A1.1

Computer hardware and operation

CHAPTER ASSIGNMENT · 30 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for the IB Diploma*, 1st edition (2025), Paul Baumgarten, Ioana Ganea, Carl Turland (Hachette Learning), for classroom use.

A1.1.1 Review questions

1. What is the primary function of the arithmetic logic unit (ALU) in a computer's CPU?

2. How does the control unit (CU) direct the operations of the CPU?

3. Why is the program counter (PC) important for executing a sequence of instructions?

4. What roles do the data bus and address bus play in the functioning of the CPU?

5. How does the memory address register (MAR) work in conjunction with other CPU components to access memory?

6. How do multi-core processors differ from single-core processors in handling tasks?

A1.1.2 Review questions

1. What is the role of a graphics processing unit (GPU) in a computer?

2. How do GPUs enhance the performance of video games and video processing tasks?

3. Why have GPUs become essential in fields such as artificial intelligence, machine learning and cryptocurrency mining?

A1.1.3 Programming exercise

10. Run benchmark software on your device to see your overall system performance. There are many options out there that you can search for; **https://novabench.com** and **www.userbenchmark.com** have free versions.

A1.1.3 Review questions

1. How do the CPU and GPU work together to enhance video-game performance?

2. Why is a GPU better suited than a CPU for tasks such as video rendering or AI computations?

3. What are shaders and textures, and how do they contribute to the rendering process handled by the GPU?

A1.1.4 Review questions

1. What is the main purpose of RAM in a computer system, and why is it considered volatile?

2. How does ROM differ from RAM in terms of its function and volatility?

3. Why is cache memory important for CPU performance, and how do the different levels of cache memory (L1, L2, L3) vary in terms of speed and size?

4. What happens during a cache hit and a cache miss, and how do these events impact system performance?

A1.1.5 Programming exercises

18. Write an LMC program to:

    (1) input two numbers, add them, and output the result

    (2) input a number and output whether it is positive or zero

(3) calculate the sum of the first five natural numbers

(4) input two numbers and output the larger one

(5) input three numbers and output them in ascending order.

A1.1.5 Review questions

1. What are the main steps in the fetch–decode–execute cycle, and why is this cycle fundamental to CPU operations?

2. How does the CPU use the address, data and control buses during the fetch–decode–execute cycle?

3. Why is the interaction between memory and registers crucial during the fetch phase of the CPU cycle?

A1.1.6 Review questions

1. What is pipelining and how does it improve performance?

2. How does a non-pipelined CPU differ from a pipelined CPU in terms of instruction execution?

3. What are the stages of a basic instruction pipeline, and how do they function together in a CPU?

4. How do multi-core processors use pipelining and parallel execution to improve computational efficiency?

A1.1.7 Review questions

1. What are the primary differences between an HDD and an SDD in terms of performance and durability?

2. Why might a low-cost device, such as an entry-level smartphone, use eMMC storage instead of an SSD?

3. What advantages do NAS (Network Attached Storage) systems offer for home or business environments?

4 How do memory cards compare to optical discs in terms of durability and data storage capabilities?

A1.1.8 Programming exercise

30 Create an RLE application that has two options: compress or decompress.

The compress option should receive a string and output the encoded version using the RLE algorithm.

The decompress option should do the opposite.

A1.1.8 Review questions

1 What are the two main advantages of compressing files?

2 Explain the difference between lossless and lossy compression.

3 How does run-length encoding (RLE) work, and in what types of files is it most effective?

4 Describe the process of transform coding in JPEG image compression and explain why it is considered a lossy compression method.

A1.1.9 Review questions

1. What is Software as a Service (SaaS) and how does it differ from traditional software installation?

2. Explain how Platform as a Service (PaaS) benefits software developers.

3. Why might a business choose Infrastructure as a Service (IaaS) over purchasing physical hardware?

Exam practice questions

1. Describe the function of the arithmetic logic unit (ALU). [2]

2. Outline the role of the program counter (PC). [2]

3. Explain the advantages of multi-core processors compared to single-core processors. [3]

4. Describe how the architecture of a GPU differs from a CPU, and why it is better suited for tasks such as video rendering. [3]

5 Compare the processing power of a CPU and a GPU in handling complex computations. [4]

6 Explain the role of L1 cache in a computer system. [2]

7 Describe the fetch–decode–execute cycle that a CPU uses to process instructions. [4]

8 Explain the concept of pipelining in multi-core processors. [3]

9 Describe the differences between solid state drives (SSD) and hard disk drives (HDD). [4]

10 Describe the method of lossy compression and give an example of its use. [3]

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/ib-computer-science/a1-1-hardware/