COS10004 – Computer Systems

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1.1 What is ROM and what is its primary purpose?

-ROM is a type of memory stands for "Read Only Memory", which is frequently used in electronics like computers. Data contain in ROM could not be erased or altered once its manufactured. ROM is suited in a system where the programming doesn't need to changed.

1.2 What is RAM and how is it different from ROM?

-RAM stands for "Random Access Memory": a type of computer memory that can hold working data and can be read and modified in any order. In contrast, ROM can only hold the unchangeable data.

1.3 What is the difference between static RAM and dynamics RAM?

-static RAM and dynamics RAM differences:

SRAM	DRAM
Faster, larger area of silicon per byte.	Slower, Smaller area of silicon per byte.
Release more heat	Release less heat
More power consumption	Less power consumption
Structure like D Flipflop	Build from single capacitor
Use for cache	Use for main memory
Expensive	Inexpensive
Store information until power removed	Store information as long as the contents are refreshed frequently

1.4 What type of memory is typically used in USB thumb drives? Why shouldn't we rely on this for critical data storage?

Flash memory is utilized in USB thumb drives. We shouldn't rely on it because crucial data storage doesn't work well with backups. The primary memory of the Neumann architecture may be accessed only one way and stores both instructions and data. Separate memories are only linked with Harvard architecture.

2. How many bits are needed to address all bytes (1024 MB) in the system's RAM?

8 589 934 592 bits are needed all bytes in the system's RAM

3. Give a brief description of the Von Neumann and Harvard computing architectures. What are the fundamental differences between the two and for what is each designed to achieve?

-"Von Neumann Architecture" known as a digital computer architecture which is based on the idea of stored program computers, where both program data and instruction data are kept in the same memory.

- Harvard Architecture is the digital computer architecture whose design is based on the concept where there are separate storage and separate buses (signal path) for instruction and data. It was basically developed to overcome the bottleneck of Von Neumann Architecture.

Classically, Harvard uses a different memory address for instructions and data while von uses the same physical memory address. Moreover, Von requires two clock cycles while Harvard simply needs one. Von Neumann architecture is less complex than Harvard

4. What is cache memory and what is its primary role?

Cache memory, often known as cache, basically acts as a buffer between the central processing unit (CPU) and the main memory. Moreover, its frequently used instructions and data for quicker processing

The purpose of cache memory is to store program instructions that are frequently used by software throughout general operations. Therefore, rapid access is necessary as it aids in maintaining the program's efficiency.

5. Explain the concept of an interrupt, and list four common types.

An interrupt is a signal sent by computer's program or a device connected to the computer instructs the operating system to stop what it is doing and decide what to do next.

There are 4 types of interrupts, which is:

+Software Interrupt

+Hardware Interrupt

+Level-triggered interrupts

+System Implementation

5.1 Polling is an alternative to interrupts? Briefly explain polling and why it is not commonly used.

To detect which device sent out the request, an interrupt controller will poll every device on a computer to identify the source. Polled interrupt is an ineffective data transfer method that takes a long time to verify if a computer's hardware is ready.

6. Explain the general concept of a stack - how do they work, and what is their primary purpose.

Stack memory is a memory use technique that allow system memory to be use as a first-in, last-out buffer for storing transient data. The stack memory operates with the help of a register known as the Stack Pointer. The stack pointer automatically updates each time a stack action is carried out and indicates the current stack memory location.

6.1 How are stacks useful for handling interrupts?

The stack plays a crucial role in preserving the state the CPU was in before it was interrupted. The nature of interrupt handler is that they can nest. Thus, a stack is workable data structure where you can store the address in correct order.

6.2 How are stacks useful in programming?

Operations of stack in programming:

+Peek: Allow you the option to inspect the topmost stack element without actually deleting it.
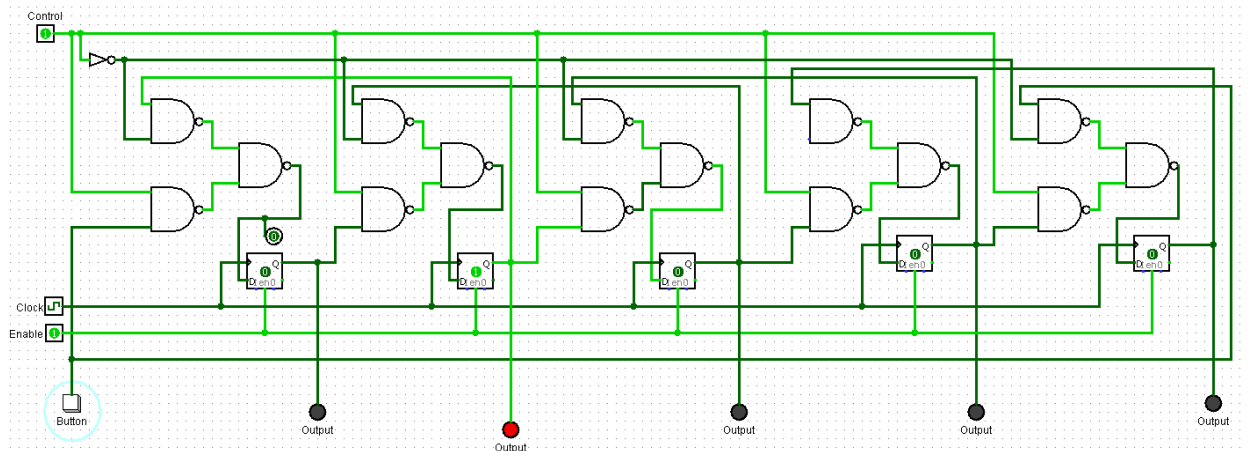
+Swap: In this operation, the first element becomes the second and the second element becomes the top, switching the positions of the two top elements in the stack.

+Duplicate: This operation allows you to push the top item back onto the stack after copying its value into a variable, creating a duplicate of the original element.
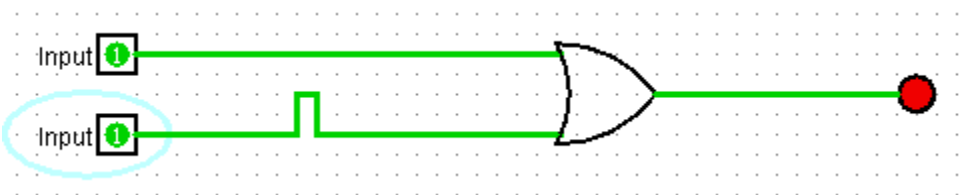
+Rotate: This parameter specifies how many elements in a stack rotated sequentially. E.g.: It will shift the first element into last place while the rest elements moved up 1 position.

Practical – Stack of Stacks

5-bit deep Stack.

10.

11.