Grade 12 A/L ICT · Lesson 2

Lesson 2 A/L Exam Practice: Questions and Answers

These questions follow the style of the G.C.E. A/L ICT exam. **Paper I** has 30 multiple choice questions with five options (1)–(5) shown here as A–E. **Paper II Part A** has structured questions and **Part B** has essay questions. Every question has a model answer and marking points. They cover all of Competency 2 (2.1–2.4): computer history and generations, processors and classification, input, output and storage devices, the von Neumann architecture and the memory hierarchy.

Paper I – Multiple choice questions (30)

1. Which is a mechanical calculating aid?

A. Intel 4004
B. Pascaline
C. Abacus
D. ENIAC
E. Harvard Mark I

2. The Harvard Mark I (1944) is best described as:

A. A microprocessor
B. Fully mechanical
C. Electromechanical
D. An analog computer
E. Fourth generation

3. Transistors replaced vacuum tubes in the:

A. First generation
B. Fourth generation
C. Third generation
D. Second generation
E. Fifth generation

4. The first commercial microprocessor (1971) was:

A. ENIAC
B. Intel 4004
C. Apple M1
D. Intel Pentium
E. Intel 8086

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5. Starting at 2,300 transistors in 1971 and doubling every 2 years, the count in 2011 is:

A. 1,205,862,400
B. 92,000
C. 4,823,449,600
D. 46,000
E. 2,411,724,800

6. A thermometer with a moving needle and a car speedometer with a needle are examples of:

A. General purpose computers
B. Analog devices
C. Supercomputers
D. Digital computers
E. Mainframes

7. A computer inside a washing machine is a:

A. Minicomputer
B. Supercomputer
C. Mainframe
D. Special purpose computer
E. General purpose computer

8. A bank processing millions of transactions for many users at once uses a:

A. Phablet
B. Analog computer
C. Smart watch
D. Graphic tablet
E. Mainframe

9. Which input device is used to mark MCQ answer sheets?

A. Digitizer
B. OMR
C. Web cam
D. OCR
E. MICR

10. Which is NOT an advantage of direct entry over keyboard entry?

A. Can work 24 hours
B. Less labour
C. Faster input
D. It always needs a skilled typist
E. Fewer transcription errors

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11. Which printer is an impact printer?

A. 3D printer
B. Thermal plotter
C. Dot matrix
D. Laser
E. Inkjet

12. A CPU will NOT work in a motherboard if:

A. The printer is laser
B. The mouse is wireless
C. The monitor is LED
D. The case is black
E. The socket type is different

13. Which interface carries both video and sound to a TV?

A. VGA
B. RJ45
C. PS/2
D. HDMI
E. SATA

14. Which optical disc can be rewritten about 100,000 times and is used with random access?

A. DVD-RAM
B. CD-ROM
C. CD-R
D. DVD-ROM
E. DVD-R

15. How many 4 MB photos fit on a 64 GB card (1 GB = 1000 MB)?

A. 16,384
B. 1,600
C. 16,000
D. 160,000
E. 256

16. Linking idle computers in many countries to study protein folding is:

A. Sequential access
B. Keyboard entry
C. Analog computing
D. Batch processing
E. Grid computing

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17. The stored program concept means:

A. Instructions and data are kept in the same memory
B. Only ROM holds programs
C. Programs are set by rewiring
D. Data are stored in the ALU
E. Programs are stored only on paper

18. During the fetch stage, the address in the PC is first copied to the:

A. Accumulator
B. MDR
C. CIR
D. ALU
E. MAR

19. Which bus carries signals in one direction only?

A. Address bus
B. None
C. Data bus
D. Control bus
E. All three

20. A 32-bit address bus can address:

A. 4,294,967,296 locations
B. 1,073,741,824 locations
C. 32 locations
D. 2,147,483,648 locations
E. 65,536 locations

21. A 3.2 GHz core needs 4 cycles per instruction. Four such cores working fully in parallel give:

A. 1,600 MIPS
B. 3,200 MIPS
C. 800 MIPS
D. 51.2 MIPS
E. 12,800 MIPS

22. Which part decodes instructions and sends control signals?

A. Accumulator
B. ALU
C. Data bus
D. Control unit
E. Cache

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23. Multi-core processors became common mainly because:

A. Disks became faster than CPUs
B. RAM stopped working
C. Software needs no CPU
D. Buses were too wide
E. Raising clock speed produced too much heat

24. Which list is in order from fastest to slowest?

A. Registers, cache, RAM, hard disk, tape
B. Cache, registers, RAM, tape, hard disk
C. Hard disk, RAM, cache, registers, tape
D. Tape, hard disk, RAM, cache, registers
E. RAM, cache, registers, hard disk, tape

25. SRAM differs from DRAM because SRAM:

A. Uses capacitors
B. Needs no refresh and is faster
C. Is cheaper per MB
D. Is used for main memory
E. Is non-volatile

26. A ROM chip erased with ultraviolet light is:

A. Mask ROM
B. EEPROM
C. EPROM
D. SDRAM
E. PROM

27. Cache hits 95% at 2 ns; misses cost 80 ns. Average access time (simple model):

A. 5.9 ns
B. 9.5 ns
C. 2 ns
D. 82 ns
E. 41 ns

28. How many address lines are needed for 8 GB of byte-addressable RAM?

A. 64
B. 8
C. 32
D. 33
E. 30

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29. Moving from RAM to hard disk in the hierarchy, which DECREASES?

A. Capacity
B. Distance from the CPU
C. Cost per MB
D. Non-volatility
E. Access time

30. A hard disk access takes 10 ms and a RAM access 50 ns. The hard disk is slower by about:

A. 2,000,000 times
B. 200 times
C. 200,000 times
D. 2,000 times
E. 20,000 times

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Paper II Part A – Structured questions

1. History and classification of computers. *(11 marks)*

(i) Give one example each of a manual, a mechanical and an electromechanical calculating aid. *(3 marks)*
(ii) State the main technology of the first, second, third and fourth generations. *(2 marks)*
(iii) Using Moore's law (doubling every 2 years), find the transistor count in 2011 starting from 2,300 in 1971. *(3 marks)*
(iv) Classify by size with one use each: supercomputer, mainframe, phablet. *(3 marks)*

2. Hardware and interfaces. *(10 marks)*

(i) A supermarket uses a barcode reader instead of typing item codes. Give two advantages. *(2 marks)*
(ii) Name the most suitable interface for each: (a) monitor (b) wired network (c) internal SSD (d) flash drive. *(2 marks)*
(iii) List three things to check when choosing a motherboard for a CPU. *(3 marks)*
(iv) How many full 700 MB CDs fit on a 25 GB Blu-ray disc (1 GB = 1000 MB)? Show working. *(3 marks)*

3. The von Neumann architecture. *(10 marks)*

(i) Draw and label the von Neumann architecture. *(4 marks)*
(ii) State the job of the program counter and the accumulator. *(2 marks)*
(iii) A CPU runs at 3.2 GHz. Calculate the cycle time in nanoseconds. *(2 marks)*
(iv) Explain the von Neumann bottleneck and one way to reduce it. *(2 marks)*

4. Memory. *(10 marks)*

(i) Define volatile memory and give two examples. *(2 marks)*
(ii) Distinguish PROM, EPROM and EEPROM. *(3 marks)*
(iii) Cache hits 95% of the time at 2 ns; misses read RAM at 80 ns. Find the average access time. *(3 marks)*
(iv) Explain why a computer needs a memory hierarchy. *(2 marks)*

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Paper II Part B – Essay questions

1. Essay 1 – Evolution of computers. *(13 marks)*

(i) Describe the five generations of computers in a table: technology, one feature and one example each. *(5 marks)*
(ii) Explain how processors evolved from the Intel 4004 to modern multi-core chips. *(5 marks)*
(iii) Classify computers by technology and purpose, with an example of each class. *(3 marks)*

2. Essay 2 – How a computer runs a program. *(13 marks)*

(i) Explain the stored program concept and why it was important. *(3 marks)*
(ii) Describe the fetch-decode-execute cycle, naming the registers used. *(6 marks)*
(iii) Compare the address, data and control buses, and state the effect of a wider data bus. *(4 marks)*

3. Essay 3 – Memory and storage. *(13 marks)*

(i) Compare registers, cache, RAM and hard disk by access time, capacity and cost per MB. *(4 marks)*
(ii) Compare SRAM, DRAM and SDRAM. *(3 marks)*
(iii) Describe magnetic, optical and flash secondary storage with one advantage of each. *(3 marks)*
(iv) A computer has 8 GB of byte-addressable RAM. How many address lines does it need? *(3 marks)*

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Exam tips

- Aids: manual (abacus) → mechanical (Pascaline, Babbage) → electromechanical (Hollerith, Mark I).
- Generations: tubes → transistors → ICs → microprocessors → AI.
- Moore’s law: transistors double about every 2 years.
- Classify by technology (analog, digital), purpose (special, general) and size (super, mainframe, mini, micro).
- Direct entry: faster, more accurate, less labour.
- OMR = MCQ sheets; MICR = cheques; OCR = printed text.
- CPU must match socket, chipset, RAM type and power.
- R = write once; RW = rewrite; DVD-RAM = rewrite many times, random access.
- Von Neumann: input, output, memory, CU, ALU; program and data share memory.
- Fetch: PC → MAR → MDR → CIR, PC + 1; then decode and execute.
- Address bus one way (2^n locations); data and control buses two way.
- Hierarchy: down = slower, bigger, cheaper; SRAM cache, DRAM main memory; PROM, EPROM (UV), EEPROM (electric).

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Answers and explanations

Paper I

1. **B** – Gears and wheels.
2. **C** – Relays and motors.
3. **D** – 1956–1963.
4. **B** – 4-bit, about 2,300 transistors.
5. **E** – 20 doublings: 2,300 × 2^{20}.
6. **B** – Continuous values.
7. **D** – Does one job.
8. **E** – Large, reliable, many users.
9. **B** – Optical mark recognition.
10. **D** – No typing is needed.
11. **C** – Pins strike a ribbon.
12. **E** – Socket must match.
13. **D** – High-definition multimedia interface.
14. **A** – Rewritable, random access.
15. **C** – 64,000 ÷ 4.
16. **E** – Separate networked computers.
17. **A** – Von Neumann, 1945.
18. **E** – Memory address register.
19. **A** – CPU → memory.
20. **A** – 2^{32}.
21. **B** – 800 × 4.
22. **D** – CU directs the CPU.
23. **E** – Power and heat wall.
24. **A** – Top of the pyramid is fastest.
25. **B** – Flip-flops.
26. **C** – Quartz window.
27. **A** – 1.9 + 4.0.
28. **D** – 2^{33} bytes.
29. **C** – Lower levels are cheaper.
30. **C** – 10,000,000 ns ÷ 50 ns.

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Paper II Part A – model answers and marking points

1. *(11 marks)*

> **(i)** (3 marks)
> Manual – abacus or Napier's bones (1); mechanical – Pascaline or Leibniz wheel or Babbage's engines (1); electromechanical – Hollerith tabulator or Harvard Mark I (1).

> **(ii)** (2 marks)
> Vacuum tubes; transistors; integrated circuits; microprocessors (VLSI) (½ each).

> **(iii)** (3 marks)
> (2011 − 1971) ÷ 2 = 20 doublings (1); 2^{20} = 1,048,576 (1); 2,300 × 1,048,576 = 2,411,724,800 (1).

> **(iv)** (3 marks)
> Supercomputer – weather forecasting (1); mainframe – bank transactions (1); phablet (micro, mobile) – calls and browsing on a large screen phone (1).

🎯 Examiner tip: for generations, always give the technology plus one example computer.

2. *(10 marks)*

> **(i)** (2 marks)
> Faster checkout (1); no typing errors, so prices and stock are correct (1).

> **(ii)** (2 marks)
> (a) HDMI or DisplayPort; (b) RJ45 Ethernet; (c) SATA or M.2 NVMe; (d) USB (½ each).

> **(iii)** (3 marks)
> Socket type (1); chipset and BIOS support (1); RAM type such as DDR5, or power (1).

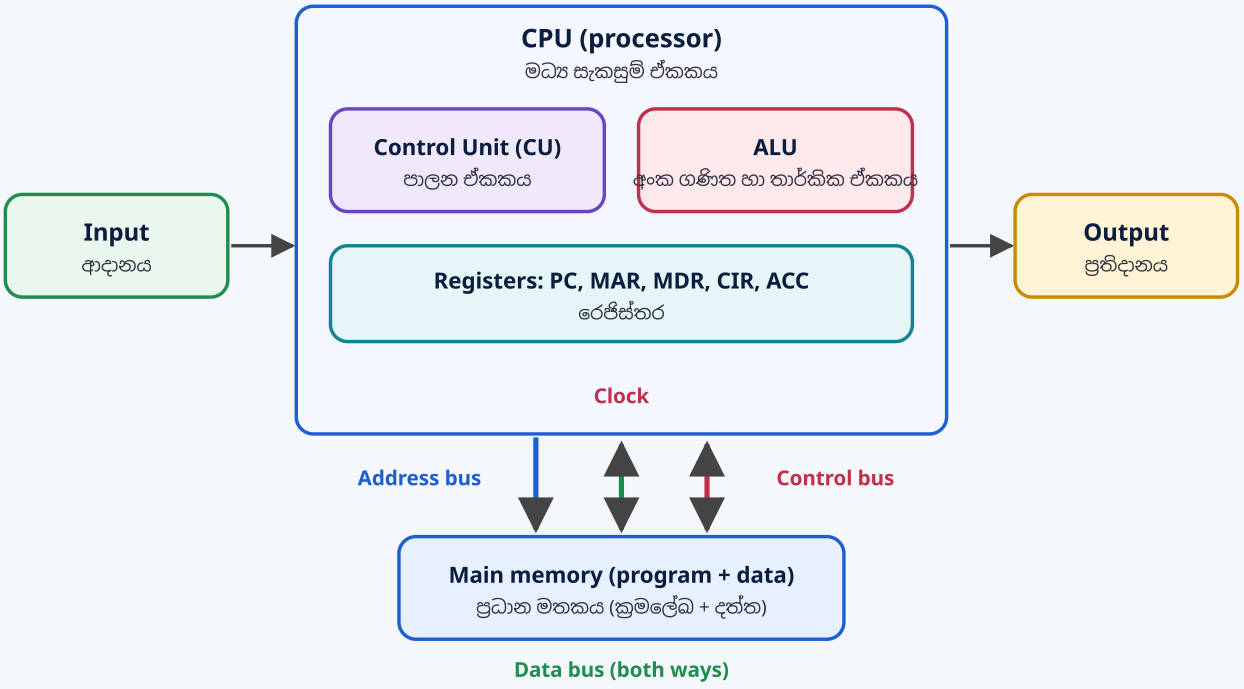
> **(iv)** (3 marks)
> 25,000 MB (1); 25,000 ÷ 700 = 35.7 (1); 35 whole CDs (1).

🎯 Examiner tip: name the device and say why it suits the situation.

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3. *(10 marks)*

(i) (4 marks)
CPU with CU and ALU (1); memory (1); input and output (1); buses labelled with directions (1).



The von Neumann architecture.

(ii) (2 marks)
PC – holds the address of the next instruction (1); accumulator – holds the result from the ALU (1).

(iii) (2 marks)
$1 \div (3.2 \times 10^9)$ (1) = 0.3125 ns (1).

(iv) (2 marks)
Program and data share one bus so the CPU waits for memory (1); use cache memory or wider buses (1).

🎯 Examiner tip: label every arrow in the diagram – unlabelled buses lose marks.

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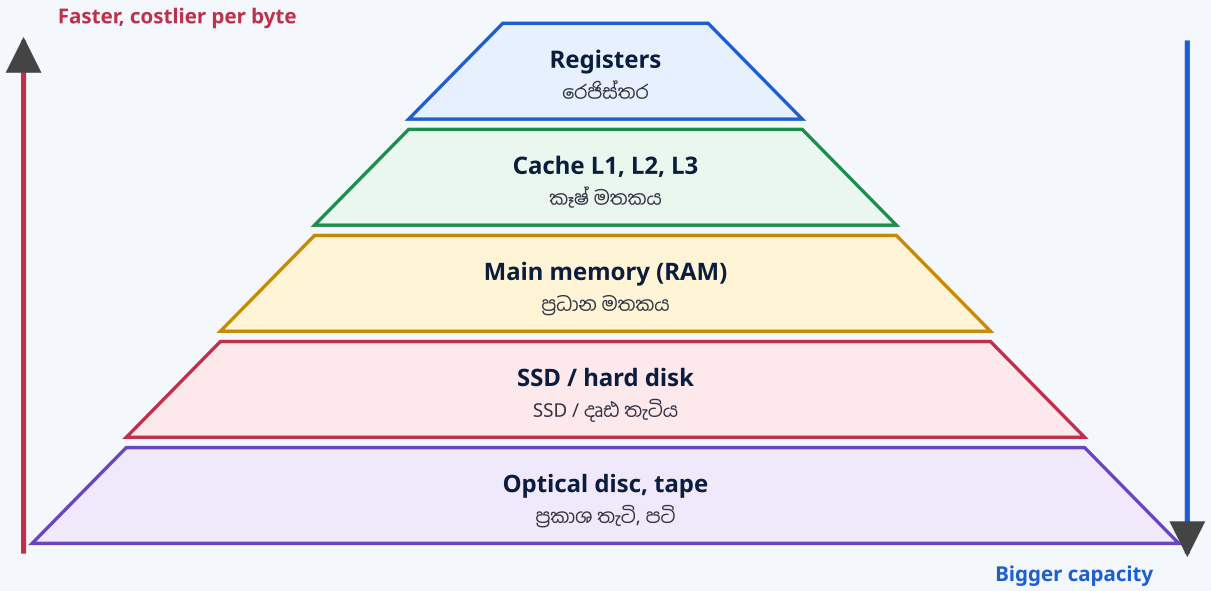
4. *(10 marks)*

(i) (2 marks)
Loses its contents without power (1); RAM and cache, or registers (1).

(ii) (3 marks)
PROM – programmed once (1); EPROM – erased with ultraviolet light (1); EEPROM – erased electrically in the circuit (1).

(iii) (3 marks)
0.95 × 2 = 1.9 (1); 0.05 × 80 = 4.0 (1); 5.9 ns (1).

(iv) (2 marks)
Fast memory is costly and small, cheap memory is slow (1); the mix gives high speed at low cost and keeps data without power (1).



The memory hierarchy.

🎯 Examiner tip: in calculations, write the formula first, then the numbers and the unit.

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Paper II Part B – model answers and marking points

1. *(13 marks)*

(i) (5 marks)
1G vacuum tubes, large and hot, ENIAC (1); 2G transistors, smaller, IBM 1401 (1); 3G ICs, keyboards and OS, IBM 360 (1); 4G microprocessors, PCs and GUI, IBM PC (1); 5G AI and parallel processing, ULSI, AI assistants (1).

(ii) (5 marks)
4004 (1971) 4-bit, 2,300 transistors, 740 kHz (1); word size grew 8, 16, 32, 64 bits (1); transistor count doubled about every 2 years (1); clock rose to GHz, about 5,000 times faster (1); heat limited clocks so multi-core chips appeared (1).

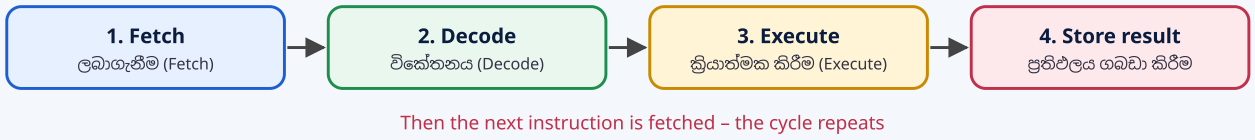
(iii) (3 marks)
Analog – continuous values, e.g. speedometer (1); digital – discrete values, e.g. PC (1); special purpose (e.g. washing machine controller) vs general purpose (e.g. laptop) (1).

🎯 Examiner tip: a neat table earns marks quickly in generation questions.

2. *(13 marks)*

(i) (3 marks)
Program and data stored together in memory (1); instructions fetched and run in sequence (1); a new job only needs a new program loaded, not rewiring (1).

(ii) (6 marks)
PC → MAR (1); instruction read via the data bus into MDR (1); MDR → CIR (1); PC incremented (1); CU decodes the instruction (1); ALU executes and result stored in ACC or memory (1).



The fetch–execute cycle.

(iii) (4 marks)
Address – one way, carries locations, width sets 2^n addresses (1); data – two way, carries data and instructions (1); control – read, write, clock signals (1); a 64-bit bus moves 8 bytes per transfer, so more data per cycle (1).

🎯 Examiner tip: give the steps in the correct order – order carries marks.

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3. *(13 marks)*

(i) (4 marks)
Registers < 1 ns, bytes, highest cost (1); cache 1–20 ns, KB to MB, very high (1); RAM 50–100 ns, GB, medium (1); hard disk about 10 ms, TB, very low (1).

(ii) (3 marks)
SRAM – flip-flops, no refresh, fast, used as cache (1); DRAM – capacitors, needs refresh, cheaper, main memory (1); SDRAM – DRAM in step with the clock, e.g. DDR5 (1).

(iii) (3 marks)
Magnetic (HDD, tape) – large and cheap per GB (1); optical (CD, DVD, Blu-ray) – cheap and easy to distribute (1); flash (SSD, cards) – fast, small, no moving parts (1).

(iv) (3 marks)
8 GB = 8×2^{30} (1) = 2^{33} = 8,589,934,592 bytes (1); 33 address lines (1).

🎯 Examiner tip: for comparisons, use the same headings for every item.

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