Data Transmission

2.1 Types and methods of data transmission

Marking Scheme

1 (a) parallel

any **one** from:

– 8 bits/1 byte/multiple bits sent at a time
– using many/multiple/8 wires/lines (1 mark)

serial

any **one** from:

– one bit sent at a time
– over a single wire (1 mark) [2]

(b) parallel

– faster rate of data transmission (1 mark)

serial

any **one** from:

– more accurate/fewer errors over a longer distance
– less expensive wiring
– less chance of data being skewed/out of synchronisation/order (1 mark) [2]

(c) parallel

any **one** from:

– sending data from a computer to a printer
– internal data transfer (buses) (1 mark)

serial

– connect computer to a modem (1 mark) [2]

2 **(a)** – universal serial bus
– description of USB [1]

(b) Any **two** from:

– devices are automatically detected and configured when initially attached
– impossible to connect device incorrectly/connector only fits one way
– has become the industry standard
– supports multiple data transmission speeds
– lots of support base for USB software developers
– supported by many operating systems
– backward compatible
– faster transmission compared to wireless [2]

Q3)

(a) Lossy
– when decompressed, some detail is lost and file is not exactly like the original (but difference is usually not noticeable)

Lossless
– when decompressed the original file is restored with no loss of data
[2]

(b) 1 mark for type of file + 1 mark for description
e.g:

– JPG
– Used to store images/pictures

– MP3
– Used to store audio/sound files
[2]

Q4)

(a)

Type	Tick (✓)
simplex	
half-duplex	
full-duplex	✓

Method	Tick (✓)
serial	
parallel	✓

Type	Tick (✓)
simplex	✓
half-duplex	
full-duplex	

Method	Tick (✓)
serial	✓
parallel	

Type	Tick (✓)
simplex	
half-duplex	✓
full-duplex	

Method	Tick (✓)
serial	✓
parallel	

[6]

(b) Any **two** from:
- single wire means there is less chance of interference/data corruption
- single wire reduces costs
- more reliable over greater distances
- bits will still be synchronised after transmission [2]

Q5)

(a) (i) Any **two** from:

serial

- one bit sent at a time // bits sent sequentially
- over a single wire
- synchronous or asynchronous

[2]

(ii) Any **two** from:

parallel

- several bits / a byte sent at a time
- using many / multiple wires
- synchronous

[2]

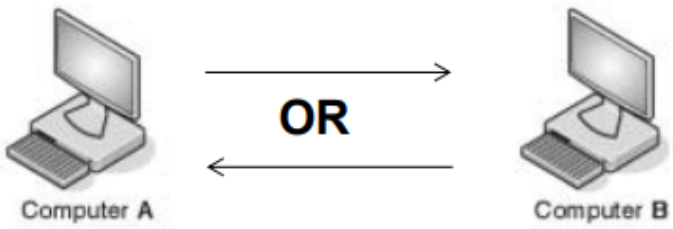
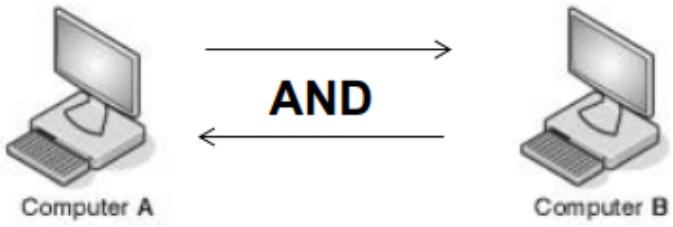
(b) – serial

Any **two** from:

- serial data transmission more reliable over long distances
- less likely for the data to be skewed/out of synchronisation
- less interference as only a single wire
- it is a cheaper connection as only single wire needed // cheaper to set up
- a fast connection is not required as a printer is limited by its printing speed

[3]

Q6)

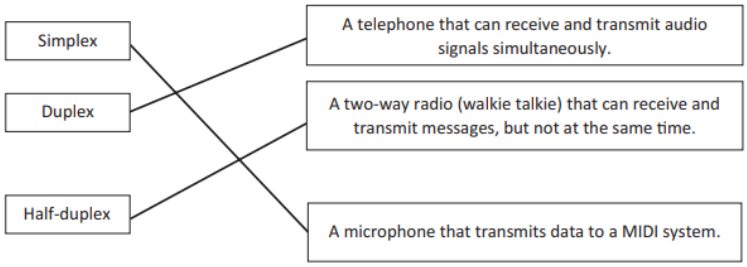
(a)	1 mark for correct arrow(s), one mark for correct description **Simplex data transmission**  (Direction of data is) one way only // unidirectional **Duplex data transmission**  (Direction of data is both ways) <u>at same time</u> / <u>simultaneously</u> / <u>concurrently</u> **Half-duplex data transmission**  (Direction of data is both ways) but at different times / <u>not at the same time</u> / <u>not simultaneously</u> / <u>not concurrently</u>	**6**

Question	Answer	Marks
(b)	1 mark each use, must be different. **Simplex** e.g.: Microphone to computer Sensor to computer Computer to printer Computer to speaker Computer to monitor Webcam to computer Sending data to a device // sending data from a device **Duplex** e.g.: Telephone call Voice over IP Computer to printer (only award once) Instant messaging Broadband connections Video conferencing Sending data to and from devices e.g wireless technology Computer to modem	**2**

Q7)

Question	Answer	Marks
(a)(i)	<table><tr><th>Method 1</th><th>Tick (✓)</th><th>Method 2</th><th>Tick (✓)</th></tr><tr><td>Serial</td><td>✓</td><td>Simplex</td><td></td></tr><tr><td>Parallel</td><td></td><td>Half-duplex</td><td></td></tr><tr><td></td><td></td><td>Duplex</td><td>✓</td></tr></table>	**2**
(a)(ii)	Any **four** from (**Max 3** for serial): ∞ Serial has <u>less/lower</u> interference ∞ Serial is (more) reliable/accurate <u>over distances</u> ∞ In serial the bits won't be skewed ∞ In serial it is easier to collate the bits together again after transmission ∞ Duplex transmits data in both directions <u>at the same time</u> ∞ simplex/half-duplex/remaining methods won't allow read and write at same time	**4**

Q8)

Question	Answer	Marks
	Term / **Application**  Three correct lines = 2 marks Two or one correct line = 1 mark	2

Q9)

Question	Answer	Marks
(a)(i)	<table><tr><th>Received Byte</th><th>Transmitted correctly (✓)</th><th>Transmitted incorrectly (✓)</th></tr><tr><td>10001011</td><td></td><td>✓</td></tr><tr><td>10101110</td><td>✓</td><td></td></tr><tr><td>01011101</td><td>✓</td><td></td></tr><tr><td>00100101</td><td>✓</td><td></td></tr></table>	4
(a)(ii)	**One** from: – ARQ – Check Sum	1

Question	Answer	Marks
(b)(i)	– Multiple bits / byte(s) sent at the same time – Using multiple wires	2
(b)(ii)	Any **one** from e.g.: – Integrated Circuits – Any appropriate CPU buses – Any suitable device connection that uses parallel	1
(b)(iii)	Two from: – Bits remain synchronised … – … reducing data errors – Only single wire is required … – … more cost effective to install/manufacture	2

Q10)

Question	Answer	Marks
(a)	1 mark for each correct answer: ∞ uses several/multiple wires ∞ transmits multiple bits at a time	2
(b)	Benefit 1 mark for: ∞ quicker/faster data transfer Drawback **One** from: ∞ More chance of data being skewed due to bits being sent simultaneously/out of order // less safe transmission as bits are sent simultaneously/out of order ∞ More expensive as requires more/several/multiple wires ∞ More chance of interference as more/several/multiple wires are used (than can create crosstalk)	2
(c)	**One** from: ∞ Used in integrated circuits ∞ Used in RAM ∞ Used in connections to peripheral devices (e.g. printer)	1

Q11)

Question	Answer	Marks
(a)(i)	**Two** from: ∞ Data is transmitted one bit at a time ∞ Data is transmitted using a single wire ∞ Bits arrive in order/sequence	2
(a)(ii)	**Two** from: ∞ Data is transmitted multiple bits at a time/simultaneously ∞ Data is transmitted using multiple wires ∞ Bits may arrive out of sequence/skewed (and are reordered)	2
(a)(iii)	1 mark for each: ∞ Data is transmitted in both directions ∞ … at the same time/simultaneously	2

Q12)

Question	Answer	Marks
(a)	∝ Bits sent one at a time ∞ Uses a single wire	2
(b)	USB / SATA / Wifi /PCI Express / Any appropriate serial device	1
(c)	∝ Data is transferred in two directions ∞ Data is sent in only one direction **at a time**	2

Q13)

Question	Answer	Marks
(a)	∝ Data is sent down a single wire … ∞ … one bit at a time ∞ Data is sent in both directions … ∞ … but only one direction at a time	4
(b)	**One** mark for correct byte (Byte) 2 // 01010100 **Three** from: ∞ Added up / counted the 1s / 0s ∞ Even parity used // 3 bytes are even ∞ Byte 2 uses odd parity // 1 byte is odd	4

Q14)

Question	Answer	Marks
(a)	**One** mark per each correct tick **Statement** / **True (✓)** / **False (✓)** Duplex data transmission can be either serial or parallel — ✓ Duplex data transmission is when data is transmitted both ways, but only one way at a time — ✓ Duplex data transmission is always used to connect a device to a computer — ✓ Duplex data transmission is when data is transmitted both ways at the same time — ✓ Duplex data transmission automatically detects any errors in data — ✓	5
(b)	∞ Parallel data transmission	1

Q15)

Question	Answer	Marks
	One mark for each correct term in the correct order ∞ Serial ∞ Parallel ∞ Serial ∞ Simplex ∞ Parallel	5

Q16)

Question	Answer	Marks
(a)	**One** mark for correct tick, **two** marks for description – Serial – Bits sent one at a time – Single wire If parallel given, no mark for parallel, but follow through for correct description of parallel: – Multiple bits sent at a time – Multiple wires	3

Q17)

(c)(i)	**Four** from: – Multiple **bits** are sent **at the same time** – Uses multiple wires – Data is sent in both directions … – … but only one direction **at a time**	**4**
(c)(ii)	Any **two** from: – Bits may arrive skewed – More expensive **to setup/manufacture/purchase cable** – Limited distance – More prone to interference/error	**2**

Q18)

(c)(i)	– Data is sent one bit at a time – Data is sent using a single wire – Data is sent in both direction … – … at the same time	**4**
(c)(ii)	Any **one** from: – Data transmission can be slower (than parallel) – Additional data may need to be sent	**1**

Q19)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark per each correct row.
<table>
<tr><th>Statement</th><th>Serial simplex (✓)</th><th>Parallel simplex (✓)</th><th>Parallel half-duplex (✓)</th><th>Serial duplex (✓)</th></tr>
<tr><td>bits are transmitted along a single wire</td><td>✓</td><td></td><td></td><td>✓</td></tr>
<tr><td>data is transmitted in both directions</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>it is only suitable for distances less than 5 metres</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Bits from the same byte are transmitted one after the other</td><td>✓</td><td></td><td></td><td>✓</td></tr>
<tr><td>data may not arrive in the correct sequence</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>data is transmitted in both directions, but only one direction at a time</td><td></td><td></td><td>✓</td><td></td></tr>
</table></td><td>6</td></tr>
<tr><td>'b)</td><td>Any three from:
– Can charge/power the mobile device (at the same time)
– (Uses serial transmission so) data less likely to be skewed / corrupted
– Universal / industry standard / connection
– Cable can only be plugged in one way // Cannot be inserted incorrectly
– Fast transmission speed
– Backward compatible
– Supports different transmission speeds
– Automatically detects device // Automatically downloads drivers</td><td>3</td></tr>
</table>

Q20)

Question	Answer	Marks
`(a)	– Enables an encrypted link (between the browser and the web server) // It encrypts the data – … based on the authentication of an (SSL) certificate // and will only send it if the certificate is authentic	2
(b)	– Transport Layer Security // TLS	1
(c)	Any **two** from: – URL begins with HTTPS – Padlock symbol is locked – Check the certificate is valid	2

Q21)

Question	Answer	Marks
(a)	Any **four** from: – Printer generates interrupt – Interrupt is given a priority – Interrupt is queued – Interrupt stops **CPU** from processing current task – CPU will service interrupt // Interrupt handler services interrupt … – … generating an output message to state there is a paper jam	**4**
(b)	Any **two** from: – A suitable description of any error that might occur – A peripheral is connected/disconnected – A key on a keyboard is pressed – A mouse button click – A phone/video call is received – A buffer requires more data – A printer runs out of paper – A printer runs out of ink – Opening an application – When switching from one application to another **NOTE:** If two suitable different errors are described, this can be awarded two marks	**2**

Question	Answer	Marks
(c)(i)	**Four** from: – Bits sent **one at a time** – … down a single wire – Data sent in both directions … – … but only one direction at a time	**4**
(c)(ii)	Any **two** from: – Simplex only sends data in one direction – … so, printer may not be able to tell computer an error has occurred, and computer may not be able to send printer the document to be printed **NOTE:** Award any valid contextual answer for MP2	**2**

Q22)

(c)(i)	Any **two** from: e.g. • Destination/receivers (IP) address • Packet number • Originator's/senders (IP) address	**2**
(c)(ii)	Any **five** from: • Data is **broken/split/divided** into packets • Each packet (could) take a different route • A **router** controls the route/path a packet takes • … selecting the **shortest/fastest** available route/path • Packets may arrive out of order • Once the **last packet** has **arrived**, packets are **reordered** • If a packet is missing/corrupted, it is requested again	**5**

Q23)

Question	Answer	Marks
(a)(i)	**Two** from: • Data is sent **one bit at a time** • A **single** wire is used	**2**
(a)(ii)	Any **two** from: • Data won't be skewed • Less chance of interference/crosstalk/corruption/error • Transmission speed is adequate	**2**
(a)(iii)	• The data may be transmitted quicker	**1**

Q24)

Question	Answer	Marks
	The diagram demonstrates (**one** mark for each): • Packets sent through several routers • … taking different routes from device A to device B • Packets arrive out of order • Packets being reordered when all arrived at device B	**4**

Q25)

Question	Answer	Marks
(a)	**One** mark for each correct transmission method: – Serial half-duplex – Serial full-duplex	**2**

Q26)

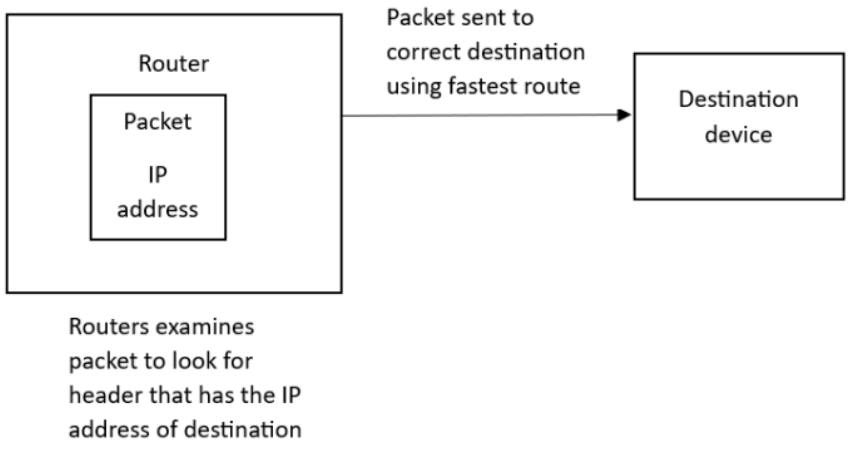
Question	Answer	Marks
	One mark for each correct term, in the correct order: – header – destination address – routers – last	4

Q27)

Question	Answer	Marks
	One mark for each correct data transmission method:	4

Data transmission method	Description
serial simplex	Data is transmitted down a single wire, one bit at a time, in one direction only.
parallel half-duplex	Data is transmitted down multiple wires, multiple bits at a time, in both directions, but only one direction at a time.
serial full-duplex	Data is transmitted down a single wire, one bit at a time, in both directions at the same time.
parallel simplex	Data is transmitted down multiple wires, multiple bits at a time, in one direction only.

Q28)

Question	Answer	Marks
	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.  	**4**

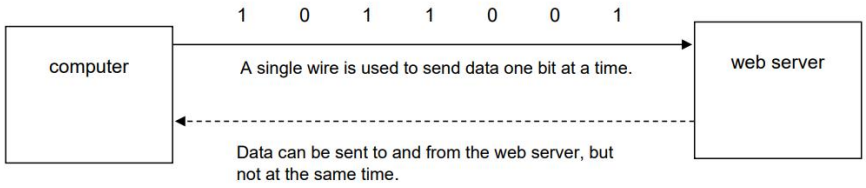
Q29)

Question	Answer	Marks
(a)	Any **three** from: • A packet is split into **three** different sections • … the header • … the payload • … the trailer	**3**
(b)	Router	**1**
(c)	Any **three** from: • The network may be spread over a long distance … • … so it is more **reliable** • Bits will be sent/arrive in **sequence** • …so bits less likely to be skewed • Less crosstalk/interference • … so less likely to have errors • The data may not need to be transmitted at a fast speed // data transmission speed of serial is adequate • The cables in the network only use serial transmission	**3**

Q30)

Question	Answer	Marks
(a)	**D**	**1**
(b)	Packet	**1**

Q31)

Question	Answer	Marks
(a)	**One** mark for each correct part of the diagram. The diagram shows: • Bits beings sent one at a time • Bits being sent over a single wire • Data can be sent to and from the web server/network component/computers … • … **not** at the same time For example: 	**4**
(b)	Any **two** from: • Bits will not be skewed // Bits are sent in order • Less chance of error • Less crosstalk/interference • Data can be sent over a long distance (if needed) • It is possible to download and upload data to the web server • Higher bandwidth than full duplex	**2**
(c)	Any **one** from: • The transmission of data may be relatively slow • Data cannot be sent and received at the same time • May be more data collisions	**1**

Q32)

Question	Answer	Marks
(a)	Any **four** from: • The data packet has three sections • It has a packet header … • … that contains data such as the destination address • It has a payload … • … that contains the main data for the email • It has a trailer … • … that contains data such as the error detection system used	**4**

Question	Answer	Marks
(b)(i)	Any **four** from: • It sends the data multiple bits at the same time // It uses multiple wires • … so the transmission speed of the data will be fast • Data may not need to travel a long distance • … as the devices are all within a single room • It sends data in both directions at the **same time** • … so users on the network can send data to each other with **no delay**	**4**
(b)(ii)	Any **two** from: • More interference/crosstalk (due to multiple wires) • **Data** may be skewed (due to multiple bits at a time) // bits may arrive out of order • More chance of data collisions (as data sent in both directions at the same time) • More chance of error in the data	**2**
(b)(iii)	Any **one** from: • Serial simplex • Serial half-duplex • Serial full-duplex • Parallel simplex • Parallel half-duplex	**1**

Q33)

(b)(i)	• Bits are sent one at a time • Bits are sent down a single wire • Data is sent in one direction only	**3**

Question	Answer	Marks
(b)(ii)	Any **three** from: • The stock control system may be a long distance away • … parallel should not be used in long distance transmission // Serial is more **reliable** for long distance transmission • The data does not need to be sent quickly • … the increased speed of parallel is not needed • … as only **small** amounts of data need to be sent • The bits are sent/arrived in order • … the **data** will not be skewed // the **data** could be skewed if parallel was used • … there will be no data collisions • There will be less interference/crosstalk (due to single wire) • … there will be fewer errors in the data • No need for a reply/response from stock control system • … **half-duplex/full-duplex** is not necessary as only one way transmission needed	**3**
(b)(iii)	Any **two** from: • (Odd/even) Parity check // Parity byte check // parity block check • Checksum • Echo check • (Positive/negative) ARQ // Automatic repeat query // Automatic repeat request	**2**