9.1 Communication Mark Scheme

Q1.

All marks AO1 (understanding)

Level	Description	Mark Range
4	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers all three areas indicated in the guidance below and in at least two of these areas there is sufficient detail to show that the student has a good level of understanding. To reach the top of this mark range, a good level of understanding must be shown of all three areas.	10-12
3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response which shows a good level of understanding of at least two areas indicated in the guidance below.	7-9
2	A limited attempt has been made to follow a line of reasoning and the response has a mostly logical structure. At least four points have been made. Either a good level of understanding of one area from the guidance has been shown or a limited understanding of two areas.	4-6
1	A few relevant points have been made but there is no evidence that a line of reasoning has been followed. The points may only relate to one or two of the areas from the guidance or may be made in a superficial way with little substantiation.	1-3

Guidance – Indicative Response

For each guidance point, if the student expands on the point to explain in what way the measure will improve performance then this can be considered to be a second point. For example:

- "Using a processor with more cores" is one point.
- "Using a processor with more cores which will be able to execute multiple instructions simultaneously" is two points.

Note that just "faster" is not enough to count as an expansion point without an explanation of why.

1. Server Hardware

Replace the processor with one which has more cores

Replace the processor with one which has more cache memory // increase the

amount of cache memory

Replace the processor with one which runs at a faster clock speed **NE.** faster processor

Use a parallel processor architecture // use more processors which can work in parallel

Use a processor with a bigger word size

Use a processor that makes (better) use of pipelining

Install more RAM // main memory // primary memory

Use RAM // main memory // primary memory with a faster access time

Replace HDDs with SSDs // Replace HDDS with HDDs that can read data at a faster rate

Defragment the HDD

Replace the motherboard with one which has buses which run at a faster clock speed

Replace the motherboard with one which has more lines in the data bus

Use the Harvard architecture

Distribute the processing across multiple servers

2. Network

Replace the network cable with cable that has a higher bandwidth // replace copper cable with fibre-optic cable **A.** Ethernet cable for fibre-optic NE. higher bandwidth network

Replace any wireless / WiFi connections with wired ones

Replace the network cards with ones that can transmit data at a higher bitrate

Consider the overall network design eg how the network is divided into subnets **A.** split the network into subnets

Use a star topology (instead of a bus)

Consider using a more efficient protocol for the data across the network

Add additional wireless access points

3. Database and Software

Use a more efficient technique for controlling concurrent access to the database // replace record/table locks with serialisation/timestamp ordering/commitment ordering

Replace the database software with software that uses more efficient algorithms for tasks **A.** examples eg replace linear search with binary search

Use the index feature of the database to speed up searching on fields that are commonly used for this purpose

Rewrite the database software in a language that is suitable for concurrent execution // use a functional programming language for the database software

Ensure the software is compiled rather than executed by an interpreter // rewrite the software in assembly language/machine code

Review the conceptual model of the database to see if it contains any inefficiencies such as data redundancy that could be eliminated **A**. normalise the database design

Consider if it would be appropriate to sacrifice normalisation of the conceptual model to improve performance

Use a non-relational database system **A.** examples eg NoSQL

Distribute the data across multiple servers

Try to reduce the amount of other (unrelated) software that might be running on the database server at the same time

Try to reduce the number of database accesses that need to be made simultaneously // run some tasks at quiet times / overnight

Purge / archive data that is no longer necessary / in use

[12]

Q2.

(a) **Mark is for AO1 (understanding)**

3;

1

(b) **Mark is for AO2 (apply)**

1500 (bits per second);
A. 3 * 500
A. Value given in response to question part 3.1 multiplied by 500.

1

(c) **Mark is for AO1 (understanding)**

B;
R. If more than one lozenge shaded.

1

(d) **All marks AO1 (understanding)**

Data skew might occur if parallel communication used;
A. Eliminates risk of desynchronisation (between data signals)
A. Bits transmitted simultaneously/together may arrive at different times
NE. Bits will not arrive together
The longer the distance the higher the likelihood of data skew;
To avoid problems of cross-talk // interference between individual wires;
Hardware (for serial communication) is cheaper to manufacture // cheaper cabling (for serial communication which is more important over long distances); A. "Easier" for "cheaper"
NE. Just statement that fewer wires required without expansion eg lowering cost
NE. References to data being corrupted without further explanation eg data skew, cross-talk

Max 2

[5]

Q3.

(a) Parity Bit: 1;

Start bit, Stop Bit: Can be either 0 or 1, but must both be different to get mark;

2

(b) **Definition (1 mark):**

Receiver and transmitter (clocks) do not need to be/are not (exactly) synchronised // transmission of data without use of

external clock signal // receiver and transmitter clock only synchronised at start of/for length of transmission // data sent as soon as available rather than waiting for clock pulse/ synchronisation symbol;

Explanation of start and stop bits (max 2 marks):

Start bit synchronises receiver (clock) (to transmitter/data) // locks receiver and transmitter in phase // starts receiver's clock // wakes receiver;
Stop bit allows start bit to be recognised // allows receiver to process received bits;
A. Start and stop bits indicate when data is being transmitted/ begins – if neither of the other two marks for start and stop bits have been awarded

3

(c) 1010001;

A. Separator between digits e.g. comma

1

(d) It is the parity bit;
A. Odd parity bit
A. If there are an even or odd number of 1s in the input

1

(e) Only a small quantity of data to send // data transmission speed not important;
Widespread availability of USB/serial connections;
Serial communication avoids crosstalk // interference between signals on each wire;
Serial communication avoids data skew;
A. Serial communication is cheaper to implement with a suitable reason given
A. For future flexibility if devices were moved further apart
N.E. Serial is less error prone / fewer errors

MAX 2

2

[9]

Q4.

(a) **Marks are for AO1 (understanding)**

Label	Description
1	channel idle / not busy / / no node transmitting;
2	no acknowledgement received; **NE** collision occurs
3	acknowledgement received; **NE** no collision detected

4	(wait for) random period of (time);

1 mark: each correct description

4

(b) **1 mark for AO1 (knowledge) and 2 marks for AO1 (understanding)**

AO1 (knowledge):

1 mark: SSID is a (locally unique) identifier for a wireless network;

AO1 (understanding):

1 mark: A wireless client must have the same SSID as the one put in the access point to join;
1 mark: Broadcasting SSID announces publicly your wireless network and can be seen as a security weakness;

3

(c) **Marks are for AO1 (understanding)**

In coffee shop speed could be limited for each device that is connected / / throttling;
In coffee shop more clients connecting to one access point;
In coffee shop connection to Internet might have less bandwidth;
In coffee shop there may be more collisions;
NOTE accept answers made in terms of home
Max 2 marks

MAX 2

[9]

Q5.

(a) **All marks AO1 (knowledge)**

1 mark: Serial sends one bit at a time / after each other whereas parallel sends multiple bits simultaneously / at same time/
A "data" for "bits" in the context of parallel transmission

1 mark: Serial uses a single wire / cable / path / line whereas parallel uses several / multiple wires / cables / paths / lines;
A serial requires fewer wires
R answers that refer to multiple channels achieved by sharing bandwidth
R unless both sides of a point are made.

2

(b) **Mark is for AO1 (understanding)**

Parallel communication can only be used over short distances / / distance between computer and peripheral too great to use parallel communication / / data skew might occur if parallel communication used;
To avoid problems of cross-talk / / interference between individual wires;
Hardware (for serial communication) is cheaper to manufacture;
A fast transmission rate may not be required;
Max 1

1

(c) **Mark is for AO1 (knowledge)**

Number of signal changes per second / / rate at which signals can change; **A** voltage changes for signal changes

1

(d) **Mark is for AO1 (understanding)**

Each signal level / signal change represents more than one bit (of data) / / channel supports more than two different signal levels / voltages / / use of modulation / coding technique eg phase modulation;
N.E. Send more than one bit at a time
Must be clear that there are more than two signal levels;

1

[5]

Q6.

(a) **All marks AO1 (understanding)**

1 mark: A will encrypt the message using **B's public;** key.
1 mark: The message will be decrypted by B using **B's private;** key.

2

(b) **All marks AO1 (understanding)**

1 mark: Detect (unauthorised) changes to message;
1 mark: Authenticate sender's identity / / confirm who sent it;

2

[4]

Q7.

(a)

Situation	Most likely to be Parallel	Most likely to be Serial	Could be either Serial or Parallel
Sending data to a peripheral, such as a printer, that is plugged directly into a desktop computer.		A✓	✓
Transferring memory addresses between the processor and the main memory of a desktop computer.	✓		
Transmitting an e-mail across a WAN from a computer in England to an e-mail server in Scotland.		✓	

1 mark per row with a correct tick
Do not award marks for any row which has more than one tick
A alternative indicators for ticks e.g. crosses, Y, Yes

3

(b) To check that a (receiving) device is connected;
To check that a (receiving) device is ready to receive data / / to inform a (transmitting) device that a (receiving) device is / is not ready to receive data;
To tell a (receiving) device that data is ready to be transmitted;
To negotiate / agree how the transmission will take place / / to agree the system to be used for transmission ; **A** an example of a setting that might be agreed during a handshake eg bit rate, parity
To ensure successful communication;
MAX 1

1

(c) Time delay between the moment something is initiated and the moment its effect begins;
A time delay between signal being transmitted and arriving
A time taken for transmitted data to arrive at the receiver
A lag for time delay
NE delay in transmission, transmission time

1

[5]

Q8.

(a) Serial send one bit at a time / after each other
whereas parallel sends multiple bits simultaneously / at same time;
A "data" for "bits" in the context of parallel transmission

Serial uses a single wire / cable / path / line whereas parallel uses several / multiple wires / cables / paths / lines;
R answers that refer to multiple channels achieved by sharing bandwidth

Both sides of point must be made.

2

(b) *Parity Bit:* 1;
Start bit, Stop Bit : Can be either 0 or 1, but must both be different to get mark;

2

(c) Receiver and transmitter (clocks) do not need to be / are not (exactly) synchronised // transmission of data without use of external clock signal // receiver and transmitter clock only synchronised at start of / for length of transmission // start bit used to synchronise clocks of sender and receiver // data sent as soon as available rather than waiting for clock pulse / synchronisation symbol;
NE data sent as soon as possible without waiting for receiver to be ready // receiver does not know when data will arrive

1

[5]

Q9.

(a) WWW (**Max 3 marks**)
A system of interlinked / hypertext documents;
Accessed via the Internet;

Using HTTP protocol;
NE web a collection of web pages

Internet (**Max 3 marks**)
A network of interconnected computer networks;
A a network of computers;
Using a globally unique address space;
Using end-to-end communication protocol // Internet Protocol // "TCP / IP";

Supports a range of application protocols;
A two examples of different protocols;
R "TCP"
R "IP"

Max 4

(b) Messages split into packets; **A** chunks
Each packet given destination / source address;
Each packet dispatched to the Internet through a router / gateway;
Packets sent independently;
Packets given a sequence number;
Routers forward packets (until they reach destination);
Path of packet transfer determined by router(s);
Packets reassembled at the destination;

Max 2

(c) **12.23.45.89**

An IP (v4) address (that uniquely identifies a machine on the Internet) // Internet protocol address;

80

A port number // a number that specifies which process on the receiving machine/host to send the data to;
A port;

Denotes that HTTP (server) is recipient of packet // packet is an HTTP packet

2

[8]

Q10.

(a) (i) To manage / control / execute commands on a remote machine;
A remote access / login
A a clear example of remote management
NE remote viewing
R remote desktop

1

(ii) Enable files on one host / computer / client to be copied to another host / computer / server;
To manage files on a remote computer / server;
A to upload / download / transfer files
NE "sharing"
NE load a file
NE transfer data

1

(iii) To retrieve / fetch (stored) email;
To check for new emails;
A access / download / receive
R sending
TO any mention of sending
NE just "email"

1

(b) (i) 192.168.3.205 // 74.125.4.148 // 208.43.202.29;

1

(ii) 80 // 25 // 58539 // 57458 // 57459;
I colons

1

(iii) 192.168.3.205:80 //
192.168.3.205:25 //74.125.4.148:58539 //
208.43.202.29:57458 // 208.43.202.29:57459 ;

1

(c) Servers might be in another room / site / cupboard / inaccessible ;
Servers might not have a keyboard / monitor installed ;
Can manage multiple servers from one machine;
Servers can be managed outside of work hours / from anywhere;
It would be quicker (**A** more convenient) (to manage from her machine than visit the servers) // better time management;
Server rooms are often uncomfortable places for people to work in;
NE she does not need to go to the servers

Max 2

[8]

Q11.

(a) Greater the bandwidth, the higher the bit rate // positive correlation // (directly) proportional;
Bandwidth must be at least 2wHz where w is the bit rate in bits per second;

Max 1

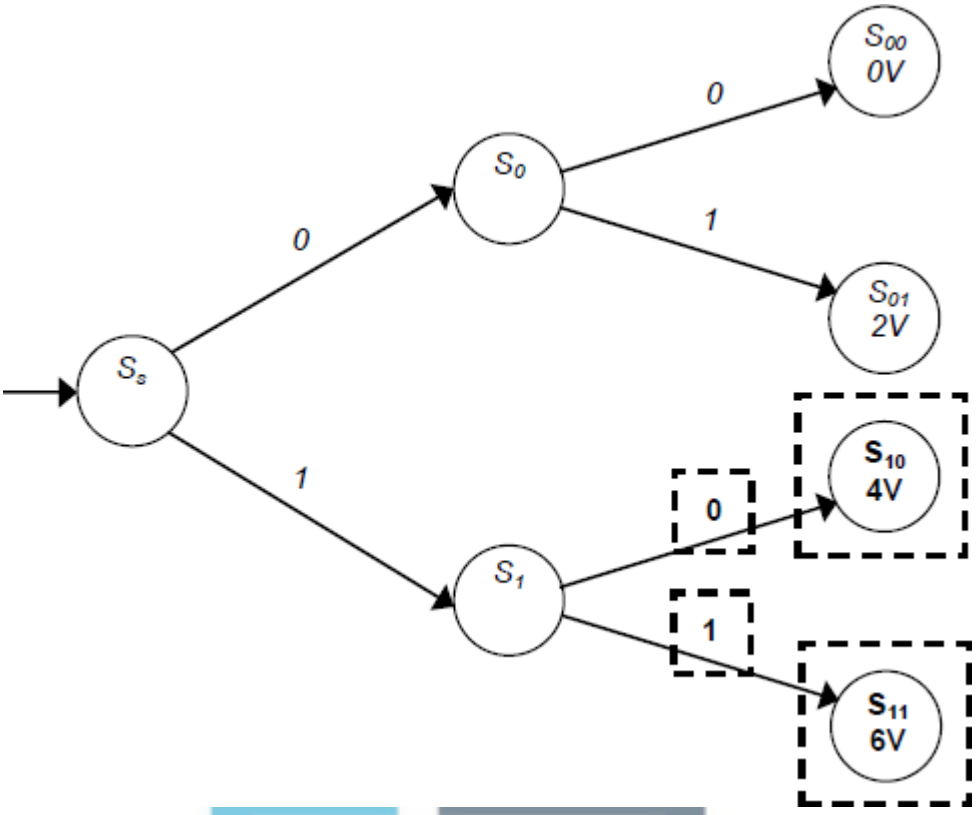
(b) Time delay between the moment something is initiated and the moment its effect begins
A time delay between signal being transmitted and arriving
A time taken for transmitted data to arrive at the receiver
A lag for time delay
NE delay in transmission, transmission time

1

(c) Bit rate is double / twice baud rate // Baud rate is half bit rate;
A "It" is double;
A 2:1

1

(d)



1 mark for labelling a transition arrow with 0
1 mark for labelling a transition arrow with 1
1 mark for labelling a state with the value 4V and a unique state name
1 mark for labelling a state with the value 6V and a unique state name

Max 2 if the states and transition arrow labels do not correspond

Note that:

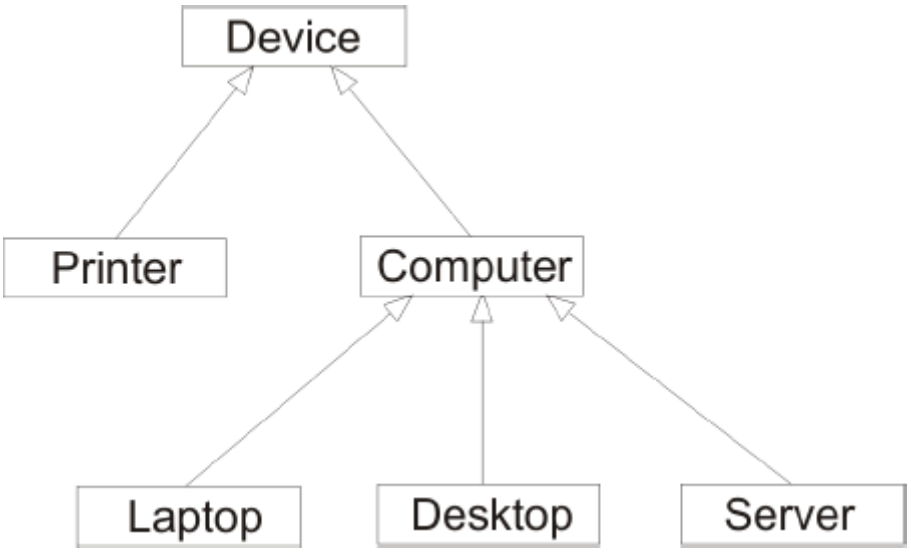
- The state names do not have to match those given here.
- The voltage values can be followed by a V, the word Volts or nothing.
- The zero and one on the transition arrows to the right of S_1 can be either way around e.g. 1 above 0 is okay.

4

[7]

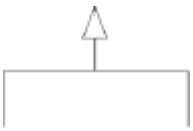
Q12.

(a)



1 mark for Device at top of diagram with Printer and Computer directly underneath it and linked to it and no other labels linked to it;
1 mark for Computer with Laptop, Desktop and Server directly underneath it and linked to it, and no other labels linked to it (except Device above);
1 mark for correctly styled diagram, i.e. lines drawn as arrows and boxes (any shape) around labels; – ***This mark is only available if candidate has already achieved at least one mark for correct contents of the diagram.***

A arrows drawn as:



A filled / empty arrowheads
A diagram rotated by 90 degrees

3

(b)

```
Computer = Class/Subclass/Extends(Device)                    1
           (Public)
               Procedure AddDevice (Override)                1
               Function GetProcessorName
               Function GetRAMCapacity                       1
               Function GetHDDCapacity
           Private / Protected
               ProcessorName : String
               RAMCapacity : Integer                         1
               HDDCapacity : Integer
           End
```

A answers that use different notations, so long as meaning is clear.

1 mark for correct header including name of class and parent class;
1 mark for redefining the AddDevice procedure;
1 mark for* defining all 3 extra functions needed to read variable values, all identified as being public (keyword public is optional if

functions are declared before variables);
1 mark# for defining all 3 extra variables, with appropriate data types and identified as being private;

A any sensible numeric types for RAMCapacity and HDDCapacity, do not have to be whole numbers
A answers that indicate separately that each variable is private or each method is public
R do not award mark for declaring new functions if any of the functions have the same name as the variables
I parameters to methods, minor changes to names that do not affect clarity

** – Do not award this mark if any extra functions / procedures have been declared, except for functions that would set values e.g. SetProcessorName or an incorrectly named procedure to add e.g. AddComputer*
 # – Do not award this mark if any extra variables have been declared

4

(c)

```
Laptop = Class/Subclass (Computer)                          1
         (Public)                                           1
             Procedure AddDevice (Override)
             Function GetBluetoothInstalled                 1
         Private / Protected
             BluetoothInstalled : Boolean
         End
```

1 mark for correct header incl
1 mark for redefining the AddDevice procedure;*
1 mark for:*

- defining the GetBluetoothInstalled function needed to read this value, identified as being public (keyword public is optional if function is declared before variable)
- defining the BluetoothInstalled variable with an appropriate data type as being private.

A Boolean or whole number types for BluetoothInstalled but reject string, character or real number types
A Different sensible name for GetBluetoothInstalled function e.g. CheckBluetoothInstalled, IsBluetoothInstalled
A answers that indicate separately that each variable is private or each method is public
I parameters to methods, minor changes to names that do not affect clarity
I addition of any extra functions or variables

** Do not award this mark if any extra functions / procedures / variables declared, except for a SetBluetoothInstalled procedure.*

2

(d) **What** *(2 marks)*:
Wireless/RF (protocol/standard/technology);
For exchanging data over short distances // for creating Personal Area Network;
NE "uses waves" for "wireless"

Example *(1 mark):*
Any sensible example, related to the use of Bluetooth with the laptop e.g. synchronising contacts between phone/ laptop, sending photographs from phone to laptop, Bluetooth mouse, Bluetooth headset / headphones (used with laptop) etc;
NE connecting to wireless network
NE mouse

If the example makes clear that the technology is wireless, but this is not explicitly stated in the "What" part of the response then the "Wireless" mark should be awarded in the "What" part.

3

[12]

Q13.

(a) Number of signal changes per second // rate at which signals can change; A voltage changes for signal changes as BOD

1

(b) (i) Each signal level / signal change represents two bits (of data)/more than one bit (of data) // channel supports four / more than two different signal levels/voltages // use of modulation/coding technique e.g. phase modulation
NE Send more than one bit at a time

Must be clear that there are more than two signal levels

1

(ii) **Step**	**Data / Request Sent**
2	Printer indicates ready; **A** Yes, Ack
3	[Computer sends] data;
6	Printer indicates ready to receive further data; **R** job complete **NE** data received

1 mark per correct step

3

(c) Baseband – whole bandwidth of medium dedicated to one channel at a time // only one computer can send data at a time // sends signals with frequencies from 0Hz to a maximum highest frequency.
Suitable for LAN – lower cost electronic components (accept examples) // simpler hardware // good performance at low cost
NE cheaper
Broadband – bandwidth of medium shared so multiple channels can be carried simultaneously // many computers can send data simultaneously // frequency bands assigned to different communications. **TO** multiple wires
Suitable for WAN – expensive to install / maintain communications media over long distance // many more devices/people needs to communicate // more cost effective to share medium.

How to award marks:

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 5 of the 5 quality of language criteria (QLx).

SUB Candidate has described both baseband and broadband and has explained accurately why at least one of these is appropriate to the context.
QL1 Text is legible.
QL2 There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QL4 Sentences and paragraphs follow on from one another clearly and coherently.
QL5 Appropriate specialist vocabulary has been used.

3–4

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QLx).

SUB Candidate has described both broadband and baseband but may not have explained why they are suitable.
QL1 Text is legible
QL2 There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QL4 The candidate has used well-linked sentences and paragraphs.
QL5 Appropriate specialist vocabulary has been used.

2

To achieve a mark in this band, candidates must meet the subject criterion (SUB). The quality of language should be typified by the QLx statements.

SUB Candidate has only described one of baseband or broadband.
QL1 Most of the text is legible.
QL2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.
QL3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.
QL4 Sentences and paragraphs may not always be well-connected or bullet points may have been used.
QL5 Specialist vocabulary has been used inappropriately or not at all.

1

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question.

If a candidate meets the subject criterion in a band but does not meet the quality of language criteria then drop mark by one band, providing that at least 3 of the quality of language criteria are met in the lower band. If 3 criteria are not met then drop by two bands.

4

[9]

Q14.

(a) Can be used over longer distances // fewer wires/cables/lines required // only one pathway required // cheaper to cable // no risk of data skew // easier to repeat/regenerate/switch // switching equipment/repeater design is easier/cheaper // no crosstalk;
R Cheaper NE
R Cannot get out of synch

1

(b) Parity Bit: 1;
Start bit, Stop Bit:
Can be either 0 or 1, but must both be different to get mark;

2

(c) Definition *(1 mark)*:
Receiver and transmitter (clocks) do not need to be/are not (exactly) synchronised // transmission of data without use of external clock signal // receiver and transmitter clock only synchronised at start of/for length of transmission // data sent as soon as available rather than waiting for clock pulse/ synchronisation symbol;
Explanation of start and stop bits *(2 marks):*
Start bit synchronises receiver (clock) (to transmitter/data) // locks receiver and transmitter in phase // starts receiver's clock // wakes receiver;
Stop bit allows start bit to be recognised // allows receiver to process received bits;
Start and stop bits indicate when data is being transmitted/begins;

Max 2

[5]

Q15.

(a) acknowledge data received by the printer;
error (signal);
busy / free / ready /'status' / acknowledge / strobe / off-line / powered/ switched off / out of paper;
A ground / earth / return;
R Interrupt / clock

Max 1

(b) (i) 110 1010;

1

(ii) 0110 1010;

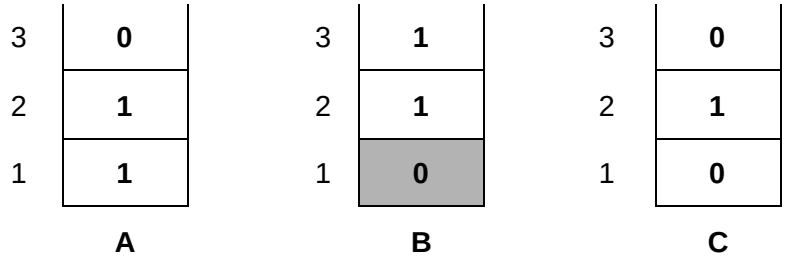
1

(iii)

8	**0**
7	**0**
6	**1**
5	**0**
4	**1**

8	**0**
7	**1**
6	**0**
5	**1**
4	**0**

8	**0**
7	**1**
6	**1**
5	**0**
4	**1**



8 parallel bits; (above, below or between the lines)
pattern A scores 2;
pattern B scores 2;
pattern C scores 1;

Max 3

(c) (i) set of rules (about the way devices communicate);
A standards **R** Instructions

1

(ii) sending signals between devices + implication of 2-way; test to see if the device is ready to receive /'are you ready?';
inform device that the data has been sent / 'here it is …';
receiver informs the sender that the data has been received / acknowledge that a transfer is completed;

Max 2

(d) (i) Universal Serial Bus;

1

(ii) Line 1 used with 7/8 bits shown (above or below);
Correct code **0110 1010**;

2

(iii) The number of bits transferred per sec / per unit of time;
I. speed
A frequency at which bits are transmitted

1

[13]

Q16.

(a) (i) IP address / Internet Protocol Address;

1

(ii) Uniform Resource Locator;
A Universal Resource Locator

1

(b)
- Forwards / backwards / Navigation – move to a previously viewed page;
- Favourites/Bookmarks – setting up/organising/stores regularly visited sites;
- Options/Tools/Settings – setting up of the Home page / enable/disable features e.g. run JavaScript;
- Home – move to the Home page;
- Refresh – refresh the current page;
- Stop – stop loading the current page / download;
- History – show a list of the last (say) 20 pages displayed;
- Security – change settings / e.g. enable/disable graphics/pop-ups/other content/plug-ins;

- View HTML – source (code);
- Address bar – allows the entering of a URL/IP/web address;
- Search bar – search list for specific web site;
- RSS feeds – receiving content news/updates;
- Application launcher icon e.g. to run email client application;

R HTML editor

Feature followed by NO description scores 0
Good description with feature implied scores 1

Max 2

(c) (i) footyhosting.co.uk

1

(ii) (Each hosted club has) a (sub) folder/directory containing the files for their site;

1

(d) 128 kbps // 2Mbps // 128 kbps AND 2Mbps;
R answers where in addition any other answer is circled

1

(e) (i) (magnetic/server) hard disk/ hard drive;
R removable hard disk
A 'disk' spelt as 'disc'

1

(ii) 8000 GB;

1

[9]

Q17.

(a) Bits are sent along a single wire/line; bits are sent one after another;
R Bits of (the) data

Max 1

(b) (i) Data bit;
Parity (bit);
Signal to start data transfer/strobe;
Signal 'ready to receive data' / busy;
Signal to acknowledge data transfer / Complete;
Out of paper/ink / error;
On-line/off-line;
Handshaking //control signal/status signal (BUT only if not by example above);
Ground;

Max 2

(ii) Transmission over long distances;
When a high data transfer rate is required;
A No driver is available;

Max 1

(c) Data is transmitted intermittently (rather than as a steady stream);
Sender and receiver are only synchronized when data is being sent // start bit synchronises the receiver;
R Description only of start and stop bits

1

[5]

Q18.

(a) E X A M ;

Mark as follows:
1 or 2 correct (1) ;
3 correct (2) ;
4 correct (3) ;
R lower case

3

(b) (i) Universal Serial Bus;

1

(ii) Parallel ;

1

(iii) Set of rules ;
Sending signals between devices;
(Computer) asks are you ready? ;
(Printer) acknowledges yes I am ;
(Computer) responds here comes the data ;
(Printer) 'thank you received' ;

Max 2

(iv) Acknowledge data received by the printer ;
Error ;
Line is busy / free / ready /'status' / ACK Request ;
Timing / strobe;
Interrupt;
R Ground

Max 1

(v) Operating system ;
Word processing software / text editing software / any sensible Application ;
Print spooler ;
Printer driver ;
R 'printing software'

Max 2

[10]

Q19.

(a) Allows for the sharing of peripherals/hardware; **R** 'Resources' programmers can access their work from any terminal; better communications / internal e-mail/instant messaging; easier/quicker/instant sharing of a program library/ sharing program code/ data files; central storage of documents e.g. program specifications; changes to important documents are held centrally / document management; setting up of an Intranet (for document management); easier for the backup of data;
R anything about program updates

Max 2

(b) (i) Easier/quicker installation/maintenance of the application software /

easier backup (only if not in(a));
R Saves space on the PCs / 'Security' / cheaper (licensing)

1

(ii) If server goes down software (may) still be available;
Software will load/accessed faster from secondary store;
Software can be personalised for individual user;
Helps to avoid degradation in network performance;
R anything about the software runs faster

1

(c) (i) Protocol set of rules (about the way devices communicate);
A standards
R Instructions

1

(ii) Handshaking …
Sending signals between devices + implication of 2-way;
Confirmation of ready for sending / receiving data;
Acknowledge that a transfer is completed;

Max 2

(d) smk-solutions.co.uk;
R www.smk-solutions.co.uk

1

[8]

Q20.

(a) **Serial transmission**
Bits are sent along a single wire/line // bits are sent one after the other / 'bit by bit';

1

(b) (i) 1;

1

(ii) (5 * 768 * 1024 / 1024) // 3840 Kbytes; **F/T** from (i);

1

(c) **Advantage**
The sound quality is higher/better;(1)

Disadvantage:
The files will be larger / files take up more disc space;(1)
R anything which suggests 'data transfer'

2

[5]

Q21.

(a) (i) Name: Start Bit;
Purpose: Synchronise receiver;

2

(ii) Name: Parity Bit;
Purpose: Perform parity check// check for errors in transmission;
A Prevent errors

2

(iii) Name: Stop Bit;
Purpose: Allow start bit to be recognised//
Allow receiver to process received bits;
A Indicates end of data

2

(b) (i) The number of signal/voltage changes per second;
A rate at which signals are sent;
A rate at which voltage changes;

1

(ii) Number of bits per second / unit of time;
R the rate at which bits are sent *(question paraphrased)*

1

(iii) Range of frequencies a channel can handle;
A maximum line speed;
A maximum transmission speed;

1

(c) A signal can contain one or more bits;
Bit rate can be higher than baud rate;
Bit rate = baud rate * number of bits per signal change;;

2

[11]

Q22.

(a) Cables are cheaper // uses fewer wires;
Data does not get skewed // out of line/sync;
Simpler/cheaper/easier to boost signals;
R Cheaper on its own (n.e)

2

(b) (i) Baud is the number of signal / pulses / voltage changes per second;
A rate at which signals / pulses are sent;
A rate at which voltage changes;

1

(ii) Number of bits per second / bits per unit of time;
Bit rate = baud rate * number of bits per signal change;
R rate at which bits are sent

1

(iii) Range of frequencies that can be transmitted;

1

(c) Greater bandwidth allows greater bit rate;

1

[6]

Q23.

(a) (i) Local Area Network;

1

(ii) Wide Area Network;

1

(b) (i) Intranet // Any example of communication within a building or site;
I Connection of computers

1

(ii) Internet// World Wide Web //
Any example of communication over a substantial distance;
I Connection of computers

1

(c) (i) A set of rules;

1

(ii) The rate that signals/ voltage changes are transmitted;

1

(ii) The number of bits transmitted per second// the number of bits transmitted per time unit;
R the rate that bits are transmitted;
R bits of data

1

(iv) The range of frequencies a medium is capable of transmitting;

1

(d) Greater bandwidth allows greater bit rate // bit rate proportional to bandwidth;

1

(e) (i) Bits transmitted one after the other (along a single channel/ wire/ line);
Or by diagram
R Bits of data

1

(ii) Bits transmitted (along several wires/ channels/ lines) at the same time;
Or by diagram

1

(iii) Can be transmitted over a longer distance// cabling is cheaper // Less chance of skew;

1

(iv) Faster transmission;

1

[13]

Q24.

(a) Data bus;
carries data to/from processor / memory / devices /components;
Address bus;
carries addresses / identifies locations;
Control bus;
carries control signals / controls devices;
A by example

Max 1 mark for carries Data / carries addresses / carries control signals

6

(b) Network adapter / network card;
A named example e.g ethernet card generate / understand signals / data (that

conform to the LAN protocol) /
Allows (successful) communication / Provides a unique network address;
R connect

2

(c) Faster transmission;

1

(d) Data transmitted longer distance than is possible with parallel / less expensive to cable;
R cheaper

1

[10]

Q25.

(a) Nodes/systems/networks/machines/computers connected/ linked/ communicating;
On different sites; over large geographical area/by satellite/telephone line/;
R different buildings

2

(b) (i) Modem/ISDN adapter/ADSL adapter; **R** network card

1

(ii) Browser software; http communication software; Telnet; FTP; Gopher;SSH;
R internet server
R dial-up networking software

1

(c) Bits are sent one after another/bits are sent one at a time/ bit by bit /bits sent singly / bits along a single wire / line;
R data

1

(d) (i) One baud is the number signal/voltage changes per second;
A rate at which signals are sent;
A rate at which voltage changes;

(ii) Number of bits per second / bits per unit of time;
Bitrate = baudrate * number of bits (per signal change);
R the rate at which bits are sent *(question paraphrased)*

2

[7]

Q26.

(a) Network adapter/network (interface) card/Ethernet card;
A a named card type eg Token Ring Card;
R NIC *on its own*
I hub

1

(b) (i) A= Ring (network); B= Bus (network);

2

(ii) Higher transmission rates possible with high traffic/ performance of B degrades with heavier traffic;

R quicker no collisions;
A fewer collisions;
Transmission of messages is simple (as messages travel in one direction only);

Max 1

(iii) Easy/inexpensive to install;
Easy to add more stations/computers/nodes/clients without disrupting network;
R users instead of node
R cable breaks, **R** computer breaks

Max 1

(c) (i) A protocol is a set of rules; **A** set of procedures; **A** a rule;
I other terms unless talked out in rest of sentence

1

(ii) To ensure successful communication/transmission/interaction;
(between different computers) answer must imply communication/receiving data not hardware linking
R sending data only
R if connection only

1

[7]

Q27.

(a) Bits transferred simultaneously / concurrently; **R** data **R** bytes
Bits sent down many wires at the same time; **A** bits of data
A a clear diagram;

Max 1

(b) (i) Data get skewed; timing of bits becomes different / out of line;
A over longer distances the data may not be correct;
A too expensive because of amount of wires/cables/lines;
R signal decays **R** corrupted data

Max 1

(ii) Use serial transmission;

1

[3]

Q28.

(a) (Parity bit is adjusted to make) number of 1's / on/off bits even;
Parity bit is regenerated/checked by receiver;
Check parity bit after transmission;
If number of 1-bits is now odd, there was an error in transmission;

Max 3

(b) The greater the bandwidth the greater the rate at which data can be sent;
Bit rate increases as bandwidth increases;
Bit rate (directly) proportional to bandwidth;

Max 1

[4]

Q29.

(a) (i) **Baseband:**
Single /data signal sent at a time Or single message/packet/frame sent at a time Or uses single channel Or one transmission at a time **A** Single stream of data;
Over full bandwidth (of the cable) Or occupying full bandwidth (of the cable)
Or signal uses all available frequencies;
(ignore any additional references which are bits, 0/1 in any part of the above)
R Single bits sent at a time
R Only works over short distances

(ii) **Broadband:**
Several /data signals sent simultaneously Or several messages/ packets/frames simultaneously Or more than one signal occupies bandwidth ;
Each at a different frequency Or in a different channel
Or in a different time slot;
Or
Multiple channels used;
Each at a different frequency Or in a different time slot;
Or signal(or equivalent) uses only one frequency Or signal (or equivalent) uses only part of bandwidth;;
R fast connection
R Video, sound and text .....
R ADSL, cable examples, etc

4

(b) (i) **Two reasons:**
Wide area networks expensive to install;
Wide area networks expensive to maintain;
Wide area networks involve long distances;
Can allow multiple data streams to keep down costs
Or can share transmission medium to keep costs down;
Many channels needed to cope with high volume of traffic
Or enables more users to use network without experiencing congestion;
R Faster
R can work over longer distances
R More than one user will want to use it simultaneously
R Cheaper, more efficient

Max 2

(ii) **First mark:**
(More packet) collisions take place;
Stations attempting to send at the same time;
Each station broadcasts to every other one;
Some stations may be attempting to broadcast at the same time;

Second mark:
Packets need to be sent again;
Station has to retransmit (after a random delay);

Max 2

(iii) **First mark:**
Exclusive bus connection (made temporarily between sender and receiver)
Or data transfers take place in turns
Or switch connects just sender and receiver

Or collision domain limited to two stations
Or switch splits bus LAN into several smaller segments
Or switch allocates a time slot to each transmission
Or each host/computer/station/workstation/node has its own link on which one packet at most can travel
Or switch allows a dedicated connection/pathway to be set up when a computer wishes to send information to another
Or switch separates work stations (in different segments)and only passes packets between segments when necessary
Or switch (ports) act as bridges which segment network;

Second mark:
Therefore collisions cannot occur (between two stations)
Or collisions reduced;

2

[10]

Q30.

(a) (i) Bits are sent one after another / bits are sent one at a time/ bit by bit / bits sent singly / bits along a single wire / line; **R** data

1

(ii) Bits transferred simultaneously / concurrently / bits sent down many wires at the same time; data is sent one word/byte at a time;
R sending blocks of data
R down 2 wires

1

(b) Speed of (serial) transmission/rate at which data is sent; the number of signal/voltage changes per second; **A** units of time one baud is (approx) one bits per second;
R rate of data transmission

1

(c) (i) 1 0 1 0 0 1 1 0

1 mark for correct ASCII binary code in 6 rightmost bits
1 mark for even number of 1s in 8 bits

2

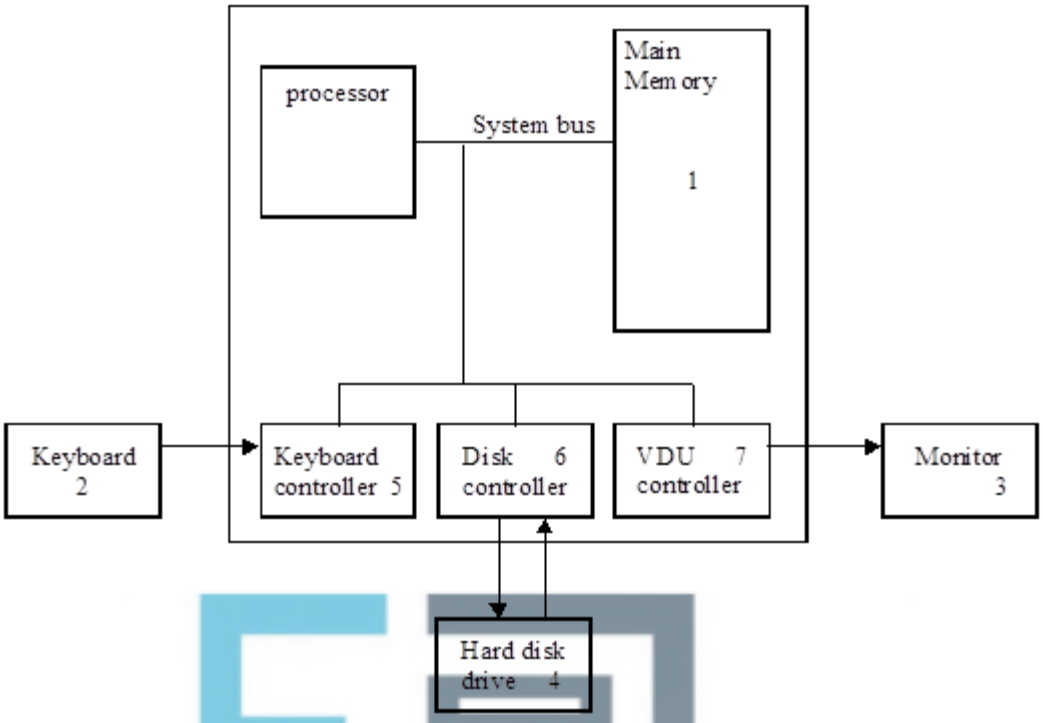
(ii) 0 0 1 0 1 0 0 1 1 0 1
OR
0 1 0 1 0 0 1 1 0 1 1;
OR
1 1 1 0 1 0 0 1 1 0 0
OR
1 1 0 1 0 0 1 1 0 0 0;

1

[6]

Q31.

(a) Correctly placed labels: main memory (1);
Keyboard & keyboard controller (2,5);
Disk controller & HD drive (6,4);
Monitor & monitor controller (7,3);



(Allow names instead of numbers)

4

(b) Machine code instructions/program stored in main memory/RAM/IAS; fetched and executed; *(concept)*
Can be replaced by another program any time;
R cache

Max 2

(c) (i) Bits are sent one after another / bits sent one at a time / bits sent singly / along a single wire/line;
R data / character

1

(ii) Bits transferred simultaneously/concurrently / bits sent down many wires at the same time;
A diagram;
R data / character

1

(d) (i) Between devices in close proximity / communication within computer / communication over short distances;

1

(ii) Distance: parallel transmission only operates over short distances;
speed: parallel transfer faster than serial;

1

(e) Start bit marks beginning of character to be transmitted / alerts/synchronises receiving device (1)

Stop bit(s) marks end of character to be transmitted / gives time for receiving device to recover; frames the character (1)

2

[12]

Q32.

(i) Bits are sent one after another/bits sent one at a time/bits sent singly/bits sent along single wire(line)

1

(ii) Bits transferred simultaneously/Bits transferred down many wires at the same time

1

NOT single stream of bits for bit of data/bits of data ignore "of data"

[2]

Q33.

(a) Mouse joystick Modem link - single stream of bits down single wire

NOT speaker

2

(b) Local printer, scanner, hard drive, - several streams of data down several wires simultaneously

2

*Only use printer **once***
For each, 1 mark for example 1 mark for description

[4]

Q1.

A very good range of responses was received to this question, with approximately half of students achieving five or more marks. Most students addressed all three aspects of the question (hardware, network, database and software). Students tended to make more points about how the hardware could be improved than about the other two areas. This was acceptable but students needed to have covered all three areas to achieve a mark of ten or above.

Some students wrote too vaguely to achieve marks, for example by writing that a "faster processor" would improve performance, without referencing a factor such as the clock speed that would make the processor faster. Other mistakes included believing that the question required students to contrast thin-client and thick-client and that the system was web based.

A small number of students wrote about issues which might be causing the system to perform poorly instead of explaining how the performance of the system could be improved. Such responses were not worthy of a mark.

Q2.

(a) This question was not well answered, with only about a third of students achieving the mark. These students correctly recognised that with eight different transmission levels the value of three bits could be sent in one group as $2^3 = 8$. Common incorrect responses were 8, 4 and 2^8.

(b) This question part was better answered than 3.1. Many students who answered 3.1 incorrectly still recognised that they needed to multiply their answer to 3.1 by 500 for this part and follow-through marks were available for students who answered 3.1 incorrectly but performed the correct calculation in this part. The most common error was to simply multiply 500 by 8.

(c) This question part was well answered with just over two thirds of students correctly recognising that there was a linear relationship between bandwidth and bit rate and that the correct answer was B. The second most commonly selected response was A.

(d) Two thirds of students showed a good understanding of this topic and were able to achieve some marks for explaining the advantages of serial communication over long distances. This was a question where knowing the correct terminology was helpful, for example using the phrase "data skew" provided a much easier route to getting a mark than trying to describe what data skew is as many descriptions did not clearly show that the student understood the concept. For example, just stating that "all the bits might not arrive together" did not clearly convey that a student understood data skew. Some statements were not considered mark worthy as they are true of serial communication too, which also suffers from interference and corruption. Responses stating that serial communication was cheaper required further explanation of why this was the case to achieve marks.

Q3.

This question was about data transmission and Mealy machines. For part (a) the vast majority of candidates were able to work out the correct parity bit and give suitable start and stop bits.

For part (b), most candidates were able to explain that asynchronous data transmission meant that that the clocks at the sender and receiver were not synchronised, or that there was no common clock. However, the purpose of the start and stop bit were poorly understood. The start bit is used to temporarily synchronise the clock of the receiver to that of the transmitter. The least well understood part of the question was the purpose of the stop bit. The stop bit serves two purposes. The first is to allow the receiver to process the received data, for example, to transfer it out of a receive buffer, before the next transmission is received. The second is to allow the identification of the next start bit, which is why the stop and start bit always have different binary values.

Parts (c) and (d) were well answered, with most candidates being able to use the Mealy machine and then recognise the significance of its output.

For part (e), the advantages of serial communication were not well understood, with many candidates failing to achieve any marks and only a few achieving both. When answering this type of question, candidates need to be aware of the context given in the question. Good responses recognised that a small amount of data was being sent, so data transmission speed was not a significant factor in this system, and went on to discuss problems associated with parallel communication that would not occur if serial communication was used, notably data skew and crosstalk. Marks were awarded for points relating to costs if these were justified, but really the fact that fewer wires were required so this would be cheaper was a very weak point given that the question stated that the two communicating devices were next to each other. Candidates need to ensure that they consider their response in relation to the context of a question.

Q7.

(a) In this part candidates were expected to apply their knowledge of parallel and serial transmission to identify which was most appropriate in three different scenarios. Candidates appeared to find this a more difficult task than to state properties or advantages of the different methods, which is what questions have focused on in previous papers. Almost all students were able to achieve one mark and over a third achieved full marks.

(b) This part was well tackled, with over two thirds of students managing to achieve the mark. The most common correct response was that a handshake would be used to check if a device was ready to receive data. Some students gave responses that related to the use of handshakes on networks that were also creditworthy. Answers that suggested that the data payload would be transmitted as part of the handshake were not awarded any marks.

(c) This part was also well tackled, with over two thirds of students managing to achieve the mark. Some students gave a generic description of latency and some defined it in terms of data transmission, which was the context used in the question. A small number failed to achieve a mark by giving a response that mixed up the two types of response, such as “It is the delay between data being transmitted and its effects being felt”.

Q8.

For (a), most candidates demonstrated some understanding of the difference between parallel and serial communication, but many lost marks by writing too vaguely, making statements such as “data is sent one at a time" without any reference to bits. Some candidates confused the comparison between parallel and serial communication with comparing broadband and baseband and wrote about sharing channels or the bandwidth of one cable being used for a single communication.

Part (b) was mostly well answered, with three quarters of candidates achieving full marks by correctly calculating the parity bit and recognising that the start and stop bit values had to be different from each other. A small but surprising number of candidates did not even attempt the question. This was odd, given that there was a 50 / 50 chance of getting each bit value right just by taking a random guess.

For (c), about half of the candidates were able to offer a reasonable explanation of what asynchronous data transmission was, and recognised that the key defining characteristic was that the clocks of the sender and receiver were not kept permanently synchronised but were, instead, temporarily synchronised for the duration of a transmission. The two most common errors were to state that no clocks were involved, or to make a point about asynchronous data transmission, such as that start and stop bits were used, but to not really get to the heart of explaining what it was.

Q9.

Describing the differences between the WWW and the Internet demonstrated that there are still some students who do not understand the role of the Internet. It was common to see the idea that the WWW was the main focus rather than being an application that uses the connections provided by the Internet. Students who scored full marks provided a good description of the Internet and the WWW and highlighted factors such as the protocols used.

Part (b) allowed students to mention that a message is split into packets and this is how many secured at least one mark. It was clear that students have a better understanding of routing but that this is still an area that could be improved.

The majority of students secured both marks in part (c). Students were not awarded a mark for just stating ‘IP’ and it was necessary to write at least ‘IP address’ to secure the mark.

Q10.

Part (a) of the question started by asking students to identify a use of a collection of protocols. The majority of students could correctly identify a use for FTP and it was obvious that this was a well known protocol. Students, however, struggled with both Telnet and POP3. Whilst the majority of students knew that POP3 was concerned with e-mail, this was not considered to be creditworthy as students should be aware of the difference between POP3 and SMTP. Students who did identify that POP3 was concerned with retrieving e-mail from a server were rewarded with the mark. It would be beneficial for students to have access to working with these common protocols so that they can gain a feel of their use.

The first few parts of (b) were answered well by students. Most secured the mark for IP address and port, but providing a socket came out as the hardest of the three parts. The most common incorrect answer for port was 37 with students picking this out from a different column of the figure. In a similar fashion, it was common to see a variety of items taken only from the figure as a guess at socket.

The last part of question was answered well with the majority of students gaining at least one mark. A wide variety of answers were seen across the marking period. Popular answers included the servers being off-site and the point that it would save time being able to access the servers from a desktop rather than travelling to them. Students who realized that the servers might be able to be managed from anywhere with an Internet connection were also awarded a mark.

Q11.

Part (a): The relationship between bandwidth and bit rate was well understood. A small number of students failed to achieve the available mark because they simply defined the terms instead of explaining how the bit rate was determined by the bandwidth.

Part (b): There were many good responses given to this question part. Credit was awarded to responses that were either given in the context of data communication or were generic definitions of latency. In context, latency is the time delay between when a signal is transmitted and when it is received. Some students clearly knew that latency related to time, but gave responses that lacked technical accuracy, such as, “the time delay between data being sent and a reply being received,” or, “the time taken to transmit.”

Part (c): The correct relationship in the example was that the bit rate was double the baud rate. Somewhat disappointingly, just under half of the students recognised this, with a small number stating the relationship the wrong way around.

Part (d): The diagram of the Moore machine was very well completed, with the vast majority of students achieving all four marks. A small number labelled the states but forgot to label the transitions.

Q12.

Part (a): Students were required to draw an inheritance diagram. Most students scored two of the available three marks which were for identifying correctly the class hierarchy. The third mark was for drawing a correctly styled diagram and many students failed to do this. Students who did achieve the third mark correctly enclosed the class names and also drew arrows that pointed upwards to a class’ parent class.

Part (b): In this question part students had to write a class definition for the Computer class. Most students had a reasonable understanding of how to do this, with almost all achieving some marks, but less than a fifth scored full marks. To achieve all four marks students needed: to make clear that the class inherited from the Device class, to redefine the AddDevice procedure, to declare private variables to store the additional properties, and to declare public functions to provide access to the values in these variables. The most commonly made mistakes were to fail to make the inheritance clear and to forget to redefine the AddDevice procedure. Some students lost marks by unnecessarily redeclaring the functions or variable from the parent class or by giving the functions the same names as the variables.

Part (c): The purpose of this question was to test if students understood that the Laptop class inherited from the Computer class, rather than the Device class. The vast majority of students who dealt with inheritance in this question part correctly identified this.

Part (d): Most students were able to identify that Bluetooth is a wireless protocol. Many, but not all of these, then went on to explain that it was designed for use over short distances. Many good examples, such as transferring photos from a mobile phone to a laptop or using a Bluetooth mouse were given. Some students lost marks by giving an example that was not in context.

Q13.

Part (a): The baud rate is the number of signal changes per second that can be supported by a transmission medium. Approximately half of the candidates stated this correctly, but some defined the bit rate instead.

Part (b)(i): The bit rate can be higher than the baud rate if more than two different signal levels are supported so that more than one bit can be encoded in each signal change.

This was recognised by some, but not many, candidates. A commonly held misconception was that the bit rate could be higher than the baud rate if the data being transmitted contained consecutive bits of the same value – for example, transmitting three 1s followed by a single 0 would only need one signal change.

Part (b)(ii): This question part was well answered, with the vast majority of candidates getting two of the three marks. Most candidates correctly explained the first two missing steps but got the last one wrong. The final stage in the handshake should have been that the printer indicates it is again ready to receive. Many candidates mistakenly believed that the printer indicated that the data had been received or was being printed instead.

Part (c): Candidates showed only a limited understanding of baseband and broadband, with just over a third scoring and marks. Many clearly had little idea what the terms meant and were just guessing based on their general knowledge of "broadband" and knowing what the terms LAN and WAN mean. Those that did achieve some marks often made quite superficial points, usually about the number of communication channels, rather than demonstrating a sound technical understanding of how the two systems differed in their method of operation.

Q14.

Part (a): The advantages of serial data transmission over parallel data transmission were well understood. The most common correct responses were that data could be transmitted over longer distances and that the cabling cost would be lower as fewer wires would be required.
Answers that referred to lower costs without any further explanation did not gain credit.
Some candidates also discussed the problem of data skew in relation to parallel transmission.
Candidates need to be aware that data going out of synchronisation is not the same as data skew occurring. Similarly, interference / noise is not the same as crosstalk. Lack of synchronisation and interference are problems that can occur with both serial and parallel communications.

Part (b): Many candidates were able to correctly calculate the parity bit and to identify appropriate values for both the start and stop bits. Credit was awarded for the start and stop bits provided they both had different values.

Part (c): Candidates demonstrated a reasonable understanding of what asynchronous data transmission is, but descriptions of the purposes of the start and stop bits were very superficial, the most common response being that the start bit indicated where the data started and that the stop bit indicated the end of the data. To gain credit candidates needed to explain that the start bit is used to synchronise the receiver to the data that is being transmitted and that the stop bit is used to give the receiver time to process the data just received or to allow it to recognise subsequently the next start bit. Some candidates lost marks by referring to "it" when it was far from clear what "it" was.

Q15.

(a) Most candidates were able to score the one mark, although a common suggestion was to use the line to send additional data, or to send data when the other eight lines were not working.

(b) Most candidates were able to score marks in part (iii). Owing to a possible ambiguity in the use of the lines, a variety of bit patterns scored marks and most candidates appreciated the significance of parallel transfer in the positioning of the bits on the diagram.

(c) Generally well answered.

(d) (ii) Although presented in this way with a figure to write on for the first time, many candidates scored the 2 marks.

(iii) Better answers were seen than on previous question papers, although some candidates wrongly framed their answer around the concept of the 'speed' of transfer.

Q16.

(a) Generally this question was consistently well answered.

(b) The marks were given were this time for a description of the feature (not just stating the name of the feature as in previous papers). The most popular answers were 'Page Navigation', 'Favourites', and 'History'. Some candidates did describe a feature which was not browser-specific such as 'Help' or 'Print', ignoring the rubric in the question stem.

(c) Any candidate who had practical experience with website construction would not have found a problem in identifying the use of folders/directories. Wrong answers, including vague answers, were 'by having a home page for each club', 'a home page with links to each club,' or, 'by having the club name at the end of the URL.'

(d) Most candidates achieved the mark, although seriously wrong answers included removable drives, DAT and even 'hard copy'!

Q17.

(a) The usual loss of marks for describing 'bits of data' rather than just 'bits' was seen.

(b) The port lines all have labels which suggest their usage such as busy, ACK, etc and these were the preferred answers. Many candidates, however, appreciated that the bookwork they had learnt about handshaking was put into practice here and were given credit.

(c) Very few worthy answers seen. If the candidates remembered their use of the keyboard as an example, then they would have been better placed for a basic definition.

Many candidates wrote that 'the data sent used stop and start bits' which again did not answer the question set.

Q18.

(a) The majority of candidates scored the full 3 marks.

(b) (i) A surprising number of candidates did not score marks on this question. There were many different wrong answers including, for example, “Ultra Slim Build” and “Uniform Byte Synchroniser”.

(ii) Most correctly stated parallel.

(iii) There were a variety of ways the candidate could score the 2 marks. For example, by focussing on the word, protocol and describing this as a set of rules for communication. The most common answers gave particular signals which are exchanged between the two devices.

(iv) There were few correct answers seen here despite an exhaustive list of possibilities on the mark scheme. Many candidates confused this scenario with the use of signals on the control bus of the motherboard.

(v) This was poorly answered. The vague term 'printer software' was not considered acceptable. Printer driver was common from the stronger candidates together with "word processing software" or even "the applications program from which the document is being printed". Few mentioned the operating system. Other common wrong answers were the suggestion that the data file to be printed was software, or describing the ASCII code table (referring back to part (a) of the question) as software.

Q19.

When any question asks for 'advantages or disadvantages" then candidates should not fall into the trap of the 'quicker/faster/easier' answer.

(a) In this part as well as part (b) the mark scheme had a wealth of acceptable answers and candidates generally scored well, often with answers which came from their own experiences of a school/college network. A common wrong answer was that "only one copy of the software need be purchased".

(c) (i) Most candidates scored the mark for a 'a set of rules" but the suspicion that their understanding went no further than that was confirmed by the answers seen for (ii).

(ii) Candidates who had the basic understanding of a two way exchange of signals or acknowledgments should have been able to score 2 with a general statement, followed by a description of a particular signal. Although not required in this question, candidates should also appreciate that particular lines/wires of the connecting cable will be used to transmit these signals.

(d) There are still some candidates who include the 'www' as part of the domain name. For the first time an answer which included the 'www' as part of the domain name scored zero.

Q20.

(a) This has been repeatedly examined on previous papers and despite the comments in previous examiners' reports, candidates are still describing "bits of data" or "data sent byte by byte". Others think it is one-way data communication or describe asynchronous data transfer.

(b) This should have been an easy mark. Candidates should have practical experience of saving a bitmap image where there are a number of different colour resolutions possible. This is an excellent example where the use of binary numbers can be given a practical dimension. The understanding required is to make the connections that a 256-colour image will require 256 different numbers to represent each possible colour, and consequently 256 different numbers can be achieved with a single byte to represent each pixel.

Part (ii) was no more than a simple calculation requiring the fact that a kilobyte is 1024 bytes.

Candidates should appreciate the full range of bitmap types; monochrome, 16-colour, 256-colour and 24-bit colour and the subsequent implications for the representation of each pixel.

(c) Well answered, again probably with candidates able to draw on practical experience of music downloads, etc. The most common misconception was the suggestion that the advantage was that you could download faster at the higher encoding rate. The disadvantage would then be poorer sound quality or lost bits/chunks of the sound due to interference.

Q21.

This question showed that many candidates had little knowledge of basic communication protocols.

(a) Despite the clear arrow above the diagram, some candidates mixed up bits A and C, giving C as the start bit. There seemed to be little understanding of the purpose of the start and stop bits. The stop bit is there to ensure that the start bit is recognised. Even when the parity bit was identified correctly, its purpose was rarely given. A common mistake was to describe the process of creating a parity bit.

(b) The terms baud rate and bit rate were often described adequately. Bandwidth was less well understood.

(c) Very few correct answers were given. Although a number of candidates understood that it was something to do with the coding of bits, few were able to describe it in sufficient detail. Many answers described the difference between serial and parallel transmission.

Q22.

(a) Skew and the cost of cabling were often identified but many candidates failed to obtain full credit by their inability to express themselves. Many answers simply gave .cheaper. as the answer.

(b) Once again, candidates failed to obtain full credit by their inability to express themselves. Baud rate and bandwidth continue to be misunderstood. Many candidates simply restated bit rate as the rate that bits are sent.

(c) Most candidates were able to identify that there is a direct relationship between bandwidth and bit rate. Very few were able to explain what that relationship is. Candidates should have made it clear that the maximum bit rate is limited by the bandwidth. Many stated that the bit rate controls the bandwidth.

Q23.

(a) The terms Local Area Network and Wide Area Network were well known.

(b) This was not answered so well as (a). Many answers involved either a statement of where it is used (rather than what it is used for) or a physical description of the network.

(c) Protocol was often answered correctly or left blank with few incorrect answers. BAUD rate was not well known. Some candidates confused this with bit rate. The term bit rate was well known but many candidates let themselves down by simply restating the question. There were many guesses at the meaning of bandwidth. Very few candidates were able to give a satisfactory explanation.

(d) Although many candidates were aware that the bit rate and the bandwidth were linked fewer were able to explain that an increase in Bandwidth allows a greater bit rate.

(e) Serial and parallel transmission were well known but many candidates failed to obtain full marks through poor descriptions. The advantages were well known and good marks were obtained for parts (iii) and (iv).

Q24.

(a) The names of the three buses were generally known but fewer candidates were able to explain how they operate. A bus is a device that carries signals around the system. Common misconceptions were that buses store data or send data. Incorrect answers included reference to system buses and/or memory buses and many candidates failed to obtain full credit by not expressing themselves well enough.

(b) The network adapter was well known but candidates failed to obtain full credit by being unable to express themselves adequately when explaining its purpose. The question stated that the network adapter connects the computer system to the local area network. An answer that restates this is not going to obtain any credit.

(c) Many candidates understood that faster transmission can be obtained by using parallel transmission. Some simply stated a definition of parallel communication being many bits simultaneously transferred but failed to state why this might be of benefit.

(d) A substantial number of candidates stated that serial transmission was faster. Many more stated that it was cheaper but failed to give any reason as to why this should be the case. Many marks were lost on this part of the question.

Q25.

In part (a), many candidates failed to gain both marks available because they did not explicitly state that nodes must be connected and that a Wide Area Network extends over more than one site.

In part (b) most candidates correctly stated that a modem is required to connect a stand-alone computer to the Internet, but some wrongly suggested a network card. Most candidates correctly identified a browser as the application software required to access a web site, though candidates did not gain credit if they only stated a proprietary name such as Internet Explorer.

For part (c), serial transmission was still poorly described. Candidates should refrain from mentioning bits of data as this may well jeopardise credit in the future. A creditworthy definition is: ‘Bits are sent one after another along a single wire’.

Part (d) showed that baud rate is a very poorly understood concept. Even though most candidates have come across the term in the context of Internet communication, very few seemed to know what it exactly measures. One baud is the number of signal changes per second. Bit rate is the number of bits transmitted per second. As one signal may encode more than one bit, bit rate is not necessarily the same as baud rate.

Q26.

(a) Most candidates correctly gave either ‘network card’ or ‘Ethernet card’ with ‘modem’ being the commonest incorrect answer. Many failed to spot the significance of the word ‘each’ in the question and gave variations on ‘file-server’ or ‘hub’.

(b) The vast majority gave the correct answers ‘ring’ and ‘bus’, with ‘star’ being a wrong choice for ‘A’ and ‘line/linear’ the usual wrong choice for ‘B’. Few candidates could think of genuine advantages of the two topologies.

(c) This is pure bookwork and has been asked several times in recent years but was poorly answered with many stating that protocol was needed to 'prevent errors occurring' or 'to prevent collisions'. A significant number of candidates suggested a protocol was a device. It was described as a security system to control the network. Many candidates still give computers human characteristics: 'protocols are needed so that computers understand each other' rather than 'so that different computers can communicate successfully'.

Q27.

This was a question which could be answered from information in textbooks and was one which has been asked many times before.

(a) Disappointingly, many candidates still talked vaguely about 'data' or 'byte' being sent simultaneously when they should have answered 'bits'.

(b) Many candidates got the mark for a description of 'skewing' while the better candidates just said 'skewing occurs'.

Q28.

(a) Most candidates gained at least one mark for stating that with even parity the parity bit is set so that the number of 1s in the byte is even. However, few candidates had a clear idea about parity, many assuming that parity guaranteed that an ASCII character was correct. The process is in three parts (hence the three marks).
(1) The parity bit is generated and attached to the other seven bits.
(2) The code received goes through the same process and compares the parity bits and if they differ, then (3) an error has occurred in the transmission and a retransmission is requested.

(b) Many candidates failed to read the question which asked for the 'relationship' between 'bit-rate' and 'bandwidth' and simply wrote definitions of the two terms. Credit was given for responses such as 'bit rate increases as bandwidth increases'.

Q29.

Many candidates struggled to score two marks for baseband and two marks for broadband. The examiners were looking for an answer for baseband that conveyed that a cable carries a single signal at a time occupying the full bandwidth of the cable.

For broadband, the examiners were looking for an answer that conveyed that several signals are sent simultaneously each in a different channel (different frequency band or different time slot). Some candidates confused baseband and broadband with serial and parallel transmission. Some incorrect answers explained baseband in terms of a telephone line and a modem overlooking the fact that local area networks based on Ethernet use baseband (hence the problem with frame collisions).

Very few candidates were able to give adequate reasons for why wide area networks are operated in broadband mode. The clue lies in the fact that multiple channels are used. Multiple channels allow the transmission medium to be shared to keep costs down and multiple channels are needed to cope with the high volume of traffic. Baseband uses a single channel that soon becomes congested when many stations wish to send. Other acceptable answers were that wide area networks involve long distances, they are expensive to maintain and expensive to install.

Candidates faired better at explaining why an Ethernet LAN degrades with increase in network traffic. Many candidates referenced the increased occurrence of collisions

between packets (Ethernet frames) and the need then for stations to resend their packets after a random time delay.

Many candidates seemed familiar with network switches but frequently candidates could not offer an accurate explanation of how switched Ethernet overcomes the performance problem associated with a non-switch based network. A switch makes an exclusive bus connection temporarily between sender and receiver and therefore collisions cannot occur. Effectively the collision domain is limited to two stations. The switch ports act as bridges that segment the network. Several candidates based their answer on segmentation and gained credit. Some candidates who successfully explained the operation of the switch failed to state that collisions were eliminated or at least reduced and so lost the second mark.

Q30.

(a) Some candidates confused serial and parallel transmission with simplex and duplex (not in the specification of CPTI). Many candidates just referred to data being transmitted one after the other and therefore did not gain credit. In serial transmission bits are sent one at a time along a single wire and in parallel transmission several bits are transferred simultaneously down several wires.

(b) Baud rate was mostly defined adequately as bits per second. Turning the question into the answer "rate of data transmission" is not worthy of credit. Some quality answers referred to the number of state changes of a signal in a second.

(c) Most candidates correctly converted 38 into the binary pattern 0100110, but many candidates do not appear to know that the most significant bit is on the left and therefore the 8-bit pattern requested should read as 10100110. Many answers did not show eight bits as required. A pleasing number of candidates understood correctly that start and stop bits need to be different in asynchronous data transmission and therefore the bit pattern should be prefixed with 1 and 0 and suffixed with 00 or 11 respectively. Credit was given for the start bit at either end, as long as the stop bits were at the other end. Some candidates got so carried away with the start and stop bits that they forgot about the bit pattern for the character in between. Worrying was the fact that some candidates used symbols such as * or # as alternatives to ones and zeros.

Q31.

Part (a) was well answered, with only a few candidates not taking note of the direction of the arrows in the diagram. Part (b) rarely gained more than one mark. A significant number of candidates thought the stored program concept only referred to programs held in ROM. Many candidates thought programs are run from disk. Those who did say they were stored in main memory gained a mark, but often did not gain the mark for fetching and executing. Many candidates missed a mark by saying “stored in memory” rather than “main memory”. In parts (c) and (d) candidates used the word “data” rather than “single bits”. A common misconception was “serial data can go one way and parallel can go both ways”. Part (d) was either answered really well or poorly. Candidates need to appreciate that parallel transmission deteriorates over distance and therefore can only be used between devices in close proximity. In part (e) there did not seem to be a great understanding of asynchronous transmission and the need for synchronisation. Many candidates did not appreciate that just one character is being transmitted between the start and stop bits, just referring to data. In asynchronous data transmission when no data are being sent the signal transmitted represents 0. This ensures that the first signal received is always a change from 0 to 1. This change in voltage can be used to start the clock of the receiving device. The receiver will then read the 8 data bits. The stop bit ensures that the receiving device has time to recover and the next start bit will be

recognised.

Q32.

Many candidates showed a complete lack of knowledge of both serial and parallel data transmission mistakenly believing that they defined the direction of data transmission. Serial was defined erroneously as unidirectional and parallel as bidirectional. Other candidates referred to data being sent one after another for serial and sent together for parallel, neither answer being precise enough to gain credit. Credit was gained by answers that referenced bits. For serial, this required bits to be sent one after another and for parallel, several bits to be transferred simultaneously. Answers in which candidates stated that several bits were sent at a time did not gain credit. The phrase “at a time” is synonymous with the phrase “in one go” which lacks the precision of “at the *same* time”.

Q33.

This was expected to be a straight forward question allowing candidates who had done their revision to collect ‘easy’ marks. However, many candidates gave an excellent answer to the question on Simplex and Duplex from the previous year’s paper. These two topics although both in the area of the syllabus described as data communication are totally different.

The better answers used diagrams to convey the idea of a single stream of bits (serial transmission) and a multiple stream (parallel transmission).