Hardware

Md. Mohsin Uddin

East West University

mmuddin@ewubd.edu

April 21, 2023

The Course Outline

Course Outline

- **Course Title:** Preparation course for FE examination
- **Intended Participants:** University Students who are going to take ITPEC examinations
- **Course Duration:** 60 hours

The Lecture Plan

Lecture Plan: Morning Exam, Sec 2-Computer System, Chapter 4-Hardware

Time	Learning Points/Keywo	Explanation Points	Method	Level
10 minutes	Hardware	NAND circuit, Flip-flop, Open loop control, Closed loop control, Sequence control	Verbal Explanation	**High**
		PWM (Pulse Width Modulation) control, Diode, LED, Transistor		
		IC, LSI, VLSI (Very Large Scale Integration), Flash memory, Circuit design		

Objectives

4.1 Understand Hardware***

- Understand the concept of electric and electronic circuits as computer components.
- Understand the characteristics of typical methods for electronically controlling a machine.
- Understand the characteristics of components and the basic considerations of the logical design.
- Understand the importance of power consumption in the development of embedded devices.

Keywords

4.1 Understand Hardware***

- NAND circuit, Flip-flop, Open loop control, Closed loop control, Sequence control, PWM (Pulse Width Modulation) control, Diode, LED, Transistor, IC, LSI, VLSI (Very Large Scale Integration), Flash memory, Circuit design

Analyzation

Analyzation

- Analyzed 12 questions
- Covered the most recent years
  - 2021 Q1 Exam
  - 2021 Q2 Exam
  - 2020 Q2 Exam

Questions

Question 1

Q1. (q2-62) Which of the following is an appropriate description concerning flash memory?

a. It operates at high speed and is used for cache memory.
b. All the data in memory can be erased with ultraviolet rays.
c. Data in memory must be re-written periodically.
d. Data can be electrically erased on a block-by-block basis.

Q1. (q2-62) Which of the following is an appropriate description concerning flash memory?

Theme: Hardware, Category: FE

a. It operates at high speed and is used for cache memory.

b. All the data in memory can be erased with ultraviolet rays.

c. Data in memory must be re-written periodically.

d. Data can be electrically erased on a block-by-block basis.

Question 1: Answer Explanation: Slide I

- A flash memory is an EEPROM (Electrically Erasable Programmable ROM) that can be erased all at once, and is used as the storage media in digital cameras and IC cards. In terms of semiconductor memory, a rewritable ROM (Read Only Memory) is called PROM, and among PROM, a memory that can electrically delete and write content in each block is called a flash memory (flash EEPROM), which has a property known as non-volatility in that its content cannot be deleted even when power supply is turned off.
  Therefore, d) is appropriate.
- a) This is a description concerning SRAM (Static RAM). A refresh operation is not necessary and data can be read fast, but the cost is higher than that of DRAM.
- b) This is a description concerning EPROM (Erasable Programmable ROM). It is a type of PROM whose content can be erased by ultraviolet radiation. It is mostly used for storing programs.

Question 1: Answer Explanation: Slide II

- c) This is a description concerning DRAM (Dynamic RAM). It is a semiconductor memory with a simple structure and a high degree of integration, which requires data to be refreshed so that the recorded content is not deleted.

Question 2

Q2. (q2-65) Which of the following is an appropriate explanation of SoC (System on a Chip)?

a. It is an electronic circuit board of a computer including the CPU, chipset, video chip, and memory.

b. It is a semiconductor chip equipped with a series of circuits that manages the transfer of data between devices such as the CPU, memory, and peripherals.

c. It is a semiconductor chip in which all the necessary functions (systems) are integrated using the same process.

d. It is a semiconductor chip in which functions with different processes are manufactured by individually optimized processes, and each chip is wired appropriately on the package.

Q2. (q2-65) Which of the following is an appropriate explanation of SoC (System on a Chip)?
Theme: Hardware, Category: FE

a. It is an electronic circuit board of a computer including the CPU, chipset, video chip, and memory.
b. It is a semiconductor chip equipped with a series of circuits that manages the transfer of data between devices such as the CPU, memory, and peripherals.
c. It is a semiconductor chip in which all the necessary functions (systems) are integrated using the same process.
d. It is a semiconductor chip in which functions with different processes are manufactured by individually optimized processes, and each chip is wired appropriately on the package.

Question 2: Answer Explanation: Slide I

- SoC (System on a Chip) is a system LSI in which several functional circuits are incorporated into a single semiconductor chip.
  Therefore, c) is appropriate.
  Although the development cost is higher than the SiP of d), it is suitable for compact products that are in mass production.
- a) This is a description concerning an electronic circuit board such as the motherboard of a PC.
- b) This is a description concerning the chipset of a PC. For example, the Intel 855 chipset by Intel Corporation is a chipset for a notebook PC.

Question 2: Answer Explanation: Slide II

- d) This is a description concerning SiP (System in a Package) in which multiple chips are stored in a single package. System LSI is broadly divided into SoC and SiP. For reference, system LSI is a general-purpose LSI, and custom LSI indicates an LSI that contains the specific functions desired by the user. Custom LSI is divided into a special-purpose ASIC (Application Specific Integrated Circuit) and a programmable FPGA (Field Programmable Gate Array).

Question 5

Q5. (2021 A FE AM-q20) Which of the following is an appropriate explanation of an actuator?

a. It amplifies weak electrical signals sent from microphones, sensors, and so on.

b. It compares a given target value and a controlled value obtained from a sensor and outputs an operation amount so that the controlled value is matched with the target value.

c. It converts the power from an energy source into rotation, translational motion, or other movements based on the control signals.

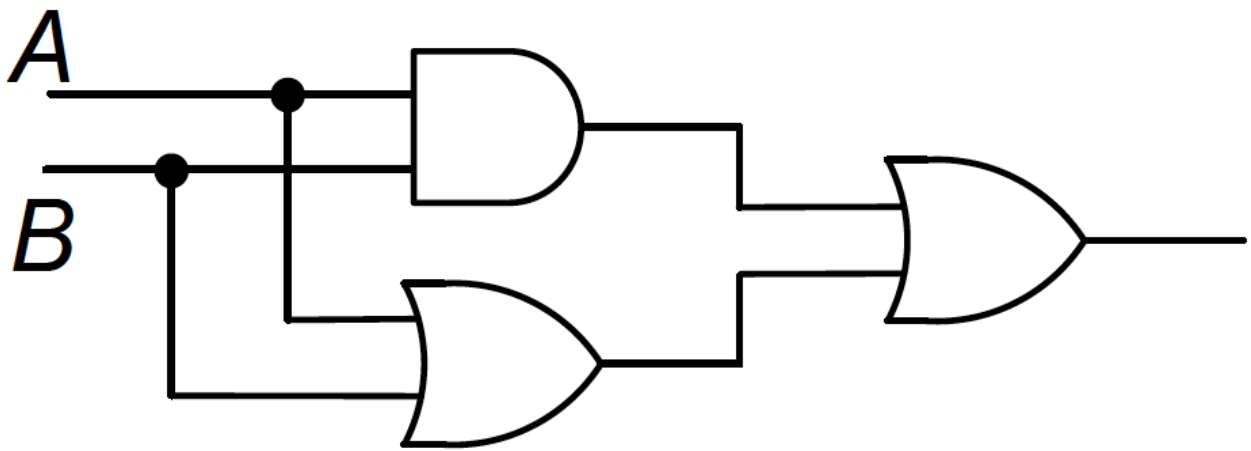
d. It detects position, angle, velocity, acceleration, force, temperature, and so on, and converts them into electric information.

Q5. (2021 A FE AM-q20) Which of the following is an appropriate explanation of an actuator?
Theme: Hardware, Category: FE

a. It amplifies weak electrical signals sent from microphones, sensors, and so on.
b. It compares a given target value and a controlled value obtained from a sensor and outputs an operation amount so that the controlled value is matched with the target value.
c. It converts the power from an energy source into rotation, translational motion, or other movements based on the control signals.
d. It detects position, angle, velocity, acceleration, force, temperature, and so on, and converts them into electric information.

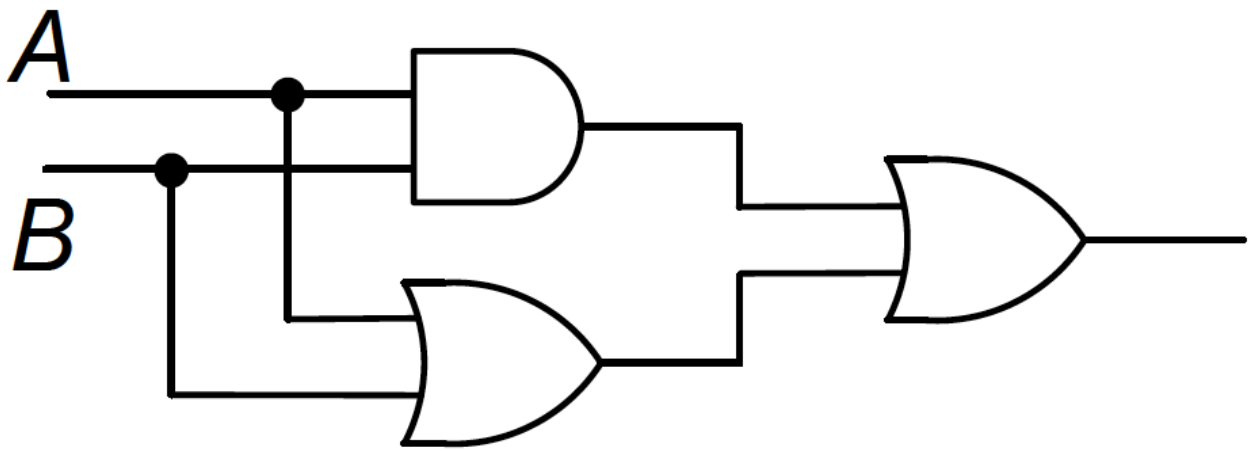
Question 6

Q6. (2021 A FE AM-q21) Which of the following is a logical expression that is equivalent to the logic circuit shown below?



a. A AND B
b. A AND (A OR B)
c. A OR B
d. B AND (A OR B)

Q6. (2021 A FE AM-q21) Which of the following is a logical expression that is equivalent to the logic circuit shown below?



Theme: Hardware, Category: FE

a. A AND B
b. A AND (A OR B)
c. A OR B
d. B AND (A OR B)

Question 7

Q7. (2021 S FE AM-q20) Which of the following is the appropriate explanation of sequence control for controlling industrial devices?

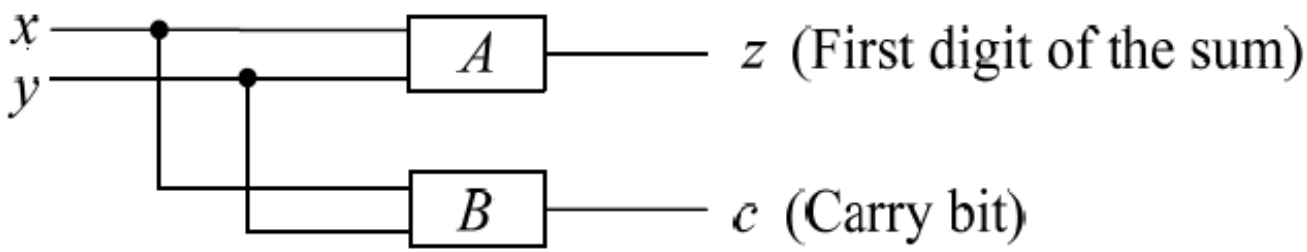
a. It is based on fuzziness, such as “slightly more” or “slightly less.”
b. It is resistant to unexpected disturbances because it continuously detects the amount of control and reflects it on the control.
c. It steps through each phase of control one after another according to a predefined order or set of conditions.
d. It takes corrective action in advance by assuming the occurrence of disturbances when disturbances can be expected.

Q7. (2021 S FE AM-q20) Which of the following is the appropriate explanation of sequence control for controlling industrial devices?
Theme: Hardware, Category: FE

a. It is based on fuzziness, such as "slightly more" or "slightly less."
b. It is resistant to unexpected disturbances because it continuously detects the amount of control and reflects it on the control.
c. It steps through each phase of control one after another according to a predefined order or set of conditions.
d. It takes corrective action in advance by assuming the occurrence of disturbances when disturbances can be expected.

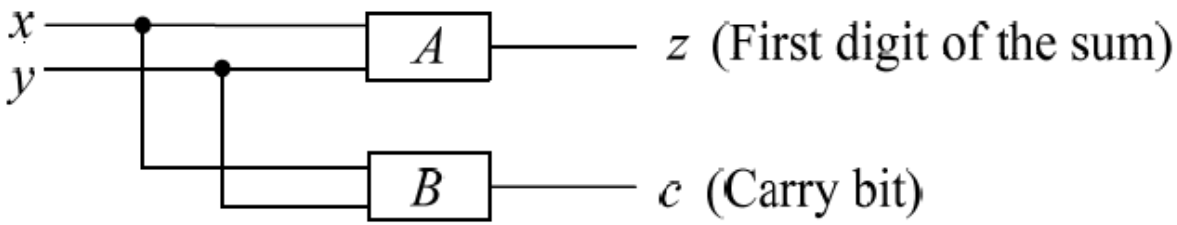
Question 8

Q8. (2021 S FE AM-q21) The half adder in the diagram below adds two (2) single-digit binary numbers, x and y, and produces z (the first digit of the sum) and c (the carry bit) as outputs. Which of the following is the appropriate combination of gate devices A and B?



	A	B
a)	Exclusive logical sum (XOR)	Logical product (AND)
b)	Logical product (AND)	Logical sum (OR)
c)	Negative logical product (NAND)	Negative logical sum (NOR)
d)	Negative logical sum (NOR)	Exclusive logical sum (XOR)

Q8. (2021 S FE AM-q21) The half adder in the diagram below adds two (2) single-digit binary numbers, x and y, and produces z (the first digit of the sum) and c (the carry bit) as outputs. Which of the following is the appropriate combination of gate devices A and B?



	A	B
a)	Exclusive logical sum (XOR)	Logical product (AND)
b)	Logical product (AND)	Logical sum (OR)
c)	Negative logical product (NAND)	Negative logical sum (NOR)
d)	Negative logical sum (NOR)	Exclusive logical sum (XOR)

Theme: Hardware, Category: FE

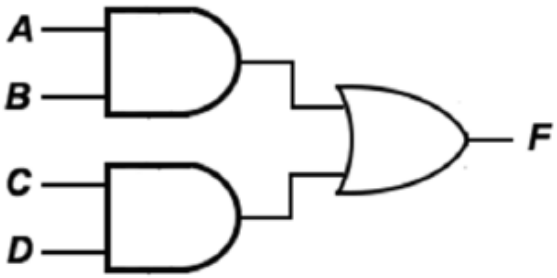
- Option a)

Question 9

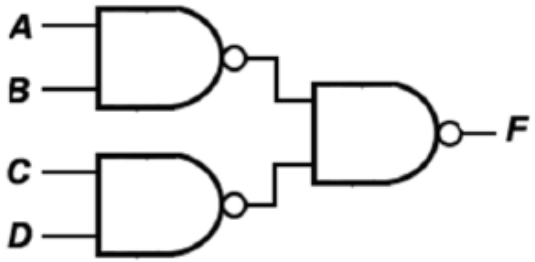
Q9. (2021 S FE AM-q22)

2. Which of the following is ***not*** an implementation of the function $F = A \cdot B + C \cdot D$? Here, "•" represents the logic AND operation, and "+" represents the logic OR operation in the expression.

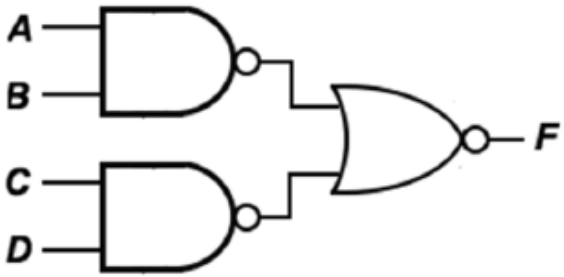
a)



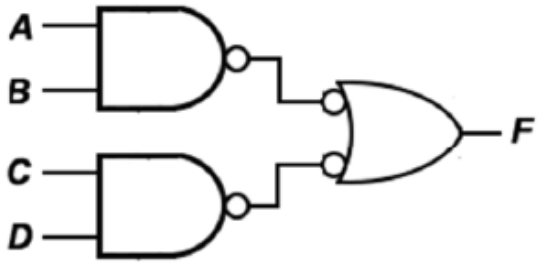
b)



c)



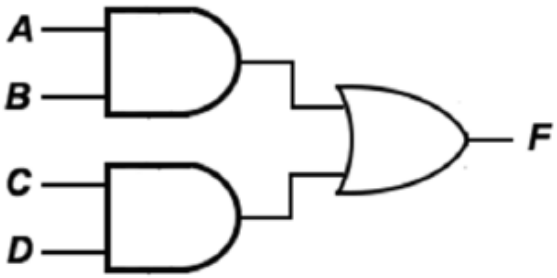
d)



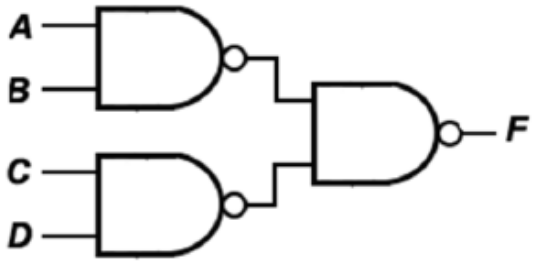
Q9. (2021 S FE AM-q22)

?. Which of the following is ***not*** an implementation of the function $F = A \cdot B + C \cdot D$? Here, "•" represents the logic AND operation, and "+" represents the logic OR operation in the expression.

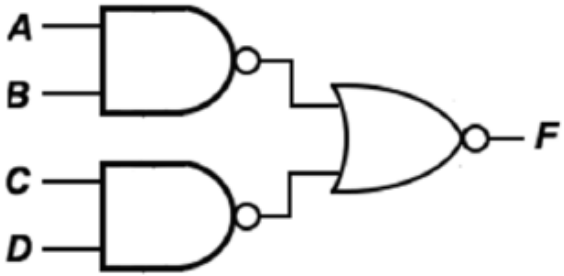
a)



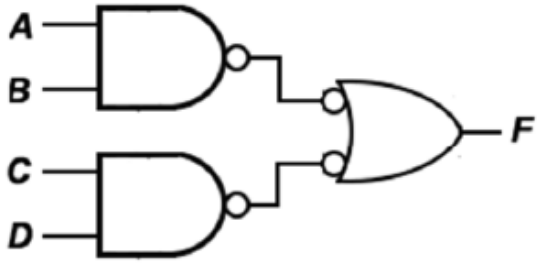
b)



c)



d)



Theme: Hardware, Category: FE

- Option c)

Question 10

Q10. (2020 S FE AM-q21) Which of the following is an appropriate description of flash memory?

a. Data must be rewritten periodically.

b. Flash memory can be rewritten at high speed and is used in the cache memory of the CPU.

c. The content can be erased electrically in units of blocks.

d. The entire content can be erased by ultraviolet rays.

Q10. (2020 S FE AM-q21) Which of the following is an appropriate description of flash memory?

Theme: Hardware, Category: FE

a. Data must be rewritten periodically.

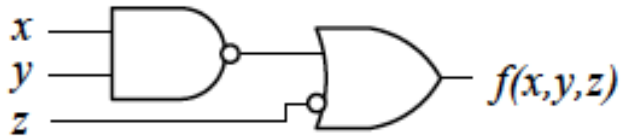
b. Flash memory can be rewritten at high speed and is used in the cache memory of the CPU.

c. The content can be erased electrically in units of blocks.

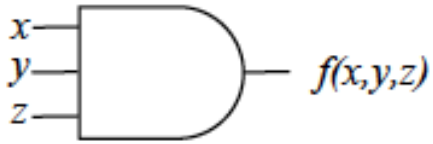
d. The entire content can be erased by ultraviolet rays.

Question 11

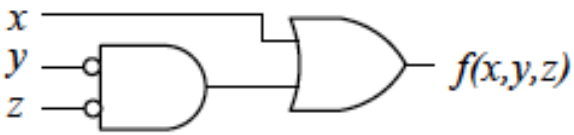
Q11. (2020 S FE AM-q22) Which of the following is equivalent to the circuit below?



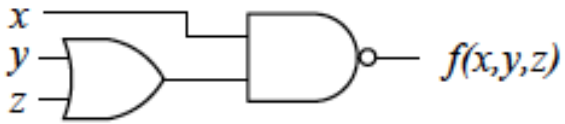
a)



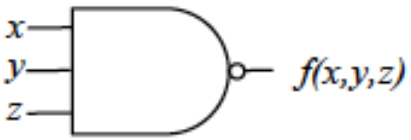
b)



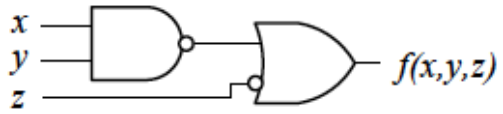
c)



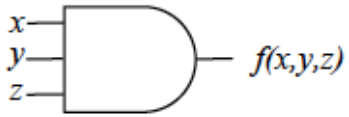
d)



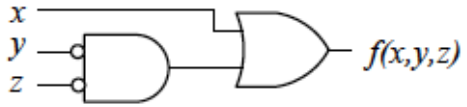
Q11. (2020 S FE AM-q22) Which of the following is equivalent to the circuit below?



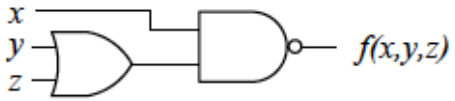
a)



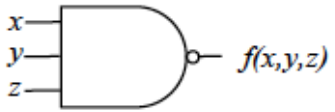
b)



c)



d)



- Option d)

Question 12

Q12. (2020 S FE AM-q23)

3. Which of the following is an appropriate equation of the XOR operator? Here, " • " represents the logical AND, "+" represents the logical OR, and $\overline{P}$ represents the inverse of P in the logical expression.

a) $X = (A \cdot B) \cdot (\overline{A \cdot B})$

b) $X = (A + B) \cdot (\overline{A \cdot B})$

c) $X = (A \cdot B) \cdot (\overline{A + B})$

d) $X = (A + B) \cdot (\overline{A + B})$

Q12. (2020 S FE AM-q23)

3. Which of the following is an appropriate equation of the XOR operator? Here, " • " represents the logical AND, "+" represents the logical OR, and $\overline{P}$ represents the inverse of P in the logical expression.

a) $X = (A \cdot B) \cdot (\overline{A \cdot B})$

b) $X = (A + B) \cdot (\overline{A \cdot B})$

c) $X = (A \cdot B) \cdot (\overline{A + B})$

d) $X = (A + B) \cdot (\overline{A + B})$

- Option b)

Any Questions?

References

 IT Fundamentals (New FE Textbook Vol. 1)