COS10004 - Computer Systems Lab05 - 103234103 Son Nguyen

Q1.1/ What is ROM and what is its primary purpose?

ROM is a type of computer memory that stores data and programs that can only be read and not easily modified (Read Only Memory). It serves a purpose as firmware/program or data storage - it's good in cryptography.

Q1.2/ What is RAM and how is it different from RAM?

RAM or Random Access Memory is a memory that is used for temporary storing that the CPU needs to process. The two differ from each other from their volatile memory difference , the read/write rule , dynamic data access etc.

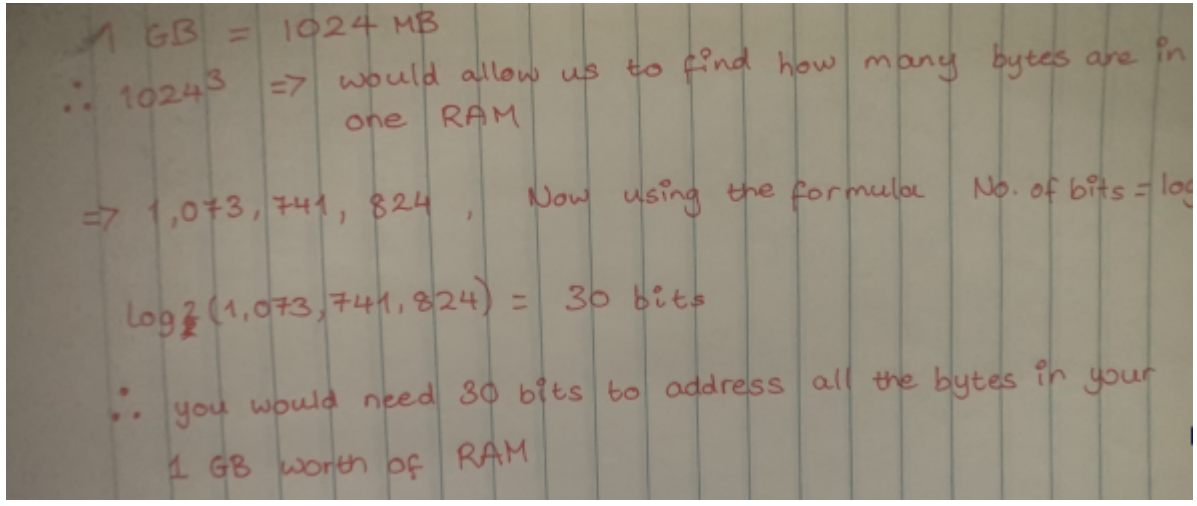
Q1.3/ What is the difference between static RAM and dynamic RAM?

Static RAM (SRAM) & Dynamic RAM (DRAM), SRAM is usually faster but consume more power and is used in application where speed is crucial such as in a PC (CPU caches) whilst DRAM is denser but more power efficient and suitable for storing large volumes of data which is why it's the preferred choice for main system memory in computers and other devices.

Q1.4/ What type of memory is typically used in USB thumb drives? Why shouldn't we rely on this for critical data storage?

USB thumb drives use Flash memory (NAND Flash) as a primary storage technology. We shouldn't rely on this for critical data storage because of its many downsides , its data retention is lacklustre - it has a limited write cycle which matters a lot if we edit the critical data. It isn't durable and was made to be compact which is also a security risk due to the fact that it can be easily misplaced.

Q2/Considering a computer with 1GB RAM (1024MB). Given memory addressing for each byte, how many bits are needed to address all bytes in the system's RAM?



Q3/ 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 - the Von Neumann computing architecture's purpose is to design computing architectures that are flexible and easy to program. Allowing computers to execute a wide range of tasks by loading different programs into memory.

Harvard - Harvard computing architectures is a model that separates the storage and processing of instructions and data into two set of distinct memory units, providing separate pathway for data and instructions

The fundamental difference between the two is that one was designed for flexibility and ease of programming whilst the other put heavy emphasis on speed and efficiency. Von Neumann designs are more suitable for general-purpose computing which is what it tried to achieve whilst Harvard designs are more suitable for applications where real-time processing and performance are critical.

Q4/ What is cache memory and what is its primary role?

Cache memory is a high-speed volatile computer memory that serves as a buffer between the CPU and the main memory (RAM) of a computer. Its primary role is to store frequently accessed data and instruction, providing faster access times to the CPU. Cache memory plays a crucial role in improving the overall performance and responsiveness of a computer system.

Q5/ Explain the concept of an interrupt, and list four common types.

An interrupt is a mechanism used in a comp system to temporarily halt the normal execution of a program or process in response to an event condition that requires immediate attention. Some example could be

- Hardware interrupt - interrupt by external hardware devices
- Software interrupt - known as “trap” or “exception” - generated via software instructions or exceptional conditions within a program
- Maskable interrupt - used for computer events , can be disable and may not need for immediate attention (BSOD)
- Non-maskable interrupt - interrupt that cannot be disabled or masked by CPU.

Q5.1/ Polling is an alternative to interrupts? Briefly explain polling and why is it not commonly used?

Polling is an alternative method of handling external events or checking the status of devices in a computer system. It is not commonly used due to wastes **CPU Time** , **Latency and Responsiveness** , **High Power Consumption** , **Complexity** , **Inefficient for Multi-Tasking** , and **Interrupt being way more efficient.**

Q6/ Explain the general concept of a stack - how they work , and what is their primary purpose.

A stack is a fundamental data structure used in CompSci and programming with a specific set of operations following the rules of LIFO(Last in First Out) principle. A stack uses a Push/Pop as well as Peek - Push/pop essentially adds/removes an item from the top of the stack meanwhile peek like it is suggested , lets you peek at the first item at the top of the stack without removing it. Stack primary purposes is to **call functions** , **evaluate expression**, **memory managements** , **undo and redo operations** , **backtracking algorithms** as well as **parsing and syntax analysis**

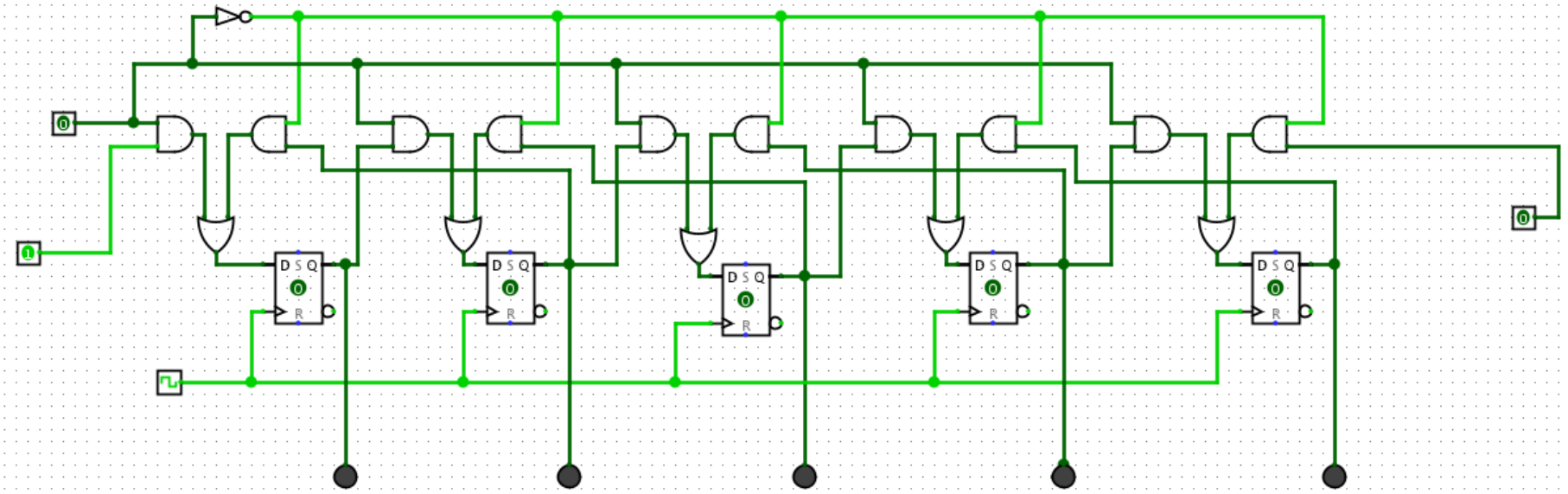
Q6.1/ How are stacks useful for handling interrupts?

Stacks are essential when handling interrupts in a computer system as they help manage the context and state of the CPU when an interrupt occurs. Like mentioned in previous questions - stacks are useful to handle interrupts as it brings all the necessary data in order to troubleshoot said problem, it's other usage for interrupt handling also include **context switching** , **nesting interrupts** , **interrupt service routines(ISRs)**, **reentrancy and multitasking** & **error handling**. These usage allow the CPU to manage context and state more efficiently when responding to interrupts.

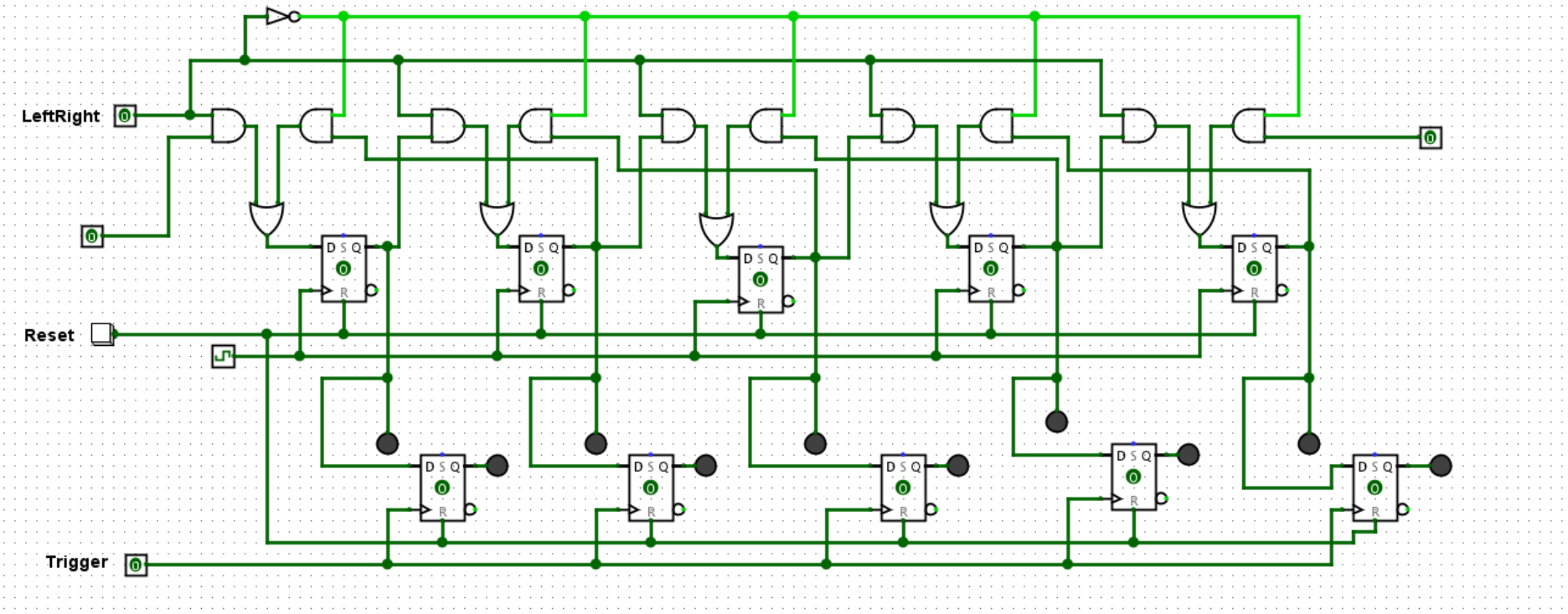
Q6.2/ How are stacks useful in programming?

Stacks are useful in programming due to being fundamental data structures that serve various essential purposes across different programming languages and applications. They are useful in **functions calls and recursion** , **expression evaluation** , **undo and redo operations** , **memory management** , **algorithm implementations** , **parsing and syntax analysis** , **data structures** , **system resources managements** , **managing program flow** & **error handling and exception propagation.**

Q7/



5 bit deep , 1 bit wide stack


LeftRight
Reset
Trigger
D S Q
R