2.1, 2.2 & 2.3 – Data Transmission
ANSWERS

Question	Answer	Marks
4(a)	**One** mark for each correct transmission method: – Serial half-duplex – Serial full-duplex	2
4(b)	Any **four** from: – The number of 1 s/0 s are counted – A parity bit is added to each byte/7 bits before transmission – … to make the **sum** of the bits/1 or 0 s in each byte **odd** – After transmission, if the number is **odd** no error is detected – After transmission, if the number is **even** an error is detected	4
4(c)	– Echo (check)	1

Question	Answer	Marks
6	**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.

Question	Answer	Marks
5(a)	– Interference // crosstalk	1
5(b)	– C	1
5(c)	Any **five** from: – Timer is started when sending device transmits a data packet to receiver – Receiving device checks the data packet for errors – Once the receiving device knows the packet is error free it sends an acknowledgement back to the sending device … – … and the next packet is sent – If the sending device does not receive an acknowledgement before the timer ends … – … a timeout occurs – … the data packet is resent … – … until acknowledgement received // until max number of attempts reached	5

Question	Answer	Marks
4(b)(i)	• Router	1
4(b)(ii)	Any **two** from: • A collection of servers • … that store data in a remote location // that allows data to be accessed remotely • … that are (normally) accessed using an internet connection	2
4(b)(iii)	Any **one** from: e.g. • May be **less** secure // by example • May lose access to them if internet connection lost/not available • Reliant on a third party maintaining the hardware // by example • Could incur an extra/ongoing fee/cost	1

Question	Answer	Marks
5(a)(i)	Any **two** from: e.g. • **Destination** IP/address • Packet number • **Originators** IP/address • Error detection method	2
5(a)(ii)	**One** mark each: • Payload • Trailer	2
5(b)(i)	No mark for choice. **Three** from for justification that matches choice. Serial • Data arrives in order sent // does not need reordering • Less likely to experience interference • … less likely to have errors • Can transmit over a longer distance (i.e. another room) • Still fast transmission… • …sufficient for this purpose Parallel • Faster transmission speed than serial • … faster response to requests • Very long connection not needed • …next room is (likely) within distance for parallel • … unlikely to error/arrive out of sequence/skew	3
5(b)(ii)	**One** mark each: • Data goes in both directions… • …at the same time	2

5(c)(i)	**One** mark each:	2

0	1	1	0	0	0	1	1
0	0	0	0	0	0	0	0

5(c)(ii)	**One** mark each: • In parity check, **interchange** of bits will not be detected // Parity check cannot detect **even** number of changes // Parity check cannot detect error if parity stays correct … • …the (possible) position of all changes will be highlighted // will identify the horizontal and vertical position of all differences/changes	2

5(c)(iii)	**One** mark each: • Bit 6 • Byte 4	2

Question	Answer	Marks
5	**One** mark each for the correct byte and bit • Byte 4 • Bit 5 Any **two** from: • Counted all the 1s • An even parity has been used • Odd number of ones in that row (byte 4) **and** column (bit 5)	4

Question	Answer	Marks
9	Any **six** from (MAX four for ARQ): • Odd or even parity is **set/agreed** for the data • A parity bit is added to each byte of data • … to make the number of 1s match parity • Data is checked after transmission to see if parity is correct • ARQ uses acknowledgement and timeout • If no error is found, a positive acknowledgement is sent to the sender / no acknowledgement is sent to the sender • If an error is found, a negative acknowledgement is sent to the sender … • … that triggers the data to be resent • When the data is sent, a timer is started • If an acknowledgement is not received within the time set, the data is resent ... • … until an acknowledgement is received / resend limit is reached	6

2.1, 2.2 & 2.3 – Data Transmission
ANSWERS

Question	Answer	Marks
7(a)	• Data is sent multiple bits **at a time** • … down multiple wires • Data is sent in one direction only	3
7(b)	Any **two** from: • Parallel is not suitable for long distances // only suitable for short distances • … the data could become skewed • Parallel cables are not manufactured above approx. 5m	2
7(c)	Any **three** from (MAX 2 for ARQ): • Checksum used to detect errors (during transmission) • … using a calculated value • ARQ checks if data is received • … uses acknowledgement and timeout • … requests data be sent again if (checksum) detects error / not received	3

Question	Answer	Marks
3(a)	**One** mark per each correct row.	5

Statement	Checksum (✓)	Check digit (✓)	Parity check (✓)
uses an additional bit to create an odd or even number of 1s			✓
checks for errors on data entry		✓	
compares **two** calculated values to see if an error has occurred	✓	✓	
will **not** detect transposition errors			✓
sends additional values when data is transmitted from one computer to another	✓		(✓)

Question	Answer	Marks
3(b)	– ARQ	1

Question	Answer	Marks
3(a)	**One** mark per each correct row.	6

Statement	Serial simplex (✓)	Parallel simplex (✓)	Parallel half-duplex (✓)	Serial duplex (✓)
bits are transmitted along a single wire	✓			✓
data is transmitted in both directions			✓	✓
it is only suitable for distances less than 5 metres		✓	✓	
Bits from the same byte are transmitted one after the other	✓			✓
data may **not** arrive in the correct sequence		✓	✓	
data is transmitted in both directions, but only **one** direction at a time			✓	

Question	Answer	Marks
3(b)	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	3

Question	Answer	Marks
3(a)	**One** mark per each row	5

Statement	ARQ (✓)	Check digit (✓)	Checksum (✓)
checks for errors on data entry		✓	
uses a process of acknowledgement and timeout	✓		
compares two calculated values to see if an error has occurred		✓	✓
may resend data until it is confirmed as received	✓		
checks for errors in data after transmission from a computer to another			✓

Question	Answer	Marks
3(b)	– Parity check	1

Question	Answer	Marks
9	– Even – Even – Odd – Even	4

3)

(i)	Any **two** from: – It cannot be inserted incorrectly – Supports different transmission speeds – High speed **transmission** – **Automatically** detected (not connected) // automatically downloads drivers – Powers the device (for data transfer) – Backward compatible	2
(ii)	– Serial	1

Question	Answer	Marks
8(a)	– Odd – Odd – Even – Even	4
8(b)	Any **one** from: – there is a transposition of bits – it does not check the order of the bits (just the sum of 1s/0s) – even number of bits change – incorrect bits still add up to correct parity	1
8(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
8(c)(ii)	Any **two** from: – Bits may arrive skewed – More expensive **to setup/manufacture/purchase cable** – Limited distance – More prone to interference/error	2

Question	Answer	Marks
6(a)	– Odd – Even – Even – Odd	4
6(b)	Any **one** from: – There is a transposition of bits – Bits still add up to correct parity	1

2(c)(i)	Any **two** from: e.g. • Destination/receivers (IP) address • Packet number • Originator's/senders (IP) address	2
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

Question	Answer	Marks
4(a)	a v m v e q n d i z m h (2 marks, 1 for each correct word)	2
4(b)	**2 marks** shift right all characters shifted five places	2
4(c)	the first cypher cannot deduce rest of cypher having identified some characters/more random substitution	2

v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u

6 **(a)** Any **one** from:
- jumbling up/scrambling characters so that message makes no sense
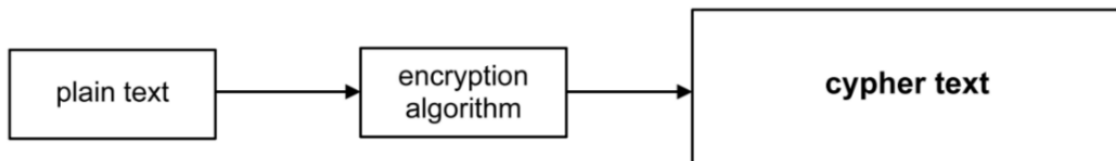- requires an encryption key to encrypt data
- need decryption key to decipher encrypted message

[1]

(b) Uses the same key to encrypt and decrypt message   [1]

(c) 1 mark for correct name in box

plain text → encryption algorithm → **cypher text**

[1]

10 symmetric encryption

encryption key

plain text

encryption algorithm

cypher text   [5]

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]

6 **(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
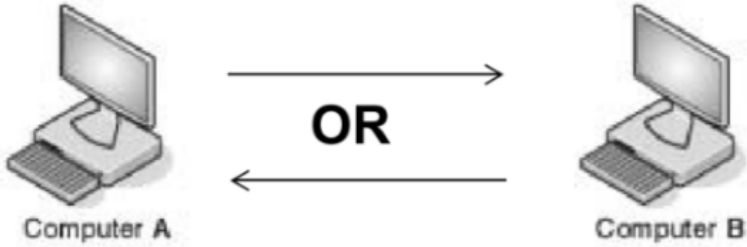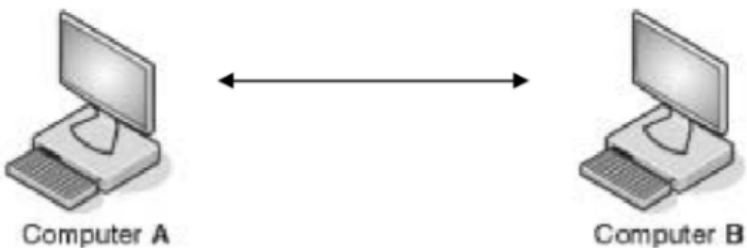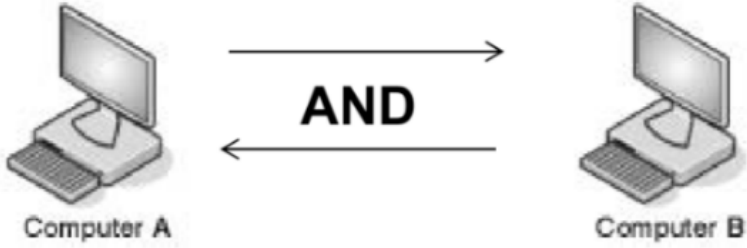– bits will still be synchronised after transmission [2]
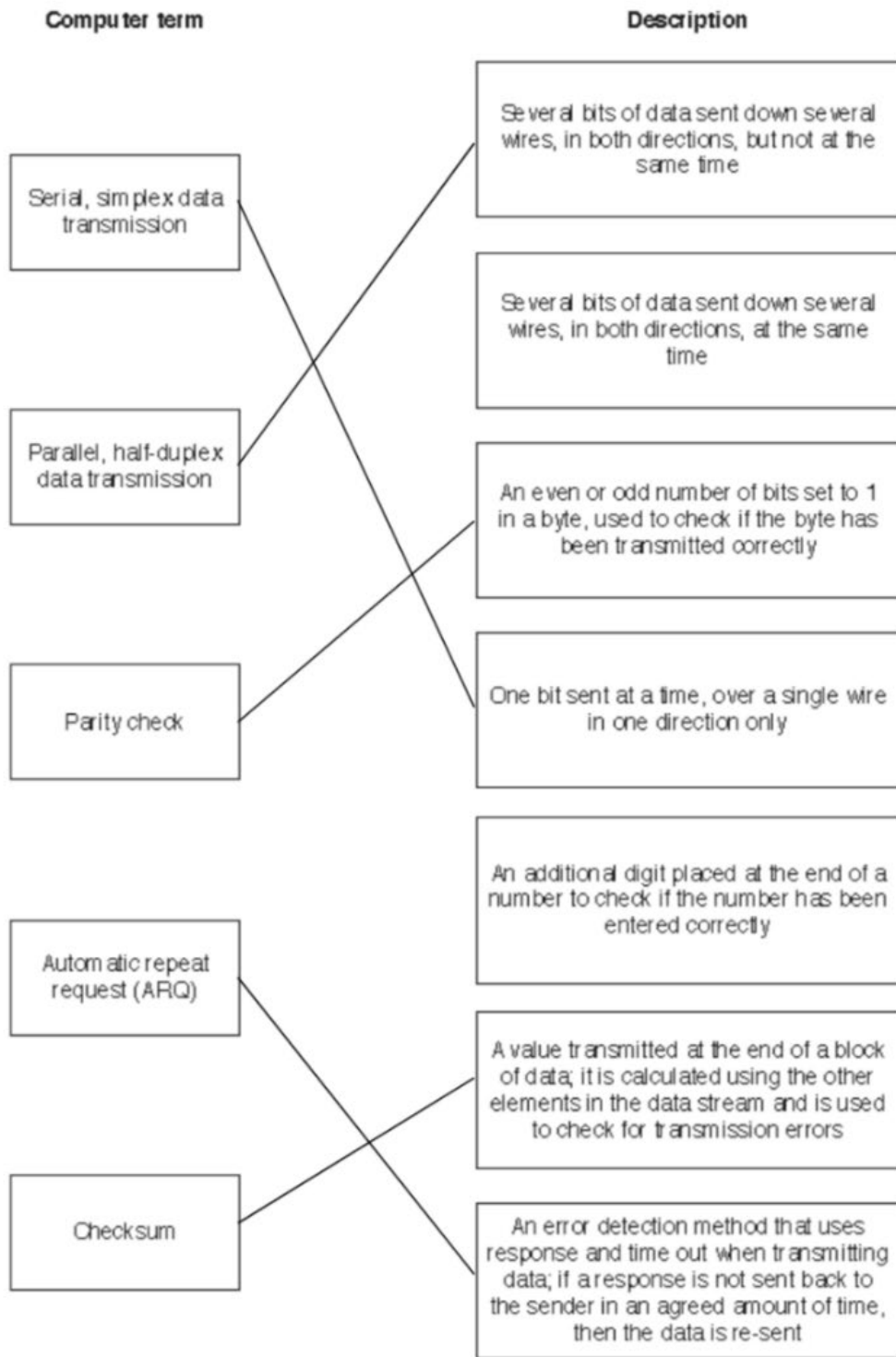
Question	Answer	Marks
4	**Two** marks for each correct description **Parity Check** Checks a byte of data Check is performed when data is received A parity bit is added (to the parity byte) Counts / checks number of 1's // counts / checks to see if 1's are even // counts / checks to see if 1's are odd Can be <u>even</u> or <u>odd</u> If parity is incorrect, error is detected **Check digit** A digit that is calculated from the data // uses modulo to calculate digit // valid description of modulo It is appended / added to the data Digit is recalculated when data is entered Digits are compared to check for error **Checksum** A value is calculated from the data // Valid description of calculation It is transmitted with the data Value is recalculated after transmission Values are compared after transmission to check for error **Automatic Repeat reQuest** Uses acknowledgement / request and time-out Error control protocol Check performed on receiving data // error is detected by e.g. parity check, check sum If error detected, request is sent to resend data // negative acknowledgement is used Resend request is repeated till data is sent correctly / requests time out / limit is reached Send acknowledgement that data is received // positive acknowledgement is used If acknowledgement not received in set time data is resent	8

Question	Answer	Marks
7(a)	1 mark for correct arrow(s), one mark for correct description	6

Simplex data transmission

Computer A   OR   Computer B

(Direction of data is) one way only // unidirectional

Duplex data transmission

Computer A   Computer B

(Direction of data is both ways) <u>at same time</u> / <u>simultaneously</u> / <u>concurrently</u>

Half-duplex data transmission

Computer A   AND   Computer B

(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>

3

Computer term	Description

Computer term:
- Serial, simplex data transmission
- Parallel, half-duplex data transmission
- Parity check
- Automatic repeat request (ARQ)
- Checksum

Description:
- Several bits of data sent down several wires, in both directions, but not at the same time
- Several bits of data sent down several wires, in both directions, at the same time
- An even or odd number of bits set to 1 in a byte, used to check if the byte has been transmitted correctly
- One bit sent at a time, over a single wire in one direction only
- An additional digit placed at the end of a number to check if the number has been entered correctly
- A value transmitted at the end of a block of data; it is calculated using the other elements in the data stream and is used to check for transmission errors
- An error detection method that uses response and time out when transmitting data; if a response is not sent back to the sender in an agreed amount of time, then the data is re-sent

[5]

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