer representation (sign-magnitude, 2's complement)
  - real number representation (IEEE standard - single and double precision)
  - range and precision of number representations
- Problem solving
  - steps to solving a problem
  - algorithm development
  - flowcharts
- Introduction to programming
  - from hardware to software (memory)
  - ordered instruction execution
  - machine language
  - programming languages (syntax)
  - compilers (object files, executable files)
  - creating a program
  - architecture dependence
  - basic program structure
- Types of errors (logic, syntax, linker, run-time)
- Fortran programming
  - Basic program structure (PROGRAM, IMPLICIT NONE, comments)
  - Data types (INTEGER, REAL, CHARACTER, LOGICAL, COMPLEX, KIND)
  - Identifiers and variable declarations (PARAMETER)
  - Arithmetic operations (integer division)
  - Built-in functions (ex. SQRT, MOD)
  - Assignment statements

  - Input/output (READ/WRITE)
  - Formatted I/O (FORMAT, ADVANCE)
  - Logical expressions (relational operators, logical operators, order of operations) (caution comparing floating point numbers - TOL)
  - Selection statements (IF, SELECT-CASE)
  - Repetition statements (DO, DO WHILE, DO EXIT, CYCLE)
  - Internal, external, and module subprograms (FUNCTION, SUBROUTINE, CONTAINS, INTERFACE, INTENT, RESULT)
  - Scope of variables
  - Arrays (compile-time and run-time (DIMENSION, ALLOCATABLE, ALLOCATE, DEALLOCATE), multidimensional)
  - File input/output (OPEN, CLOSE, READ, WRITE)
  - Derived data types (TYPE)
  - Recursion (RECURSIVE, RESULT)
  - Modules (MODULES, USE, PUBLIC, PRIVATE, PROTECTED, ONLY)
  - Pointers (POINTER, TARGET, ASSOCIATED, NULLIFY)
  - Dynamic memory allocation
  - Command-line arguments (COMMAND_ARGUMENT_COUNT, GET_COMMAND, GET_COMMAND_ARGUMENT)

- C programming
  - Basic program structure (main function, return, comments)
  - C library (#include, stdio.h, stdlib.h, string.h, math.h)
  - C compilation process (pre-processor)
  - Input/output (scanf, printf, fgets)
  - Assignment statements
  - Data types (short, int, long, char, float, double, unsigned) (Note no logical, false if zero, true if nonzero)
  - Identifiers and variable declarations (const)
  - Arithmetic operations (mod % , short-cut operators +=, ++, . . .)
  - Math functions - math.h (sin, fabs, pow. . .)
  - Logical expressions (relational operators, logical operators, operator precedence)
  - Selection statements (if, switch, break)
  - Repetition statements (while, for, do while, continue)
  - Functions (void, pass-by-value/pass-by-reference)
  - Arrays

  - Pointers (`*, &`)
  - Arguments to main (argc, argv)
  - String functions (sscanf, sprintf, strcpy, strcat, strcmp, strtok)
  - File input/output (FILE *, fopen, fclose, fscanf, fprintf, EOF)
  - Dynamic memory allocation (malloc, calloc, sizeof, type casting, realloc, free)
  - Data structures (struct, ., `->`)
  - C pre-processor (`#include, #define, #if, #ifdef`)
  - typedef
- Makefiles
- Examples/algorithms
  - Mean time to failure
  - Approximating trigonometric functions
  - Euclid's algorithm (computing greatest common divisor)
  - Temperature conversion
  - Poisson probability
  - Angle conversion
  - Coordinate conversion (polar to rectangular)
  - Dice roll
  - Final mark calculation
  - Sorting (selection, insertion)
  - Searching (linear, binary)
  - Properties of a circle
  - Linked list, sorted linked list
  - Factorial
  - Simple calculator
  - Computing max/min/average
  - Histogram
  - Rectangles

- Fibonacci sequence
- Tracking inventory / Cash register
- Plotting random data
- Binomial coefficient
- Compute multiples
- Measurement conversion (choose from menu)
- Volume of a cone
- Grade point average
- Count negative values
- Toll calculation
- Smallest power to exceed a value
- Angle between vectors
- Prime numbers (Sieve of Eratosthenes)
- Letter grade
- Age in weeks
- Exam mark required to achieve desired final grade
- Swap values
- Compute n^{th} partial sum (approximation of e)
- Piecewise function
- Sum of integers
- Distance between points
- Count even values
- Palindrome