

PhD Comprehensive Exam
Computer Electronics & Communications Specialization
Academic Year 2023-2024

Examination Time: 4 Hours

Reading Materials:

Part I: Software Systems: Data Structures/Operating Systems

Responsible Faculty: Prof. Dr. Doaa Shawky, Engineering Math and Physics Department, Faculty of Engineering, Cairo University

a) Data Structures

Basic data structures (with implementations) such as arrays, singly linked lists, doubly linked lists, and circular lists, along with stacks and queues, in addition to the computational efficiency of the basic operations.

Reference:

Goodrich, M. T., Tamassia, R., & Mount, D. M. (2011). Data structures and algorithms in C++. John Wiley & Sons.
Sections 3.1 - 3.4, 4.1 – 4.2, 5.1–5.2.

b) Operating Systems

Basic CPU and memory virtualization: mechanisms and policies.

- i) CPU Scheduling: Chapters 7-10.
- ii) Memory Virtualization: Chapters 18-22

Reference:

Arpaci-Dusseau, R. H., & Arpaci-Dusseau, A. C. (2018). Operating systems: Three easy pieces. Arpaci-Dusseau Books, LLC.

Available for free at: <https://pages.cs.wisc.edu/~remzi/OSTEP/>

Part II: Pattern Recognition

Responsible Faculty : Prof. Dr. Nemat AbdelQader, Electronics and Communications Engineering Department, Faculty of Engineering, Cairo University

Topics:

Definitions
Typical application areas
Introduction
Classifiers Based on Bayes Decision Theory
Discriminant Functions
Estimation of Unknown Probability Density Functions
System Evaluation
Bayesian Networks
Linear Classifiers
Non Linear Classifiers
Clustering Techniques
Feature Selection and Extraction

Text Book:

- 1- Pattern Recognition by "Sergios Theodoridis", second edition, chapters 1, 2, 3, 5
- 2- Deep Learning for distant speech Recognition by " Micro Ravanelli" December 2017, chapters 2, 3

Part III: Computer Networks

Responsible Faculty: Prof. Dr. Khaled Fouad ElSayed, Professor of Communication Networks, Faculty of Engineering, Cairo University

I) Undergraduate Curriculum

The Internet

IP Protocol (Operation - Frame Format) - Routing in the Internet (Shortest Path Routing - OSPF Routing - BGP Routing) - TCP Protocol (Connection Management – Automatic Repeat Request Protocols - Sliding Window - Timer Management)

Local Area Networks

Types of LANs - The IEEE 802.x family of protocols - Ethernet Protocol Architecture - Multiple Access Techniques and Simplified Performance of the CSMA/CD protocol - LAN Interconnection and Extended LANS - Spanning Trees - Prim's Algorithm for MCST

Text Book and Reading Material:

- 1- Computer Networking: A Top-Down Approach Featuring the Internet, Jim Kurose and Keith Ross, Addison-Wesley, 5th Edition or later, Pearson Education. Chapters: 1, 3 and 4.
- 2- Communication Networks: A First Course, Jean Warland, McGraw-Hill, 1998, Chapters: 3 and 4.
- 3 - Slides by Dr. Khaled Elsayed for ELC 3080 (available by request).

II) Graduate Curriculum

Queueing Theory and Network Dimensioning

- Little's Formula
- Markov chains
- Exponential and Poisson distributions
- M/M/1
- M/M/1/B
- M/M/C
- M/M/C/C Erlang-B
- Packet vs. Circuit Switching
- Networks of queues

Text Book and Reading Material:

- 1- D. Bertsekas and R. Gallager, Data Networks, 2nd edition, 1992. Chapter 3.
- 2 - Dr. Khaled Elsayed Slides for the ELC 681 Graduate Course (available by request).

Part IV: Computer Organization

Responsible Faculty: Prof. Dr. Mohamed Watheq El-Kharashi, Professor of Computer Systems, Ain Shams University.

Reference:

Computer Organization and Design: The Hardware/Software Interface, 5th Edition by David Patterson and John Hennessy, Morgan Kaufmann, 2013.

Chapter 4: The Processor, from Section 4.1 to Section 4.10, excluding Section 4.2

Chapter 5: Large and Fast: Exploiting Memory Hierarchy, from Section 5.1 to Section 5.10, excluding Sections 5.5 and 5.6

Chapter 6: Parallel Processors from Client to Cloud, from Section 6.1 to Section 6.8, excluding Section 6.6

Part V: Subject Selected by PhD Thesis Supervisor

Responsible Faculty: The head of the advising committee of the student