Exam Preparation

Monday, October 16, 2023

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1 Important Topics (Relevant for Exam)

> Tip
>
> **Canvas Slides**: The following notes would refer to lecture slides presented on Canvas (with page numbers).

> ⚠ Warning
>
> **Important!!**: This list is complete for Ashish's lectures (you need to check with Tom if you have questions related to lectures he delivered)

> ⚠ Warning
>
> **Important!!**: This list is not exhaustive! Everything we covered during the lectures, labs and tutorials is fair game for your final exam. Use this list only as a guideline rather than a final list.

1.1 Week 1

1.1.1 Lecture 1 Introduction

This is the least like a traditional lecture so I will highlight some important concepts you need to know from this lecture.

- Definition of computer science? [From slides 9 to 18]
- Social Aspects of Computer Science [Slide 19 and the Required Reading 1]
- Understanding why it is important to use both logic and creativity in CS [Slide 20 to 28]
- Standardisation and Non-Standardisation [Slide 29 to 34, we also covered this again in Networks lecture]
- Everything in Computational Thinking (Part 4/5) [Slide 46 to 54]

Note: You do not need to remember anything from the Course Overview section :)

1.1.2 Lecture 2

- Everything in the Building blocks of a computer (from Slide 8 to 22): Transistor, Basic Gates (AND, OR, NOT) and their Truth Table, Combinational Circuits (designing circuits from boolean expression, see the example of XOR)
- Everything in Abstraction in Hardware (from Slide 23 to 27): What is a binary and decimal number system, Conversion from Binary to Decimal and vice versa.
- Everything in Arithmetic Logic Unit (from slides 35 to 39): What is an ALU, what number and purpose of inputs and outputs (what is an opcode and status)

- Everything in More Abstraction CPU (from slide 40 to 49): Structure of the CPU (Control Unit, ALU, Registers and RAM), Instruction Sets, Given a sample instruction set writing a very simple machine code (see example on Slide 47), Moore's Law (you need to know what it is)

1.2 Week 2

Please check with Tom if you would like a specific list of topics from this week. I will cover some of the important aspects from this week during our exam prep.

1.3 Week 3

In this week, everything within the lecture slides can be in your exam. I will provide a list of topics that I think are a must to know but everything covered during the lectures, tutorial, and labs in this week is fair game for your final exam.

1.3.1 Theory of Computation 1

- You need to understand why we need a formal theory of computation [Slide 4 to 19]
- Definition of Strings, Languages, and the relationships between alphabets, languages, strings, and characters. [Everything within Part 1/4, Slide 20 to 29]
- Finite Automata: You need to know what finite automata are and how to design finite automata for a given language (practice using the tutorial sheet! You cannot do this without practice). You need to also be able to identify if a given string is recognized by a finite automata. [Everything within Part 2/4, Slide 30 to 51, and Everything within Part 3/3, Slide 53 to 66]
- Deterministic Finite Automata: You need to know the formal definition of what a DFA is (look at the five-tuple definition on Slide 69). [Everything in Part 4/4 is important including the examples, Slide 67 to 77]

1.3.2 Theory of Computation 2

- Tabular DFA: You need to know how to create a Tabular DFA both from a given language or an already designed DFA [Everything in Part 1/4, Slides 8 to 16, you do not need to understand or memorize the code demo on slide 14]

- Regular Languages: You need to understand the definition of regular language, the complement of a regular language, and the relationship between a regular language and the complement of a regular language (especially in terms of the feasibility of designing a DFA for both) [Everything in Part 2/4, Slide 17 to 25]
- NFAs: Similar to DFAs, you need to know the formal definition of NFA (5-Tuple definition, see slide 34), you also need to know how to design an NFA for a given language (practice is very important), and you should also review everything else in Part 3/4 including NFA acceptance, -Transition. [Everything in Part 3/4 and Part 4/4 Slides 29 to 53, you do not need to memorize the Guess-and-Check technique on Slide 44, this is just one of many ways to design NFAs]

1.4 Week 4

1.4.1 Computer Networks Lecture 1 & 2 (Dr. Ashish Sai)

Everything in your lecture slides except for Part 3/4 [Slides 71 to 83] is relevant and important for your final exam.

- Introduction to Networks: You need to understand how computer networks work starting from Shannon's communication model to different types of networks (PAN, LAN, WAN). You also need to know what communication channels are and their pros and cons. You do not need to memorize the discussion around NSA/CIA on slide 17,18,19. You should know what bandwidth is however memorizing the content on slide 26 is not needed (Slide with details on bandwidth requirements for different applications). You also need to know what Network Topologies are including Point-to-point, star, Mesh, and Bus. You should also know what their diagrams look like as indicated on Slide 29. You should know the difference between DTE and DCE (see slide 30 to 32). You should also know the difference between a router and a switch. [Everything in Part 1/4, slide 6 to 32]
- Introduction to the Internet: You need to know what the Internet is and how it started (no need to memorize the diagram or the exact years on slide 36). You also need to understand the client-server model (we revisit this several times during this lecture, please make sure you review all the occurrences of it), you should also know what traceroute command does (you do not have to write any code), you should know what URL is and how it assists in communicating over the internet, the discussion around standardized protocols (including TCP/IP), you need to know HTTP and SMTP are (no need to memorize any of the specific details about SMTP or HTTP e.g. error code or SMTP configuration detail present on slide 49). You need to understand all the layers in TCP/IP protocol and you should be able to describe their purpose and name some protocols used within each of these layers. [Everything in Part 2/4, Slide 33 to 70]
- You can ignore Part 3/4 from slides 71 to 83, this would not be in your exam

- Everything in Part 4/4 from slides 85 to 90

1.4.2 Lecture by Tom

Please check with Tom if you would like a specific list of topics from this week. I will cover some of the important aspects of this lecture during our exam prep.

1.5 Week 5

1.5.1 Information Security and Privacy (Dr. Ashish Sai)

You only need to study parts 1,2 and 3 from these slides for your exam (Encryption, Misconception vs Reality, and Passwords).

- You need to know why it is important to care about security.
- Encryption: Understand the difference between encryption and decryption, and be familiar with terminologies used in information security (e.g. plaintext vs ciphertext). You should know why we would want to use an open algorithm and only keep the keys private. You should also know symmetric and asymmetrical cryptographic algorithms and the difference between these two. You should also understand why all encrypt option algorithms can be broken (especially by brute-force) and why we do not need to worry about it (at least in the short term. see slide 11). You should also know different applications of encryption (for both symmetric and asymmetrical). [Everything in Part 1 from Slides 6 to 18]
- Misconception vs Reality: You should understand everything within this part, you should know what end-to-end encryption is and why it is important. You should also understand why it is beneficial to use a password manager. [Everything in Part 2 from Slides 20 to 26]
- Passwords: Everything within this part is relevant and important. You need to know what Hashing is and why it is useful for password storage. What are Multi-factor Authentication and its potential weaknesses? You need to understand the two types of attacks to get passwords: phishing and dictionary. You should also understand how you could prevent these attacks from happening if you were to design an application that could be attacked using these attacks. [Everything in Part 3 from Slides 32 to 51]

1.5.2 Lecture by Tom

Please check with Tom if you would like a specific list of topics from this week. I will cover some of the important aspects of this lecture during our exam prep.