1. What does the term "bit" stand for? Answer: B) Binary Digit

2. Which device converts digital signals to analog signals? Answer: D) Digital-to-Analog Converter

3. In which memory type is data stored using the state of flip-flops? Answer: A) SRAM

4. What logic gate provides an output of 1 only when all its inputs are 0? Answer: C) NOR Gate

5. The process of dividing the frequency of a clock signal by two is achieved using what digital component? Answer: B) Flip-Flop

6. What is the primary advantage of using cache memory in computer architecture? Answer: A) To speed up data access by reducing the time it takes to access data from main memory

7. How many states does a bistable device have? Answer: C) Two

8. Which of the following is a feature of sequential circuits? Answer: D) Their outputs depend on the sequence of previous inputs as well as the current inputs

9. The concept of 'Instruction Level Parallelism' aims to achieve what in CPU design? Answer: A) Executing multiple instructions in parallel within a single CPU cycle

10. What principle does RAID technology rely on to improve system performance and reliability? Answer: B) Data mirroring and striping across multiple disks

11. In computing, what does EEPROM stand for? Answer: B) Electrically Erasable Programmable Read-Only Memory

12. What is the significance of Moore's Law in the development of computer hardware? Answer: A) It predicts the doubling of transistors on a microchip approximately every two years

13. Which addressing mode allows an instruction's operands to be specified within the instruction itself? Answer: A) Immediate Addressing

14. What does a compiler do in the context of programming languages? Answer: A) To translate high-level programming language into machine code

15. What is the main advantage of using the hexadecimal number system in computing? Answer: C) It simplifies binary representation for easier understanding and debugging

16. The arithmetic operation performed by an ALU can be determined by what? Answer: D) The control signals

17. Which gate is used as the basic building block for creating flip-flops? Answer: B) NAND Gate

18. What describes a system where output depends on the current input and previous input? Answer: B) Sequential Circuit

19. Which type of logic gate is used to implement memory storage? Answer: C) Latch

20. What method is typically used to minimize logic circuits for simpler implementation? Answer: D) Karnaugh Maps

21. What is the primary function of a CPU's control unit? Answer: A) To direct the operation of the processor

22. How do optical drives store data? Answer: B) By using a laser to change the reflectivity of the disc surface

23. What distinguishes ROM from RAM in terms of functionality? Answer: A) ROM is read-only, while RAM can be read and written to

24. In digital communication, what does UART stand for? Answer: C) Universal Asynchronous Receiver-Transmitter

25. What is the role of an assembler in software development? Answer: D) To translate assembly language into machine code

26. What type of filter would you use to remove high-frequency noise from a digital signal? Answer: B) Low-Pass Filter

27. How is a synchronous circuit different from an asynchronous circuit? Answer: A) Synchronous circuits operate based on clock signals, asynchronous do not

28. What is the primary use of a Digital to Analog Converter (DAC)? Answer: C) To convert digital signals into analog signals

29. What technique is used for error detection in data transmission? Answer: D) Parity Check

30. In what type of circuit is Boolean algebra applied to design and analysis? Answer: B) Combinational Circuit

31. Calculate the binary sum: 1101 + 1010. Answer: A) 10111

32. If a digital clock frequency is 8 MHz, what is the period of the clock cycle? Answer: B) 125 nanoseconds

33. Simplify the Boolean expression: AB + A'B + AB' Answer: B) A + B

34. Simplify the Boolean expression: (A + B)(A + C)(B + C) Answer: D) A + BC

The **program counter** (PC) stores the memory address of the next instruction to execute, and the **instruction register** (IR) stores the bits of the current instruction being executed by the CPU.
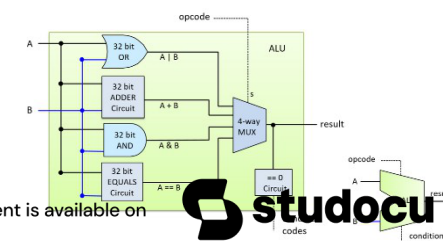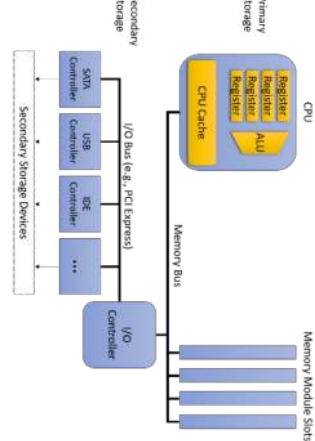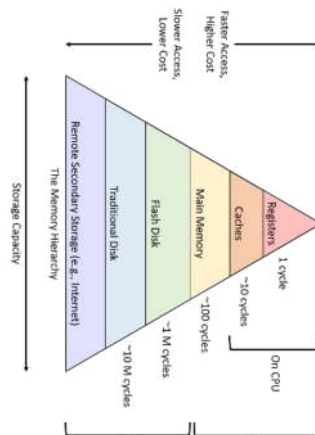
A **multiplexer** (MUX) is an example of a control circuit that selects, or chooses, one of several values. The CPU may use a multiplexer circuit to select from which CPU register to read an instruction operand value.
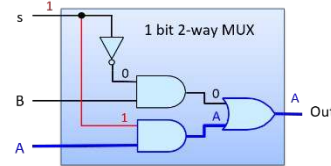
The OR gate then computes (0 OR A)
Thus, MUX circuit outputs A's value

Tri-State allow multiple devices to communicate over a single shared line, known as a bus, without interfering with each other.

$(ab + ac) + (ab + bc)$

$ab + ac + bc + ab$

Associative theorem

$= ab + ab + ac + bc$
Commutative Theorem

$= b (a + a) + ac + bc$
Distributive Theorem

$= b (1) + ac + bc$ Identity Theorem

$= b + bc + ac$ Associative Theorem

$= b + ac$ Absorption Theorem

$f = xyz + xz$

$f = z(xy + x)$ Distributive Theorem

$= z (x + xy)$ Associative Theorem

$= z ((x + x) \cdot (x+y))$ Distributive Theorem

$= z (1 \cdot (x+y))$

$= z(x+y)$

Parity bits: Detects errors, but can't correct them.

Registers, ALU, and Control Unit:

Registers:

- Temporary storage units within the CPU.

- Hold data, addresses, and control information.

Arithmetic Logic Unit:

- Performs arithmetic and logic operations.

- Manipulates data based on instructions.

- Coordinates activities within the CPU.

- Controls the flow of data and instructions.

flip-flops are used for sequential logic operations, allowing for the storage of one bit of information.

SR Flip-Flop (Set-Reset Flip-Flop): Has two inputs, Set (S) and Reset (R), and two out puts, Q and Q'. It retains its state until a specific input combination (like S=0, R=0) is received.

SRAM stores data in small electrical circuits (for example, latches). SRAM is typically the fastest type of memory, and designers integrate it directly into a CPU to build registers and caches.

DRAM stores data using electrical components called *capacitors* that hold an electrical charge. It's called "dynamic" because a DRAM system must frequently refresh the charge of its capacitors to maintain a stored value. Modern systems use DRAM to implement main memory on modules that connect to the CPU via a high-speed interconnect called the **memory bus**.

Pass Gates act like digital switches, controlling whether a signal can pass through a circuit path.

They allow for the dynamic reconfiguration of data paths, enabling complex operations like signal routing, data multiplexing, and memory management.

managing the flow of data to ensure accurate and efficient operation

in a CPU, Pass Gates are used to control the flow of data between the registers and the arithmetic logic unit (ALU), ensuring that data is available where and when it's needed

Group binary into groups of 3 for base 8. Group binary into groups of 4 for base 16.

HEX - 0 -9, A-F