Questions Summary & Overview :: 2025

CCE 221 :: Digital Logic Design

Source code is **available on GitHub**.
Made with **typst typesetting**.

Legends

- **Bold texts** mark importance.
- ⭐ mark represents repentance amount in the previous questions,
- while, single ⭐ mark represents appearance.
- ~~Strike-through~~ refers to out of syllabus.
- Highlighted texts are something I didn't find in materials, so help me to find it :)

By no means, **this is any sorts of suggestions**. Just a quick **overview!**
Nothing more, nothing less :)
And yah, can be **inaccurate**! Feel free to **criticize**.

Contents

Revision 01
Try to directly open the file from Rising Flare, to avoid missing any updates.

1 Binary System

Not really that important, but still you can read...
In our mid, r-1′s complement was required!

1.1 Definitions

1. Flat and dual-in-line package (Mahbub sir)

1.2 Thoery + implementation

1. Number base conversion (decimal, binary, octal, hexa or **base-n**) ⭐
2. complements (r's and r-1′s)
3. substruction with r's complement
4. Advantages and disadvantages of digital techniques over analog techniques ⭐

2 Boolean Algebra and Logic Gates

2.1 Thoery + implementation

1. Basic theorems and properties of bool algebra ⭐
   - basic therorem :: postulates
   - Operator precedence
   - Venn Diagram
   - Boolean functions
   - Algebric manupulation
2. Canonical and standard forms
   - Minterm & Maxterm examples
   - Sum of Maxterm
   - Product of Maxterm
     - Example 2-5
   - Conversation between Canonical Forms ⭐ ⭐
   - Standard Form

3 Simplification of Boolean Functions

3.1 Definitions

1. Prime implicants
2. Essential prime implicants

3.2 Thoery + implementation

1. **2-3-4-5-6 Variable Maps (Simplification)** ⭐
   - Find prime implicants and essential prime implicants using K-map. ⭐
2. **Don't care condition** ⭐
   - **"An expression with the minimum number of literals is not necessarily unique."** ⭐ ⭐
3. **Tabular Method** ⭐
   - Simplify Don't Care Condition using Tabular Method.

4 Combinational Logic

For Mahbub sir's part, it's recommended to solve exercise problems from both books.

4.1 Thoery

1. Design procedures (x7 steps)
2. Universal Gate (definition) ⭐

4.2 Logical implementation

1. Adders
   - Half adder
   - Full adder
2. Subtractors
   - Half subtractor
   - Full subtractor
3. BCD to excess-3
4. Analysis procedure ⭐ ⭐
5. Multilevel NAND and NOR implementation ⭐
6. implementation with universal Gates
7. XOR & XNOR
8. Parity

5 Combinational Logic with MSI and LSI

For Mahbub sir's part, it's recommended to solve exercise problems from both books.

5.1 Definitions

1. Adder ⭐
2. Decoder ⭐
3. Binary parallel adder
4. Programmable read only memory (ROM) ⭐

5.2 Thoery + implementation

1. Carry propagation
   - Look ahead carry generator
2. Decimal adder
   - BCD adder ⭐
3. Magnitude comparator ⭐
4. Decoder & Demultiplexer ⭐ ⭐
   - Decoder with enable (E) input
5. Encoder & Multiplexer ⭐ ⭐
6. Boolean function implementation
7. Read-only memory (ROM)
   - Combinational logic implementation
   - Types of ROM
8. Programmable logic array (PLA)

6 Sequential Logic

6.1 Definitions

1. Sequencial logic
2. Flip flop ⭐
3. Synchronous vs asynchronous circuits ⭐

6.2 Thoery + implementation

1. Combinational vs sequential circuits ⭐
2. Clocked RS flip-flop ⭐
3. Clocked D flip-flop ⭐
4. Clocked JK flip-flop ⭐ ⭐
5. Clocked T flip-flop
6. Triggering of flip-flops
   - Master-slave flip-flop
   - Edge-triggered flip-flop

> For the following topics, it's **recommended to watch YouTube videos**.
> **"Sequential Circuits"** by **Neso Academy** is a good one.
>
> Also there're some recommended ones from **Mahbub sir** (link availabe on 🌄 ✨ or Classroom).

7. Analysis of clocked sequential circuits
   - Example of a sequential circuit
   - State table ⭐
   - State diagram ⭐
   - State equation
8. State reduction
   - State assignment
9. Design procedure

7 Registers, Counters and the Memory Unit

> Go through Rising Flare's progress for capturing exact tables and figures.

7.1 Definition

1. Register ⭐
2. Bidirectional shift register ⭐
3. Binary ripple counter ⭐
4. Serial vs parallel transfer ⭐

7.2 Thoery

1. Registers
   - 4 bit register with parallel load ⭐
   - register with parallel load (D flip-flops) ⭐
   - Block diagram of a sequential circuit
   - Example 7-1
2. Shift register

- Serial transfer from register A to register B ⭐ ⭐
- Bidirectional shift register with parallel load
- 4-bit Bidirectional shift register with parallel load

3. Serial addition ⭐ ⭐
4. Ripple counter (asynchronous counter) ⭐
5. BCD Ripple counter (asynchronous counter) ⭐ ⭐
6. Synchronous counter
   - 4-bit synchronous binary counter
7. Johnson counter (construction) ⭐
8. The memory unit
9. Examples of Random Access Memory (RAM)
   - Memory cell
   - Integrated circuit memory
   - Magnetic core memory

8 Register-Transfer Logic

> From this chapter we actually need to know only simple statements.
> Don't skip statements,
> and get overloaded with the details!

8.1 Definition

1. Register
2. Binary information
3. Microoperation
4. MBR (previous chapter)

8.2 Thoery

1. Microoperation types
2. Interregister transfer
   - Fig 8-2
   - Table 8-1
   - Fig 8-3
3. Memory transfer
4. Arithmetic, logic and shift microoperations
   - Basics and statements
     - Table 8-2
   - Logic microoperation
     - Table 8-3
   - Shift microoperation
5. Overflow

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Nobody can go back and start a new beginning,
but anyone can start today and make a new ending.
~ Maria Robinson