Ph.D. Preliminary Examination
Topics & Reading List
Department of Computer Science
Kent State University

Discrete Structures
- Functions, relations, sets
- Basic logic
- Fundamental properties of integers and boolean matrices
- Proof techniques: induction and recursion
- Counting, discrete probability
- Graphs and trees, Boolean algebra
- Modeling computation: basic languages and grammars, regular expressions and Turing Machines

Suggested reading: Rosen, *Discrete Mathematics and its Applications*, McGraw Hill, latest edition,
Chapters: all

Design and Analysis of Algorithms
- Basic analysis tools: growth functions and asymptotic analysis
- Algorithm design strategies: greedy, divide and conquer, dynamic programming
- Analysis & design: hashing, basic searching & sorting, elementary graph and string matching algorithms
- Complexity classes P and NP

Suggested reading: Cormen, Leiserson, Rivest & Stein, Introduction to Algorithms, latest edition,
Chapters: 1-4, 6-7, 11-16, 22-25, 32, 34.

Data Structures and Fundamentals of Programming
- Abstract data types
- Fundamental data structures
- Vectors, lists, stacks, queues, binary trees, graphs
- Object oriented programming, inheritance
- Polymorphism, and dynamic variable binding
- Containers and iterators
- Hashing, priority queues and heaps

Suggested reading: Ford & Topp, *Data Structures with C++*, Prentice Hall, latest edition,
Chapters: all

Foundations of Programming Languages
- Describing syntax and semantics
- Names, bindings, type checking, and scope
- Lexical and syntactical analysis
- Data types, expressions, and statements
- Subprograms and parameter passing mechanisms
- Exception handling
- Object-oriented languages
- Functional and logic programming languages

Suggested reading: R. Sebesta, Concepts of *Programming Language*, Addison Wesley, latest edition,
Chapters: all

Computer Architecture and Organization
- Computer performance measure and analysis
- Instruction set design
- Computer arithmetic
- Processor design and control
- Processor pipelining
- Loop unrolling and software pipelining (A)
- Queuing theory (B)
- Memory organization
- I/O subsystems
- Multiprocessors

Suggested reading:
i. Patterson & Hennessy, *Computer Organization & Design*, Morgan Kaufmann, latest edition,
Chapters: all
ii. Patterson & Hennessy, Computer Architecture, A Quantitative Approach, Morgan Kaufmann, latest edition,
Chapters: (A) Section 4.4, (B) Section 7.8.

Computer Operating Systems
- Process management: processes, threads, CPU scheduling,Process synchronization, deadlocks
- Memory management: main memory, virtual memory.
- Storage management: file system interface and implementation, disk structure, OS I/O systems
- Protection and security

Suggested reading: Silberschatz, Galvin, & Gagne*, Operating Systems Concepts, latest edition.*
Chapters: 1-15.