

Full Chapter Worksheet - Chapter 3

Answers

0478/11 – June 2019

3	1 mark for each correct device												
	<table border="1"> <thead> <tr> <th>Description of input or output device</th><th>Name of device</th></tr> </thead> <tbody> <tr> <td>This is an input device that works by shining a light onto the surface of a document. The light source is automatically moved across the document and the reflected light is captured by mirrors and lenses.</td><td>2D Scanner</td></tr> <tr> <td>This is an input device where a laser or a light source is moved across an object. The width, height and depth of the object are measured to allow a model to be created.</td><td>3D scanner</td></tr> <tr> <td></td><td></td></tr> <tr> <td>This is an output device that uses many small mirrors to reflect light towards a lens. This will display an image.</td><td>Projector</td></tr> <tr> <td>This is an output device that creates an object by building layer upon layer of material.</td><td>3D printer</td></tr> </tbody> </table>	Description of input or output device	Name of device	This is an input device that works by shining a light onto the surface of a document. The light source is automatically moved across the document and the reflected light is captured by mirrors and lenses.	2D Scanner	This is an input device where a laser or a light source is moved across an object. The width, height and depth of the object are measured to allow a model to be created.	3D scanner			This is an output device that uses many small mirrors to reflect light towards a lens. This will display an image.	Projector	This is an output device that creates an object by building layer upon layer of material.	3D printer
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6(b)	Four from (max 3 marks for benefits only, without an explanation): • More read/write cycles (over its lifetime) // greater longevity ... • ... likely to be a lot of read/write functions each day • Read/write speed is sufficient ... • ... even though it is slower than solid-state • Cheaper per unit of data stored ... • ... better value for the company to purchase • ... so the law company can afford to buy a server with greater storage capacity • No requirement for portability ... • ... as a server, it does not need to be moved • Trusted technology ... • ... it has been traditionally used for many years												
6(c)	• DVD • CD • Blu-ray												

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1(a)	Three from e.g.: – Keyboard – Mouse – Microphone – 2D scanner – 3D scanner – Touchscreen – Webcam // digital camera – Joystick – Trackpad – Sensor – Interactive whiteboard
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1(b)	Three from e.g.: – Monitor // touchscreen – Inkjet printer – Laser printer – 3D printer – Speaker – Headphones – LED Projector – DLP – 2D cutter – 3D cutter – Actuator
2(a)	Two from: – It is non-volatile – Can be easily disconnected from the computer – It is not directly accessed by the CPU – Suitable example e.g. CD, DVD, USB flash memory
2(b)(i)	One from: – ROM – RAM
2(b)(ii)	Two from: – HDD – SSD – Flash memory
3	1 mark for each correct term, in the correct place: – Data/instructions – Instructions/data (must be the alternative to MP1) – Fetched – RAM – Decoded – Executed
4(a)	Two from e.g.: – <u>DVD</u> uses red laser/light whereas <u>blu-ray</u> uses blue/violet laser/light – <u>DVD</u> has a smaller (storage) capacity // <u>Blu-ray</u> has a larger (storage) capacity – <u>DVD</u> has two layers (of polycarbonate) whereas <u>Blu-ray</u> disks have a single layer (of polycarbonate) – <u>DVD</u> has a slower transfer rate (of approximately 10 mbps) // <u>Blu-ray</u> has a faster transfer rate (of approximately 36 mbps)
(b)	Three from: – Read only memory – Non-volatile memory // Contents of memory are retained when power is turned off//permanent storage – Primary storage // directly accessed by the CPU – Holds firmware/boot-up instructions/start-up instructions/BIOS – Cannot be written to

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6(c)	Four from (max. 2 marks per type): Primary – Memory that is directly accessed by the CPU – An example is RAM / ROM – RAM stores programs and data that are currently in use and ROM stores boot-up instructions – RAM is volatile and ROM is non volatile Secondary – Storage that is not directly accessed by the CPU – An example is HDD / SSD – Stores data / files that can be accessed at a later stage – Non volatile
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0478/12 – November 2019

6	One mark for each correct tick		
	Statement	Resistive (✓)	Capacitive (✓)
	This touch screen has multi-touch capabilities		✓
	This touch screen cannot be used whilst wearing gloves		✓
	This touch screen is made up of two layers with a small space in between	✓	
	This touch screen uses the electrical properties of the human body		✓
	This touch screen is normally cheaper to manufacture	✓	
	This touch screen has a quicker response time		✓

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1(a)	Any three from: – MAR – MDR // MBR – PC // IAR // NIR // SCR – ACC – CIR // IR – IAS
1(b)(i)	– Fetch – Execute
1(b)(ii)	– Control unit

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Statement	Capacitive (✓)	Resistive (✓)
Needs pressure to be applied to create a circuit		✓
May not register a touch if the user is wearing gloves	✓	
More commonly used in smartphones	✓	
More responsive to a touch	✓	
Needs an electrical field to be changed to register a touch	✓	
Cheaper to manufacture		✓

One mark per correct tick

8(b)

Two marks for benefits, **one** mark for drawback

Benefits:

- Faster speed of printing
- Can print duplex / on both sides
- Many letters can be printed from one toner cartridge
- Can print in high volumes

Drawback

- Toner cartridge more expensive to buy
- More time to warm-up
- Larger footprint

0478/12 – November 2020

5(a)

One mark for each correct row:

Statement	True (✓)	False (✓)
It is a flat panel display	✓	
It creates images using red, green and blue diodes	✓	
It is not very energy efficient and gives off heat		✓
It is also used in mobile devices such as smartphones and tablets	✓	
It is a front-lit display		✓

5(b)

One mark for each correct term in the correct place:

- Control
- Unique
- Identify
- Protocol
- Dynamic

0478/13 – November 2020

9(a)	Any three from: – Both need a red laser to read/write data – Both are spun to be read – Both use spiral tracks for data – Both are optical storage – Both are off-line storage // both non-volatile – Both use pits and lands to store data
9(b)	Any one from: – DVD can be dual layer, but CD can only be single – DVD has higher storage capacity – DVD has a shorter wavelength laser – DVD are spun faster – DVDs have a higher data transfer rate

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(ii)	Any four from: – It has platters – Platters/disk divided into tracks – Platter/disk is spun – Has a read/write arm that moves across storage media – Read/writes data using electromagnets – Uses magnetic fields to control magnetic dots of data – Magnetic field determines binary value
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0478 – November 2021

2(a)	– Microphone
2(b)	– capacitive

0478 – November 2021(2)

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One mark per each correct row.

Statement	3D scanner (✓)	Barcode reader (✓)	QR code reader (✓)
uses position and alignment markers for orientation when scanning			✓
scans the shape and appearance of an object	✓		
uses reflected light from a laser to convert a black-and-white pattern into binary		✓	(✓)
can often be built into an Electronic Point Of Sale (EPOS) terminal, for example, a supermarket checkout		✓	(✓)
it is an example of an input device	✓	✓	✓

0478 – March 2023

- 3(b) Any **three** from:
- Currently running data
 - Currently running (application) software
 - Currently running instructions
 - Currently running parts of OS
 - Currently running utility software

0478 – June 2023(3)

2(a)	Any one from: • To perform a fetch-decode-execute cycle • To process / execute an instruction
2(b)	Two from: • It may increase the performance • ... because more instructions can be processed simultaneously
2(c)(i)	Two from: • To store / holds data / address / instruction • ... temporarily
2(c)(ii)	One mark for correct name of bus. Two marks for matching description. Address bus Transmit / carries addresses between components in the CPU Data bus Transmit / carries data between components in the CPU Control bus Transmits control signals from the control unit to other components in the CPU

- 3 **One** mark for each correct missing term or definition:

Term	Definition
router	a device that forwards packets to their correct destinations in a network
IP address	this address is assigned by the network and used to identify a device on a network
network interface card (NIC)	this is a component in a device that enables it to connect to a network
MAC address	this address is assigned by the manufacturer and is used to uniquely identify the device
firewall // proxy-server	this can be hardware or software based and filters traffic coming into and out of a network

10	Any four from: • The secondary storage / hard drive can be partitioned to create the virtual memory • ... and page B sent to the virtual memory ... • ... which makes space for page D in RAM • ... Once page A / C / D / another page is not required / has been processed • ... page B can be sent from the virtual memory back to RAM when it is required
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0478 – November 2023

1(d)	Any two from: – (The CPU completes) 2.4 billion – ... cycles/clock pulses per second
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0478 – November 2023(2)

3(a)(i)	– The maximum number of FDE cycles/instructions a CPU can perform/process/execute in a second
3(a)(ii)	– Increases/improves the performance // Tasks can be performed quicker/faster – ... because more FDE cycles/instructions can be processed in a second
4(a)	Any two from: – Performs a single/limited/dedicated function/task – It has a microprocessor – It has dedicated hardware – Uses firmware – It is normally built into a larger device/system – User normally cannot reprogram – It does not require much power – It is cheap to manufacture – Works automatically // works without human intervention – It is small (in size) – It is a real-time system

0478 – November 2023(3)

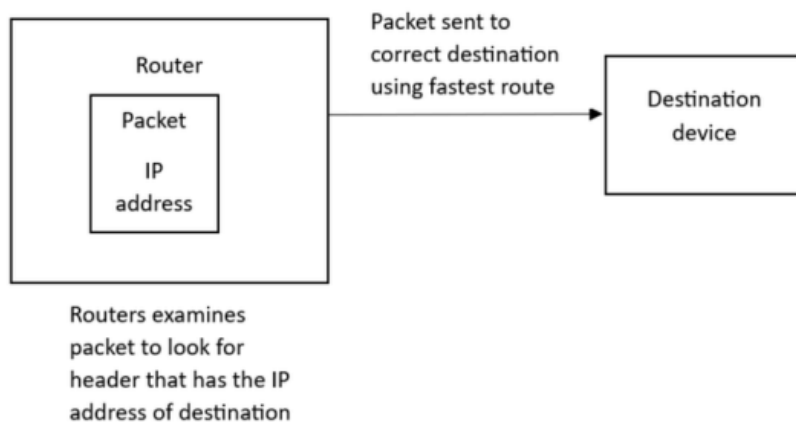
3(b)	Any two from: – It is a type of storage – ...that stores frequently used data/instructions – To speed up access – ... as it is faster to access than RAM – It has different levels e.g. L1 – L3
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The diagram demonstrates (**one** mark for each part):

- The router examining the packet ...
- ... looks for the packet header
- ... looking for the IP address of destination
- The packet being sent toward its correct destination
- ... by the fastest route // decides which route it takes
- Router is shown connecting devices/networks
- Router is shown assigning an IP address to a device

e.g.



9(a)

One mark for each correct type:

Type of secondary storage	Statement
optical	data is stored using pits and lands
solid-state	data is stored using control gates and floating gates
magnetic	data is stored using electromagnets
optical	data is stored using a laser
magnetic	data is stored on a platter that is divided into tracks and sectors

Question	Answer	Marks
2(a)	One mark for letter and One mark for matching correction. - Statement BMAR stores addresses and not instructions - Statement CData is from bus not PC // - Data is from address in MAR not PC	4
2(b)(i)	It can run 3.5 billion FE cycles each second // it can execute 3.5 billion instructions each second	1
2(b)(ii)	Any two from: More cores increases/improves the performance More cores mean more FDE cycles/instructions are executed each second ...because each core runs an FE cycle/instruction simultaneously	2
2(b)(iii)	Any two from: More cache improves performance ...because more cache means the processor can access more frequently used data/instructions faster ...instead of having to access the data from the slower-access RAM	2

6(b)(i)	Any five from: - Sensor continuously sends the digitised value / reading / distance to the microprocessor - Microprocessor compares the data / signal to the stored data of a person and distance of 3m - If the data / signal is less than (or equal to) a person and within 3m ...a signal is sent to actuator to make the tractor stop / apply the brakes - If the data/signal is greater than 3m no action is taken - If stopped and data/signal is not a person and/or more than 3m a signal is sent to actuator to make the tractor start - The whole process repeats until turned off
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Question	Answer
6(b)(ii)	One mark for sensor and One mark for matching use: e.g. - Accelerometerto adjust for uneven ground // to detect if the tractor crashes - Proximityto detect if near the end of the field // to detect other obstacles - Light to identify when to turn the headlights on

Question	Answer
1(a)	Any two from: Example: • Touch screen • Microphone • Button • Webcam // (digital) camera • Accelerometer • Biometric device
1(b)	Any one from: Example: • Screen • Speaker • LED
1(c)	SSD // Solid-state drive // Solid-state (device)

Question	Answer
5(d)	Any four from: The diagram shows: • The registers MAR, MDR and PC • Address sent from PC to MAR • ...using address bus (award anywhere for correct use of address bus) • ...PC is incremented • Address sent from MAR to RAM • Data/instruction sent from RAM to MDR • ...using data bus (award anywhere for correct use of data bus) • Data/instruction sent from MDR to CIR/CU • Control unit sending control signal for any part of the process • ... using control bus (award anywhere for correct use of control bus) Example: PC sends address to MAR then increments <pre> graph LR subgraph CPU subgraph Control_unit [Control unit] CIR[CIR] end PC[PC] MAR[MAR] MDR[MDR] end PC --> MAR MAR -- "The address is sent from the MAR using the address bus" --> RAM[RAM] RAM -- "The instruction is sent to the MDR using the data bus" --> MDR MDR -- "The instruction is sent to the CIR to be decoded" --> CIR </pre> The instruction is sent to the CIR to be decoded

8(c)	Any six from: • A proximity sensor is used • The sensor continuously sends digitised data to the microprocessor • The microprocessor compares the data to a stored value/range of values • If the value is within the range/matches the robot continues planting • If the value is above/below/outside the range a signal is sent by the microprocessor to turn/stop the robot • ... using an actuator to turn/stop the robot • This process repeats until the robot is turned off
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0478 June 2024 (12)

Question	Answer
5(a)	One mark for each correct term in the correct place: • address • memory address register // MAR • random access memory // RAM • memory data register // MDR • data • current instruction register // CIR • control unit // CU
5(b)	A list of (machine code) commands that can be processed by the CPU

0478 June 2024 (13)

6(c)	One mark for each use (Max 1) per sensor: Example: Temperature • Checking whether the water in a kettle is boiling • Monitoring the temperature in a room that is climate controlled Humidity • Checking whether the air is dry enough in a spray-painting garage • Checking whether the air is moist enough in a greenhouse Infra-red • Detecting motion in a room for a security system • Detecting whether a person is approaching automatic doors Magnetic field • Counting vehicles that cross a bridge • Monitoring vehicles that enter a car park
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Question	Answer
8(a)	To process instructions/data To run the fetch–decode–execute cycle
8(b)(i)	Any one from: • To temporarily store data/instruction/address • To allow immediate access to data during the FDE cycle

8(b)(ii)	Any three from: • Memory address register // MAR • Memory data register // MDR • Accumulator // ACC • Program counter // PC • Current instruction register // CIR
8(c)	Any three from: • To execute instructions • To perform calculations // by example • To perform logical operations // by example • To store interim results of calculations • Stores/reads/writes data to/from the accumulator
8(d)	Any Four from: • It could have more cores • ... increasing the number of FDE cycles/instructions it can perform at the same time • It could have a higher clock speed • ... increasing the number of FDE cycles/instructions per second it can perform • It could have a greater cache size • ... meaning more frequently used data can be accessed faster

0478 November 2024 (11)

Question	Answer
5(a)	Any two from: • Program counter // PC • Memory address register // MAR • Memory data register // MDR • Current instruction register // CIR
5(b)	Any three from: • CIR/CU receives the instruction from the MDR // Instruction sent from MDR to CIR/CU • ... using the data bus • Instruction is separated into opcode and operand • Control unit decodes the instruction • ... using an instruction set
5(c)	Any one from: • Accumulator • Memory address register // MAR • Memory data register // MDR
5(d)	• data • address • control
5(e)	• It can now execute more instructions/FDE per second • ... this will increase the performance of the CPU

0478 November 2024 (12)

5(a)	Any four from: • A check digit is calculated from/using the barcode data • ... using an <u>algorithm</u> // by example e.g. Modulo 11 • ... and added to the barcode • When/after the barcode is scanned the check digit is recalculated ... • ... using the same algorithm • If the check digits do not match an error has occurred when scanning the barcode // If the check digits match no error has occurred when scanning the barcode
6	One mark for each correct term or definition in the correct place: Components • Control unit // CU • Memory address register // MAR • Data bus • Current instruction register // CIR Descriptions • (Program counter) Stores the address of the next instruction to be fetched • (Accumulator) Stores the interim result for a calculation

0478 November 2024 (13)

Question	Answer
3(a)	Any two from: • Program counter // PC • Memory address register // MAR • Current instruction register // CIR
3(b)	One mark for each correct part of the diagram. The diagram shows: • Data/Instruction sent from the MDR to the CIR/CU • ... using the data bus • ... the CIR that is built into the CU • Data/instruction separated into operand and op code • <u>Control unit/CU</u> decodes instruction • ... using an instruction set For example: <pre>graph LR; MDR[MDR] -- "Instruction sent using data bus" --> CIR[CIR]; subgraph CU [Control Unit]; CIR; end; CU -- "Decodes instruction using instruction set" --> CU;</pre>

3(a)	1 mark each ● Accumulator ● Current instruction register ● Program counter
3(b)	Execute/process instructions and data to produce output // Perform FDE cycle
3(c)(i)	1 mark for Computer A 1 mark each to max 2 for justification ● It has a 4 cores ● ...each core will execute one instruction at a time ● 4 instructions can be executed simultaneously
3(c)(ii)	1 mark each to max 2 It has a higher clock speed More FDE cycles can run per second More instructions can be executed per second
3(d)	a list of all the commands that can be processed by a CPU
4(a)(i)	infra-red/motion/movement
4(a)(ii)	1 mark each to max 3 Receive digital data continually from the sensor Uses sensor data to calculate distance to person identified Compares calculated/sensor data to stored data/1m ... if data indicates $\leq 1\text{m}$ person detected (microprocessor sends signal to display welcome message on screen)
4(b)	1 mark each ● Dedicated function // special purpose device // not general purpose device - Dedicated hardware // by description e.g. hardware is only used for ATM functions
4(c)	1 mark for input, for example: ● Microphone ● Braille keyboard/pad 1 mark for output, for example: ● Speaker ● Headphones
5(a)(i)	1 mark each to max 2 ● Receive data from the network... ● ... and convert it to be understood by the computer ● Convert data from the computer to a form to be transmitted over the network ● To allow a physical connection between a computer and a network

5(a)(ii)	1 mark each to max 3 ● (Represented) in hexadecimal ● Numbers are separated by colons ● Six groups of digits ● Sets of 2-digit (hex) numbers
5(b)(i)	C

0478 June 2025 (11)

5(a)	<table border="1"> <thead> <tr> <th>Term</th><th>Definition</th></tr> </thead> <tbody> <tr> <td>current instruction register (CIR)</td><td>stores the instruction that is being decoded/executed</td></tr> <tr> <td>core</td><td>This is a processing unit within the CPU that can fetch, decode and execute instructions.</td></tr> <tr> <td>instruction set</td><td>This is a list of all the commands that can be processed by the CPU.</td></tr> <tr> <td>cache</td><td>stores frequently used data/instructions</td></tr> <tr> <td>accumulator</td><td>stores the result of interim calculations</td></tr> </tbody> </table>	Term	Definition	current instruction register (CIR)	stores the instruction that is being decoded/executed	core	This is a processing unit within the CPU that can fetch, decode and execute instructions.	instruction set	This is a list of all the commands that can be processed by the CPU.	cache	stores frequently used data/instructions	accumulator	stores the result of interim calculations
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accumulator	stores the result of interim calculations												
5(b)	Control unit // CU												
5(c)	Three from: • On each clock pulse, an FDE cycle is performed. • The clock speed is the number of FDE cycle performed in a second // The clock speed is the number of times the clock pulses per second/per unit of time. • If clock speed is increased more FDE cycles can be performed in a second // If clock speed is decreased fewer FDE cycles can be performed in a second. • If clock speed is increased, it can improve the performance of the CPU // If clock speed is decreases it decreases the performance of the CPU.												

0478 June 2025 (12)

1(a)	Any one from: • ROM • Cache
1(b)	Any one from: • It is volatile storage // Data is lost when the power is turned off. • It needs to be regularly replaced by other data // The data regularly changes // Data needs to be constantly updated
2(a)	A

4(a) **One** mark for each correct component or description

Component	Description
Control unit // CU	It sends signals to all the components in the CPU to manage the flow of data through the CPU.
Arithmetic and logic unit // ALU	It carries out all the arithmetic and logic operations in the CPU.
Cache	It stores frequently used data/instructions
Program counter (PC)	It stores the address of the next instruction to be fetched
Clock	It controls the number of fetch-decode-execute (FDE) cycles that are performed per second.
Memory data register // MDR	It stores data immediately before it is transmitted to RAM and immediately after it is received from RAM.

4(b) **Two** from:

- An embedded system is designed to perform a dedicated/limited/single function // computer can be used to perform many different functions.
- An embedded system has **dedicated** hardware // computer has hardware that can be used by other devices.
- An embedded system has software that is not easily updated/reprogrammed // software can easily be updated/reprogrammed on the computer.
- An embedded system has a microprocessor // A computer has a CPU.
- An embedded system can be part of/built into a larger device // A computer is normally standalone