1 Ethernet is considered a standard.

Explain why Ethernet is a standard.

[2]

2 Naomi's office has five computers connected into a Local Area Network (LAN). There is also one printer that all the devices can print to.

Ethernet cables are used within the office building.

Tick **one** box in each row to identify if the statement about Ethernet is True or False.

Statement	True	False
Ethernet is a protocol		
Ethernet uses wireless data transmission		
Ethernet can transmit data at speeds of up to 100 Gbits per second		
Ethernet is a protocol within the TCP/ IP stack		

[4]

3(a) A house has computers in each room and a central router. Every room allows both Ethernet and WiFi connections to the router.

Identify if the house network is a LAN (local area network) or a WAN (wide area network).
Justify your choice.

Network type:

Justification:

[3]

(b) The following table has descriptions of Ethernet and WiFi.

Tick (✓) **one** box in each row to identify if the description is more appropriate for Ethernet or WiFi.

Description	Ethernet	Wifi
A wired connection		
More likely to be affected by interference		
Data can be transmitted at a faster speed		
Wireless transmission		
Shorter transmission range before data is lost		

[5]

(c)

i. Describe the purpose of the router in the house's network.

---

[2]

ii. Identify **two** additional items of network hardware, apart from cables and a router, that may be used within the house network.

1 ---

2 ---

[2]

4 An airport has computers that are connected together on a Local Area Network (LAN).

Each computer has an IP address and a MAC address.

i. Give **one valid** example of an IPv4 address and **one valid** example of an IPv6 address.

IPv4 _____

_____

IPv6 _____

_____ [2]

ii. Describe the format of a MAC address.

_____

_____

_____

_____ [2]

5 A bank uses a local area network to connect all the computers in its head office.

Computers in the network can be identified using both IP addresses and MAC addresses.

Describe **two** differences between IP addresses and MAC addresses.

[4]

6 An office has a LAN (Local Area Network). The office has four employees who each have a laptop. The office also has one server and one networked printer.

The office is set up as a star network with a switch at the centre. All devices are connected to the network using cables.

i. Draw the devices and connections in the office star network. All devices must be clearly labelled.

[3]

ii. Describe the role of the switch in the office network.

---

[2]

END OF QUESTION PAPER

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td></td><td></td><td>1 mark each to max 2

• Ethernet is used by (mostly) all manufacturers // Ethernet is used in many devices
• To allow compatibility with other devices
• Ethernet has a high bandwidth
• Ethernet has inbuilt security
• Ethernet is a proven/reliable connection
• Ethernet is low cost for purchase / installation / maintenance (compared to other wired connections)</td><td>2</td><td>Accept description of a standard, and/or benefits of Ethernet (i.e. why has this become a standard).

<u>Examiner's Comments</u>

Many candidates found this question challenging and gave a description of what Ethernet is, or why it is a protocol.

Some candidates explained what a standard is, and some candidates gave the features of Ethernet and why this makes is appropriate as a standard. For the latter the most common responses were that it was reliable and has a fast transmission speed.

Some candidates were able to define a standard in terms of all devices using it, and some described it appropriately as a requirement for compatibility between these devices.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>1 mark for each row.

<table><tr><th>Statement</th><th>True</th><th>False</th></tr><tr><td>Ethernet is a protocol</td><td>✓</td><td></td></tr><tr><td>Ethernet uses wireless data transmission</td><td></td><td>✓</td></tr><tr><td>Ethernet can transmit data at speeds of up to 100 Gbits per second</td><td>✓</td><td></td></tr><tr><td>Ethernet is a protocol within the TCP/ IP stack</td><td>✓</td><td></td></tr></table></td><td>4</td><td>2 ticks in 1 row = 0 mark</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for LAN
1 mark per bullet for justification to max 2

• Small distance/geographical area by example e.g. same building/house
• Connected by own hardware/infrastructure // not connecting through Internet // no hired/third-party infrastructure // dedicated connection</td><td>3
AO2 1a
(2)
AO2 1b
(1)</td><td>Do not allow – in a local area, local needs to be quantified in some way.

No marks for WAN.

<u>Examiner's Comments</u>

Most candidates were able to correctly identify the network as being a LAN. Many of these were also able to justify it based on the size of the network. Fewer candidates were able to justify the network beyond its size. Some candidates looked to the next question and took the idea of the network being wireless or using Ethernet connections as meaning it was a LAN, not understanding that a WAN can also make use of these connections.</td></tr>
<tr><td></td><td>b</td><td></td><td>1 mark per row

<table><tr><th>Description</th><th>Ethernet</th><th>Wifi</th></tr><tr><td>A wired connection</td><td>✓</td><td></td></tr><tr><td>More likely to be affected by interference</td><td></td><td>✓</td></tr><tr><td>Data can be transmitted at a faster speed</td><td>✓</td><td></td></tr><tr><td>Wireless transmission</td><td></td><td>✓</td></tr><tr><td>Shorter transmission range before data is lost</td><td></td><td>✓</td></tr></table></td><td>5
AO1 1a
(5)</td><td>0 mark for row with > 1 tick

<u>Examiner's Comments</u>

This question was answered well with the majority of candidates getting each answer correct.</td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance
	c	i	1 mark per bullet to max 2 • Directs packets/data to destination // directs packets/data in a network • Receives packets/data from the network/Internet • Forwards packets/data to other computers on the network/Internet • Connects (different) networks together // e.g. joins home network to Interne • Has (public) IP address for LAN • Designates (private) IP addresses to network nodes	2 AO1 1a (1) AO1 1b (1)	Controls flow of data as BOD for bullet 1. Bullet 1 needs to refer to the router directing the destination e.g. it is making a decision/choice on where to send it. Bullet 4 - it has to be referring to the connection between the Internet and home network, or forwarding of data between them. Just referring to accessing Internet is not enough. Do not allow information for data/packets <u>Examiner's Comments</u> This question required candidates to demonstrate their understanding of a router and its purpose in a network. Candidates need to have an understanding of the purpose of the hardware in a network as to the roles is performs, and how it does this. Less able candidates gave generic descriptions such as 'it connects devices together', or 'lets a user go on the Internet'. These are not in-depth enough to explain the actual purpose of the router, i.e. to receive packets from a computer, read the address and forward the packet to its destination. Similarly, with access to the Internet, the router receives the package to go onto the Internet, packets it appropriately for the new type of network and then sends it onto the new network. The more able candidates were able to describe the purpose of directing packets to their destination, as opposed to sending it arbitrarily to other devices.

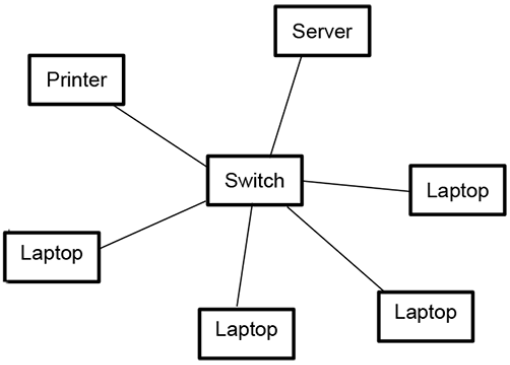
Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per item to max 2 e.g. • Network Interface card / NIC • Wireless access point / WAP • Wireless network interface card / WNIC / wi-fi card • Bridge • Switch • Hub • Repeater // wireless extender/booster • Server	2 AO1 1a (2)	Accept modem, power line adapter, Ethernet **jack** Must be an item of network hardware <u>Examiner's Comments</u> Many candidates were able to identify at least one device, most commonly switches and hubs.
			Total	12	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
4		i	1 mark for each valid IP v4: • 4 groups of denary numbers between 0 and 255 separated by full stops (example v4: 123.16.46.72) v6 • 8 groups of hex numbers between 0 and FFFF separated by colons. Double colon can appear **once** and replaces any number of groups of consecutive 0000 (example v6: 0252:5985:89ab:cdde:a57f:89ad:efcd:00fe) (example v6: F513:8C:2A::999:0000 expanded would be F513:8C:2A:0000:0000:0000:999:0000)	2	V6 Each hex number can be between 1 and 4 digits Examiner's Comments Many candidates found this question challenging with few candidates giving valid IP addresses. IPv4 was more commonly accurate, although a common error was giving numbers greater than 255. Few candidates were able to give an IPv6 address. Common errors including giving 6 groups of numbers and separating each group with a full stop.
		ii	1 mark each to max 2 • (usually presented in) hexadecimal / denary / binary • 6 groups of numbers // 12 (hex) numbers • … each group has paired/2-digit (hex) numbers / 8 bit binary number • 48 bits long • Separated by colons/hyphens • (The first half/part) contains the **manufacturer ID** // (first half/part) identifies the manufacturer • (The second half/part) contains the **serial number** // (second half/part) identifies the device	2	MP1 'numbers' is NE Allow both marks for a valid example. NB '6 pairs of numbers' gets MP2 and MP3. '4 pairs of numbers' gets MP3 Examiner's Comments The most common responses given marks included identifying that it is usually in hexadecimal and that the groups are separated by colons or hyphens. Some candidates identified the two separate parts of the MAC address.
			Total	4	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5			• IP addresses can be changed / are allocated as needed • MAC addresses can't be changed / every device has a fixed MC address • IP(v4) addresses are 4 bytes long • MAC addresses are 6 bytes long • IP(v4) addresses are normally written in denary • MAC addresses are normally written in Hex • IP addresses are configured by software • MAC addresses are configured in hardware • IP addresses are used for routing across a WAN / internet • MAC addresses are only used within the LAN [marks in pairs, maximum 2 pairs]	4	For bullets 3 and 4, accept answers where candidates refer to IPv6 being 16 bytes (128 bits). Award one mark if candidates state that IP addresses and MAC addresses are of different size.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
6		i	1 mark per bullet • Four laptops/computers, a server and printer present and clearly identifiable (positions do not matter) • Switch as a device clearly identifiable… • …all devices directly connected to the switch and only the switch (FT from MP2) e.g.  	3 AO2 1a (3)	• Printer may be connected to the server or to the switch. • Accept PC for laptop • If the candidates has given server/switch or switch/server in the centre, mark the first one in their list. If they give server/switch, they do not get MP2, but allow access to MP3. <u>Examiner's Comments</u> Most candidates were able to gain at least 1 mark by drawing the required elements. Fewer candidates were able to correctly label the central device as the switch; many incorrectly labelled this as the server, or server/switch. This error demonstrates a misunderstanding that all devices connect centrally to a server, instead of a device such as a switch. Some candidates did not clearly label their devices or did not fully apply the scenario to the diagram i.e. labelling 'device' instead of the specific laptop, printer, server as required.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per bullet to max • To connect the devices together • Receives data/packets/traffic • Direct/send data/packets/traffic **only** to its **destination** • Creates/generates a list of devices connected to it as it receives signals • Uses MAC addresses of devices connected to it	2 AO1 1a (1) AO2 1a (1)	• Do not award information, penalise once. • Do not award packet switching out of context. • Accept MP3 by example <u>Examiner's Comments</u> This question required an understanding of the purpose and function of a switch in a network. A surprising number of candidates thought that the switch turns the network on and off. The better answers conveyed that signals were transmitted from the devices to the switch, and that the switch then transmitted the signals to the destination. A small number of candidates were able to demonstrate and understanding of how the switch records the MAC addresses of the devices attached to it and then uses these to forward data packets.
			Total	5	