Lab 04

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Theory (Memory, Architectures, Interrupts and Stacks)

1. Review the lecture slides on types of memory and provide a short answer to the following

questions (using your own words):

1.1. What is ROM and what is its primary purpose?

ROM is read-only memory; it stores information that can only be read.

1.2. What is RAM and how is it different from ROM?
RAM is random access memory
Table comparing RAM and ROM

RAM	ROM
Require power to store data	Not require power to store data
Normal operations	Use in start-up process of a computer
RAM chips have capacity of 1 to 256 GB	ROM chips have capacity of 4 to 8 MB

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

Static RAM	Dynamics RAM
Modest power requirements	Low power requirements
Fast, larger area of silicon per byte	Smaller area of silicon per byte
Retain information until power removed	Retain information if 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 used in USB thumb drives. We should not rely on this because it does not integrate well with backup

2. Consider a computer with 1GB RAM (1024 MB). Given memory addressing is for each

byte, how many bits are needed to address all bytes in the system's RAM?

8 bits

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	Harvard
Program data and instruction data are stored in the same memory	Separate storage and separate buses (signal path) for instruction and data.
Requires the use of a stack	Run faster and more secure
Common bus for data transfer	Separate bus for data transfer

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

Store frequently accessed instructions/data in high-speed memory => Optimise memory access

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

A device (e.g., I/O) issues an electrical signal, which feeds into a priority encoder which then issues an INT signal to the CPU

4 common types:

- Clock

- Keyboard/Mouse

- Error

- Network

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

Polling is an alternative approach to interrupts. It checks state/input of each hardware device in a pre-defined sequence

It is not commonly used for some reasons:

– Can waste time checking hardware which is doing nothing.

– Doesn't take advantage of the stack.

– If one device freezes, this can make the entire computer unresponsive.

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

Stacks are a fundamental data:

– Simple and efficient storage/recalling of data

– Reduces need for storing memory addresses

6.1. How are stacks useful for handling interrupts?

Stacks provide basis for storing and recalling state while an INT is handled

6.2. How are stacks useful in programming?

They can be used to maintain a list of operations for an undo function in a piece of software