- CS 261
  - Binary representations
    - Base conversions
      - Binary
      - Octal
      - Decimal
      - Hexadecimal
    - Endianness
      - Big
      - Little
    - Integers
      - Unsigned
      - Sign magnitude
      - Ones' complement
      - Two's complement
    - Bitwise operations
      - AND
      - OR
      - XOR
      - Left shift
      - Right shift
        - Logical
        - Arithmetic
    - Floating point
      - Normalized
      - Denormalized
      - Infinity (+/-)
      - Not-a-Number (NaN)
    - Text
      - ASCII
      - Unicode
      - UTF-8 vs. UTF-16/32
    - Code
      - Machine code
        - RISC vs. CISC
        - Opcodes
        - Registers
      - Assembly code
  - Assembly/machine code
    - Movement & arithmetic
      - Addressing modes
        - Immediate
        - Register
        - Indirect
        - Base + displacement
        - Indexed
        - Scaled indexed
      - Stack management
      - Integer arithmetic
      - Bitwise logical & shifts
      - Floating-point arithmetic
        - Vector (SIMD) instructions
        - SSE instruction sets
        - XMM/YMM registers
        - Stupid Floating-Point Hacks (TM)
    - Control flow
      - Condition flags
        - CF
        - OF
        - SF
        - ZF
      - Comparisons and tests
      - C goto code
      - Labels
      - Unconditional jumps
      - Conditional jumps
      - Conditional moves
      - Loop
        - Do-while
        - Jump-to-middle
        - Guarded-do
      - Jump tables
    - Procedures
      - Application Binary Interface (ABI)
      - Calling conventions
      - Stack frames
        - Return address
        - Call and return
      - Parameters
      - Registers
        - Caller-saved
        - Callee-saved
      - Local variables
    - Data structures
      - Homogeneous vs. heterogeneous
      - Arrays
        - Pointer arithmetic
        - Indexing
        - Nested / multidimensional
      - Structs / records
        - Alignment
      - Unions
    - Buffer overruns
      - Shellcode
      - Stack randomization
      - Canary values
      - Read-only code regions
  - Operating systems
    - Kernel
      - User vs. kernel mode
      - Monolithic vs. microkernel
    - Virtual memory
      - Virtual vs. physical memory
      - Address spaces
      - Memory pages
      - Page faults / swapping
      - MMU and TLB
      - Allocation
        - Explicit
        - Implicit
    - Exceptions
      - Async vs. sync
      - Recovery options
      - Types
        - Interrupt
        - Trap
        - Fault
        - Abort
      - Exception table
      - System calls
        - SysV
        - POSIX
      - Signals
        - Common signals
          - SIGALRM
          - SIGINT
          - SIGSEGV
          - SIGKILL
          - SIGTERM
        - Signal handlers
        - signal() / raise()
        - Debuggers
    - Processes
      - Logical flows
      - Concurrency
      - Multitasking / time-sharing
      - Parallelism
      - Context switching
      - C language
        - fork
        - wait
        - execve
      - Shell
        - Jobs
        - Foreground vs. background
    - Threads
      - Processes vs. threads
      - Shared memory
      - POSIX threads (pthreads)
      - Data races
      - History of parallelism
        - Uniprogramming
        - Multiprogramming
        - Multiprocessing
        - Distributed computing
    - Files
      - Types
        - Regular
        - Directory
        - Socket
      - File systems
        - File hierarchy
        - Absolute vs. relative file name
        - Mount points
        - Metadata (stat)
      - Implementation
        - Low-level syscalls
        - File sharing
        - High-level libc functions
      - Standard I/O
        - Input
        - Output
        - Error
        - Redirects
        - Pipes
      - Permissions
        - Unix permissions
        - ACLS
  - Architecture
    - von Neumann architecture
      - System stack
    - Logic gates
      - Relays
      - Transitors
      - Digital signals
      - Universal gates
    - Combinational circuits
      - Boolean formulas
      - HDL
      - Circuit equivalency
      - Basic
        - Equality checkers
        - Multiplexors
        - Half adders
        - Full adders
      - Advanced
        - Ripple-carry adders
        - Adder/subtractors
    - Sequential circuits
      - Circuit "memory" via feedback
      - Time sensitivity
      - Edge-triggers vs. master-slave
      - Clocks
      - Basic
        - SR latch
        - D latch
        - Flip-flops
      - Advanced
        - Registers
        - Register files
        - Memory
        - Shift registers
        - Counters
    - CPU design
      - Stages
        - Fetch
        - Decode
        - Execute
        - Memory
        - Write back
        - PC update
      - Components
        - Clocked PC register
        - ALU / register file / memory
        - Control logic
        - Wires & buses
      - "No reading back" principle
      - Throughput and latency
      - Pipelining
        - Instruction-level parallelism
        - Tradeoff: throughput vs. latency
        - Issue: non-uniform partitioning
        - Issue: data and control dependencies
        - Stalling and forwarding
        - Branch prediction
    - Memory hierarchy
      - Technologies
        - SRAM
        - DRAM
        - HDD / SSD
        - Tape
      - I/O architecture
      - DMA
      - Historical trends
    - Memory design
      - Caching
        - Locality
          - Temporal
          - Spatial
          - Strides
          - Latency
          - Prefetching
        - Cache memory
          - Cache miss
          - Cache hit
          - Cache write
          - Cache architecture
          - Memory mountain
  - C and Unix/Linux
    - Terminal interface
      - Shells (bash and scp)
      - Basic file utilities (cd, ls, cat, cp, etc.)
      - Command line parameters
      - Text editors (nano, vim, emacs)
      - Build systems (make)
    - Compilation
      - Preprocessing
      - Compiling
      - Assembling
      - Linking
    - Debugging
      - Breakpoints
      - Watchpoints
      - Step into
      - Step over
      - Backtracing
    - Memory model
      - Static code
      - Static data
      - Stack
      - Heap
    - C language
      - Pointers
      - Strings
      - File I/O
      - Getopt
      - Structs
      - Typedefs
      - Bitwise operations