1.2 Communication

1.2 Data Communication

S No	Learning Outcome	To Read	Have Read	To Revise	Have Revised	Prepared
	1.2.1: Serial and parallel data transmission					
1	Show understanding of what is meant by transmission of data					
2	Distinguish between serial and parallel data transmission					
3	Distinguish between simplex, duplex and half-duplex data transmission					
4	Reasons for choosing serial or parallel data transmission					
5	Show understanding of the need to check for errors					
6	Explain how parity bits are used for error detection					
7	Show understanding of the use of serial and parallel data transmission, in Universal Serial Bus (USB) and Integrated Circuit (IC)					
	1.2.3: Internet principles of operation					
8	Show understanding of the role of the browser and Internet server					
9	What is meant by hypertext transfer protocol (http and https) and HTML					
10	Distinguish between HTML structure and presentation					
11	Show understanding of the concepts of MAC address, Internet Protocol (IP) address, Uniform Resource Locator (URL) and cookies					

Chapter at a glance:

A **network** is defined as a collection of computers and peripheral devices (such as printers) connected together.
Generally, a network over short distances is called a **local area network (LAN)** while those over great distances are **wide area networks (WAN)**.
Network adapters: These adapters (also called network interface cards or NICs) connect computers to a network so that they can communicate.
Network hubs and switches: Hubs and switches connect two or more computers to an Ethernet network.
Routers connect computers and networks to each other (for example, a router can connect your home network to the Internet).
Modem: Hardware device that converts signals from analogue to digital and vice versa; typically used to convert signals sent over the public service telephone network.
Bit is short of binary digit. It is the smallest unit of data in computer. It consists of a 0 or an 1.
Bit rate is the rate of transmitting data
A **web browser** is software which allows a user to display a web page on their computer screen. Web browsers interpret or translate the HTML code from websites and show the result of the translation.
Simplex data transmission is *sending data in one direction only (i.e. from sender to receiver) Example: data being sent from a computer to a printer.*
Half-duplex data transmission is s*ending data in both directions but only one at a time (i.e. data can be sent from 'A' to 'B' or from 'B' to 'A' along the same line, but not at the same time). Example: a walkie-talkie, fax machine.*
Full-duplex data transmission is s*ending data in both directions simultaneously* (i.e. data can be sent from 'A' to 'B' and from 'B' to 'A' along the same line, *both at the same time*). Example: a phone line.
Serial data transmission is when data is sent, *one bit at a time*, over *a single wire or channel*

Serial Transmission is transfer of data bit by bit using single wire (bits are sent one after the other in a single stream).
Parallel Transmission is transfer of data in groups of bits using multiple wires.
The **universal serial bus (USB)**is an asynchronous serial data transmission method. It has quickly become the standard method for transferring data between a computer and a number of devices.
Interference refers to disturbance that occurs in the signals when sending data that may corrupt it.
ISP (Internet Service Provider)*:* Company that provides individual's access to the Internet and other services such as webhosting and emails
IP Address: Location of a given computer/device on a network; can be a static or dynamic value
URL (Uniform Resource Locator): The standard format for referring to are source on the Internet; also called Uniform Resource Indicator (URI); made up of:
●the protocol, e.g. http
●the domain name, e.g. ruknuddin.com
●the filename e.g. computer.html
HTML: Authoring language used to create documents on the World Wide Web; uses tags and attributes
HTML Structure refers to contents of web pages.
HTML Presentationis format of webpage.
Cascade Style Sheet CSS is used to define presentation for web pages, including the design and variations in display for different devices and screen sizes.
Web Server are the computers which hosts web sites.
Checksumtechnique used in data transmission to validate data by sending a block of data calculated from the contents of preceding blocks.
Parity Checktechnique used in data transmission to validate data by sending an additional bit determined by the contents of the preceding bits to make the total number of 1s odd or even.
Parity Block is an additional byte where the bits are computed from the preceding data bytes. The bytes are arranged in a grid and each parity byte bit is calculated from the bits in the column above.
Check digit is a validation technique that involves calculating an additional digit from the ones that proceed it. Following two Methods are used to calculate check digit
Automatic Repeat Request (ARQ) is another method used to check whether data has been correctly transmitted.
It uses an **acknowledgement** (a message sent by the receiver indicating that data has been received correctly) and **timeout** (this is the time allowed to elapse before an acknowledgement is received).
If an acknowledgement isn't sent back to the sender before timeout occurs, then the message is automatically resent.
With **echo check**, when data is sent to another device, this data is sent back again to the sender. The sender compares the two sets of data to check if any errors occurred during the transmission process.

1.2.1 Data Transmission

Data transmission is communicating data among different parts of a computer or among different computers.

Generally, a network over short distances is called a **local area network (LAN)** while those over great distances are **wide area networks (WAN)**. Whether a network is a WAN or a LAN, it allows the computers to:

- communicate with one another
- share information centrally
- share copies of software
- give access to data and program files to multiple user

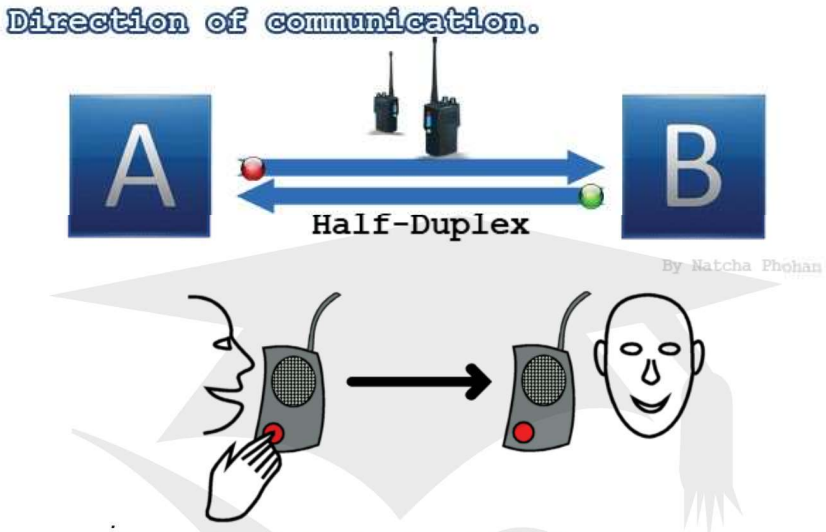
In a LAN there is the added benefit of being able to share hardware. For example, the office with 20 computers may only have one or two printers. Also, those printers may be of different types and used for different tasks.

Types of Communication on the basis of direction

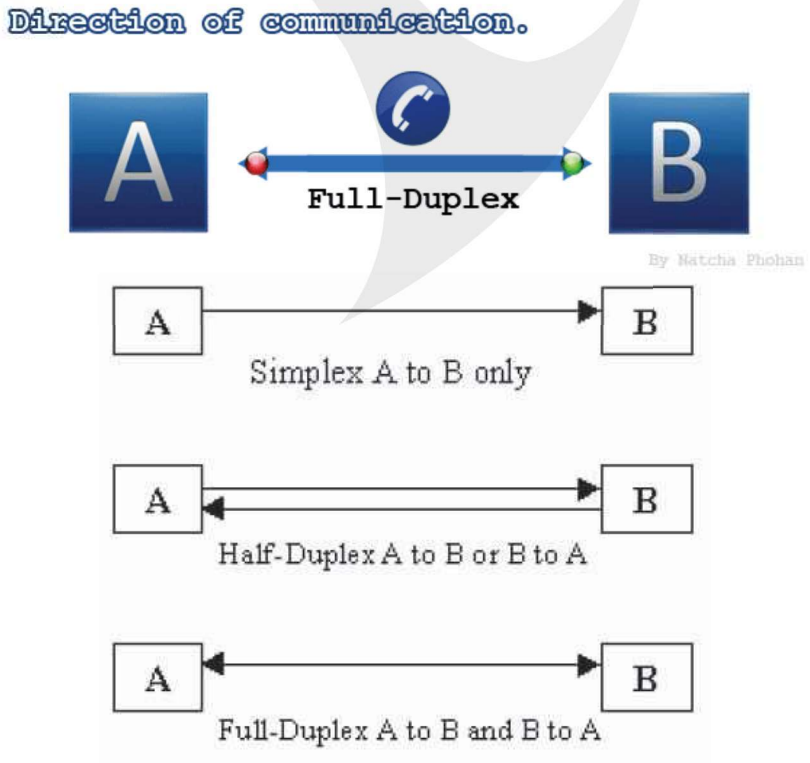
Simplex data transmission is *sending data in one direction only (i.e. from sender to receiver). Example: Radio, TV. Data being sent from a computer to a printer, from keyboard to CPU etc.*

Simplex Data Transmission:
(One way only)
Mouse to CPU
Keyboard to CPU
CPU to Monitor

Half-duplex data transmission is *sending data in both directions but only one at a time (i.e. data can be sent from 'A' to 'B' or from 'B' to 'A' along the same line, but not at the same time).*
Example: a walkie-talkie, fax machine, reading or burning data on CDs or DVDs, both but not at the same time.

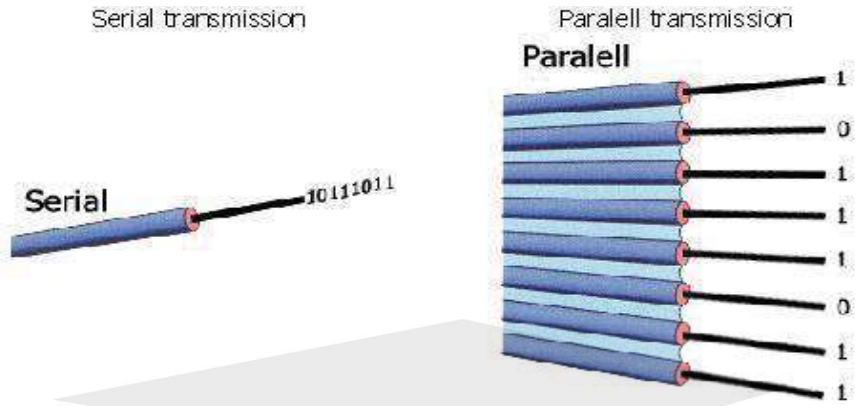


Full-duplex data transmission is s*ending data in both directions simultaneously* (i.e. data can be sent from 'A' to 'B' and from 'B' to 'A' along the same line, *both at the same time*).
Example: a phone line, reading and writing data on HDD.



Types of communication on the basis of media:

There are two types of communication on the basis of media

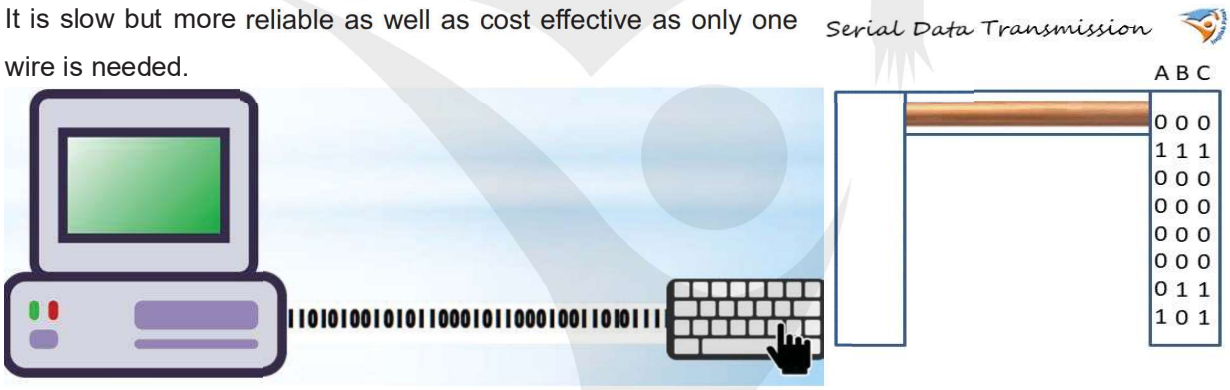


Serial transmission of data

Bit by bit transmission of data using single wire is known as Serial Transmission.

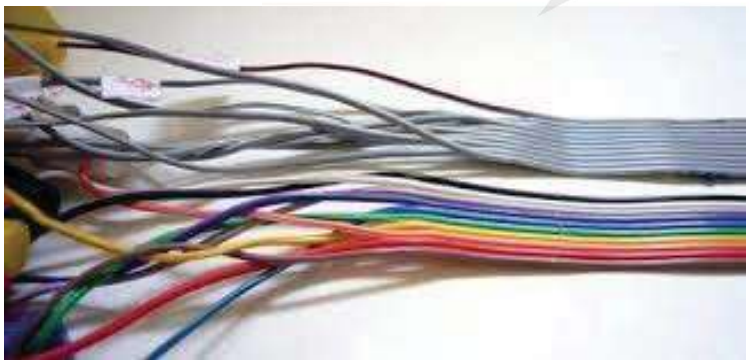
It used for external transmission (between two peripheral devices or devices and CPU).

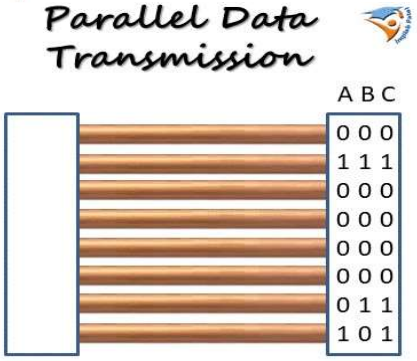
It is slow but more reliable as well as cost effective as only one wire is needed.



Parallel transmission of data

If the devices are connected by more than one wire, then more bits can be sent simultaneously. A sensible number of wires would be eight, because then a whole byte can be sent at the same time.





This type of data transfer is called **parallel data transmission**.

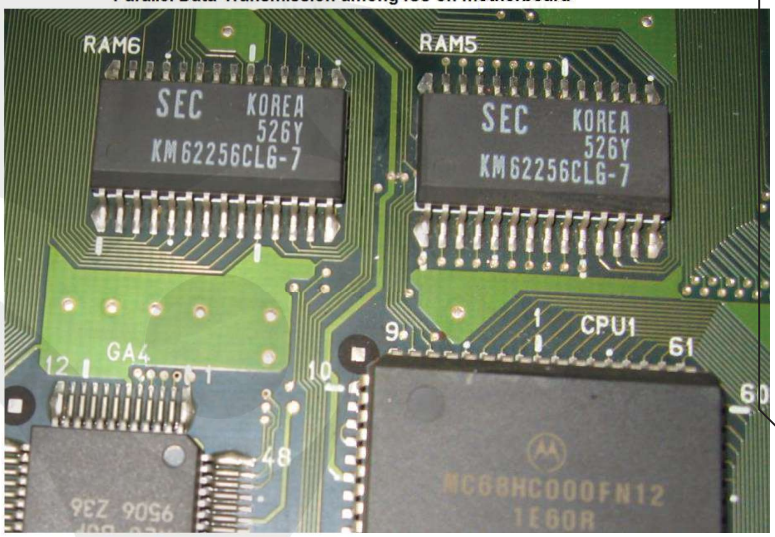
Parallel transmission of data is obviously faster than serial transmission because more bits are travelling at the same time. However, it is less reliable as the bits can become muddled up. If one bit is delayed because of the resistance on its wire, for example, it may arrive in time to be counted as a bit in the next byte! This problem, where the bits become out of sequence, is called “skew”. Parallel transmission is only suitable for short distances (internal transmission).

Information flows through the computer in many ways. The CPU is the central point for most information. When you start a program, the CPU instructs the storage device to load the program into RAM. When you create data and print it, the CPU instructs the printer to output the data.

Parallel transfers take place between the following devices:

- ICs on motherboard
- CPU and RAM
- CPU and interface cards (see Chapter 8)
- **LPT** (printer) port and parallel printer
- **SCSI** port and SCSI devices
- **ATA/IDE** host adapter and ATA/IDE drives
- RAM and interface cards (either via the CPU or directly with DMA)

Parallel Data Transmission among ICs on motherboard



Parallel cable used to transmit data from HDD and processor

Why are parallel transfers so popular?

- Multiple bits of information are sent at the same time.
- At identical clock speeds, parallel transfers are faster than serial transfers because more data is being transferred.

However, parallel transfers also have problems:

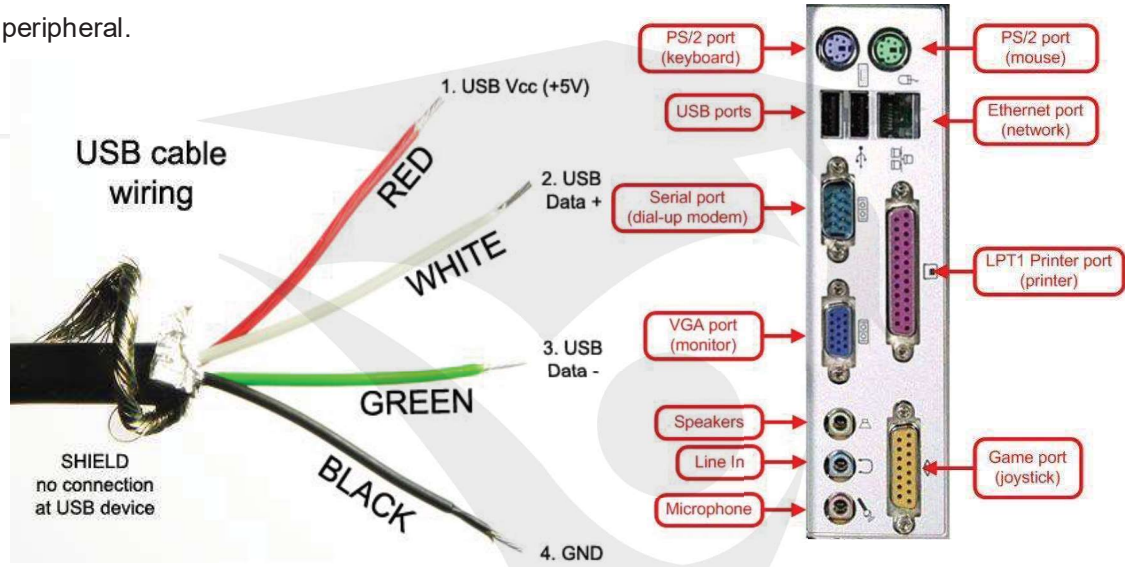
- Many wires or traces (wire-like connections on the motherboard or expansion cards) are needed, leading to interference concerns and thick, expensive cables.
- Excessively long parallel cables or traces can cause data to arrive at different times. This is referred to as *signal skew*

Because of the different types of devices that send and receive information, two major types of data transfers take place within a computer: parallel and serial.

USB (Universal Serial Bus):

Universal Serial Bus (USB) is a plug-and-play interface that allows a computer to communicate with peripheral and other devices.

- It is a BUS as it has wires to transmit data.
- It is UNIVERSAL as it connects devices cover a broad range; anything from keyboards and mice, to music players and flash drives.
- It is SERIAL as in USB data is transmitted bit by bit. USB has 4 cables of which 2 are used for power supply (0V and 5V), 1 to send data from PC to peripheral and 1 to receive data from peripheral.



Test Yourself) Most computers use Universal Serial Bus (USB) ports to allow the attachment of devices.

Describe **two** benefits of using USB ports.

1. ……
   ……
2. ……
   ……

Marking Scheme

Any two from:

- *devices automatically detected and configured when first attached/plug and play*
- *it is nearly impossible to wrongly connect a device*
- *USB has become an industrial standard*
- *supported by many operating systems*
- *USB 3.0 allows full duplex data transfer*
- *later versions are backwards compatible with earlier USB systems*
- *allows power to be drawn to charge portable devices*

Need to check for errors

Can you raed tihs?

'I cnduo't bvleiee taht I culod aulaclty uesdtannrd waht I was rdnaieg. Unisg the icndeblire pweor of the hmuan mnid, aocdcrnig to rseecrah at Cmabridge Uinervtisy, it dseno't mttaer in waht oderr the lterets in a wrod are, the olny irpoamtnt tihng is taht the frsit and lsat ltteer be in the rhgit pclae. The rset can be a taotl mses and you can sitll raed it whoutit a pboerlm. Tihs is bucseae the huamn mnid deos not raed ervey ltteer by istlef, but the word as a wlohe.
Aaznmig, huh? Yeah and I awlyas tghhuot slelinpg was ipmorantt! See if your fdreins can raed tihs too'

Calculate rent charges if rate per room for office is 10,000 and for bungalow is 20,000

Type	Rooms	Rent
Office	2	
Bnuglow	5	
Offcie	3	
Bungalow	6	
Offiec	2	
Office	1	
Bunglow	4	
Offcie	4	
Bungalwo	5	
Offcie	6	

This is the calculation of rent charges by computer using following formula in spreadsheet

=IF(C22="Office",D22*10000,IF(C22="Bungalow",D22*20000,"Error"))

Type	Rooms	Rent
Office	2	20,000
Bnuglow	5	Error
Offcie	3	Error
Bungalow	6	120,000
Offiec	2	Error
Office	1	10,000
Bunglow	4	Error
Offcie	4	Error
Bungalwo	5	Error
Offcie	6	Error

Reason for identifying errors

When data, of whatever type, are transmitted from one device to another, they are transmitted as a series of binary digits. Any data that are transmitted are going to be made up of a very large number of bits. Consequently, there are bound to be occasions on which the data are not transmitted correctly or on which they become corrupted during transmission.

There are only two possible types of error that can occur; either a 1 is received as a 0 or a 0 is received as a 1. Mistakes rarely occur, but when they do occur they can be very serious, as the data are no longer correct. This makes it important that there should be methods for checking the data when they are transmitted.

Error Detection Methods

Following are the methods of error detection during data transmission

Echo Check

The simplest way of checking the transfer of the data is to send the data back again. If the data sent back are the same as the data sent in the first place then the original data must have reached the destination unaltered. If not, the data must be sent again. This is known as echoing back. Echoing back is very effective, but suffers from having to send data twice. The transmission mode needs to be either duplex or half duplex to allow data transfer in both directions.

Parity check

A parity check is a single bit which is added to the end of the message, and indicates that the number of ones in the message is even or odd. If a single error occurs, the receiver could detect it because parity bits will no longer match.

A **parity check** involves checking that the number of 1 bits in a byte totals to an even number (called "even parity") or an odd number (called "odd parity"). If two devices that are communicating decide to use odd parity, there must always be an odd number of 1s. If a byte is received with an even number of 1s, an error must have occurred. For example, the byte 01011000 is sent. It has three 1 bits so it passes the odd parity check.

When it is transmitted, the byte received is 11011000. This has four 1 bits, which is an even number, so there must have been an error in transmission. The receiving device would ask for it to be sent again. Although this example uses odd parity, even parity can equally well be used. The two devices have to agree which type of parity to use.

Parity is used not only during data transfer between devices but also when data are transferred between different components of the CPU. If two mistakes are made in the same byte, they cancel each other out and the faulty data are accepted.

This problem can be overcome and a clever way of identifying mistakes can be implemented by using **parity blocks**.

What is wrong with the following statements?
a. The two checksums match so there is no error in the data file that has been transmitted.
b. Odd parity means that correct bytes are always an odd binary number.
c. 01101100 has been received using odd parity therefore it has been correctly transmitted.
There are two types of parity, odd and even. Try to think of reasons why odd parity may be preferable to using even parity.

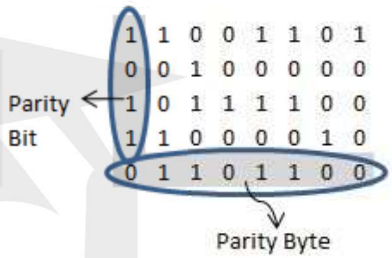
A byte can represent a character code in eight bits, giving potentially 256 different characters. However, an ASCII character reserves one of the bits for a parity bit. This leaves seven bits for the character code, reducing the number of different characters to 128.

Parity blocks

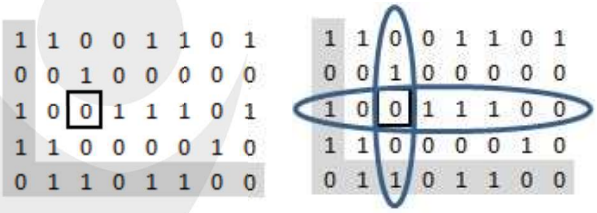
A further check can be made on the data bytes which are transmitted. An additional byte, called the parity byte, is calculated and transmitted for each group of bytes. The data bytes and parity byte together are called a parity block.

A parity block is like a rectangle made up of rows and columns. The last bit in each row, i.e. in each data byte, is the parity bit, which checks if there is an error in the byte. One possible problem with a parity bit check is that two errors in the same byte are not picked up by the parity bit check. They are however detected by the check which the parity byte performs.

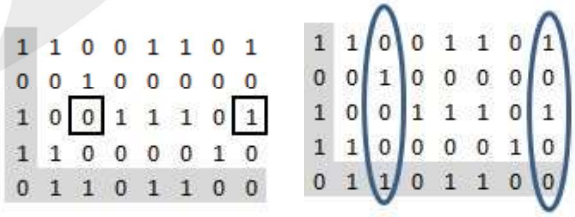
Think of the parity byte not as data but as a whole row of parity bits, each of which is there to check the column of bits above it in the grid. Consider the following transmission in which four data bytes are followed by the parity byte using odd parity. The correctly transmitted parity block (four data bytes followed by the parity byte) is shown below:



Assume that there was an error in the transmission and the bytes shown below were received by the device. The number of 1s data byte are not in odd, so the conclusion is that there must be an error with it. The parity byte shows that there is an error with the calculation in column three. The conclusion is that the incorrect bit in byte three must be the one in column 3, so change this from 0 to 1.



Consider Figure given below, which shows two bits received in error in the same data byte. Byte three passes the parity bit check. The point here is that the parity bit is in error! The parity byte, however, shows that there is an error – the bits in positions 4 and 8 of the parity byte do not match the calculation for columns 4 and 8.



It is claimed that checking the parity bits and using a parity block check will identify 99% of all transmission errors.

Checksum

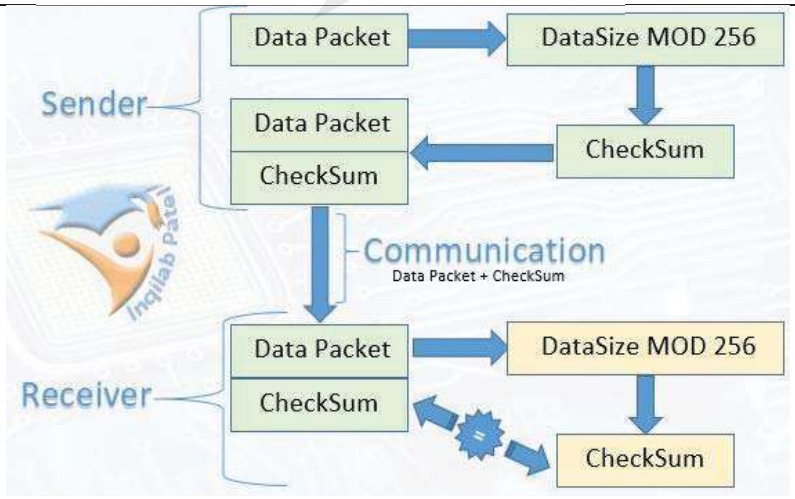
Data are normally sent as blocks of bytes rather than as individual bytes. Whatever the data represent, they are in binary form and hence could be treated as numbers that can be added together. Another checking procedure is to add all the bytes that are being sent in the block of data. Any bits lost at the most-significant end as a carry are ignored, so the answer is an eight-bit number. This "check byte" or **checksum** is calculated before the data are sent and then calculated again when they are received. If there are no errors in the transmission, the two answers match. If, however, the two bytes are different there must be at least one checksum that has been corrupted and the whole block of data has to be re-sent.

The following algorithm is used to calculate check sum:

1. Calculate file size
2. If file size<256 then
3. Checksum=file size
4. Else
5. Checksum=file size MOD 256
6. Endif

Sort the steps for Check Sum into order. Write the correct number in the column Step No.

Steps of Check Sum	Step No.
The block of data is sent along with check sum.	
The check sum is calculated and added to the block of data.	
The computer then compares its calculated check sum with the check sum received.	
If the two don't match, then the there is an error in data transmission	
The receiving computer calculates check sum.	



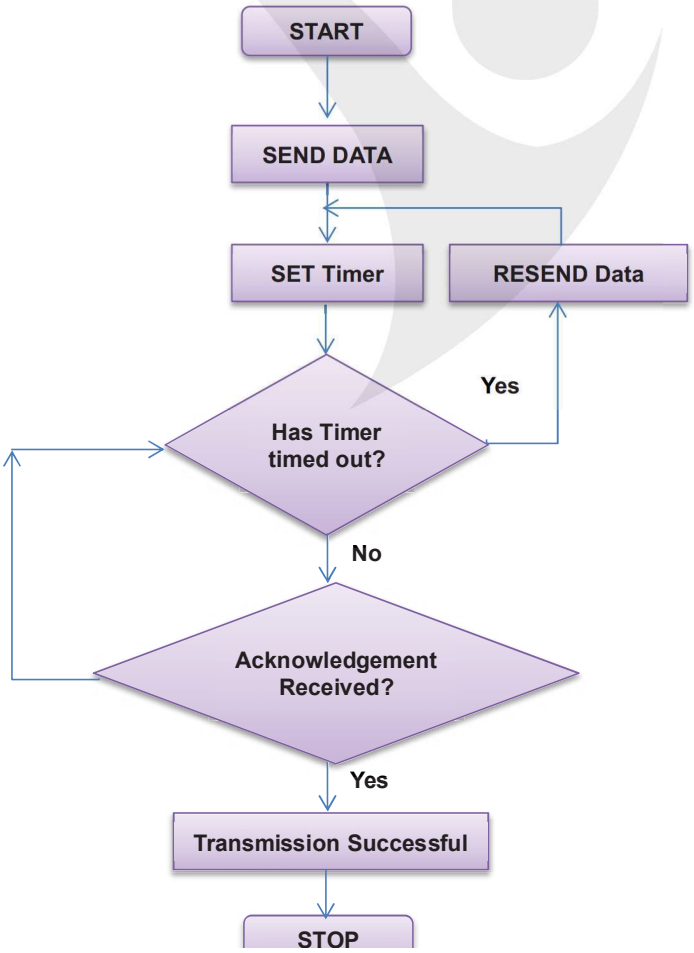
AUTOMATIC REPEAT REQUEST (ARQ)

https://en.wikipedia.org/wiki/Automatic_repeat_request

Automatic Repeat reQuest (**ARQ**), also known as **Automatic Repeat Query**, is an error-control method for data transmission that uses acknowledgements (messages sent by the receiver indicating that it has correctly received a packet) and timeouts (specified periods of time allowed to elapse before an acknowledgment is to be received) to achieve reliable data transmission over an unreliable service. If the sender does not receive an acknowledgment before the timeout, it usually transmits the packet until the sender receives an acknowledgment or exceeds a predefined number of retransmissions.

Sort the steps for ARQ into order. Write the correct number in the column Step No.

Steps of ARQ	Step No.
Sending computer transmits a block of data	
After a set period of time, a timeout occurs which triggers the data to be automatically resent by the sending computer.	
The sending computer waits for a period of time to see if receiving computer acknowledges receipt of the data.	
This will continue until the receiving computer acknowledges the data has been received.	



Check digit

A check digit is a digit added to a string of numbers for error detection purposes. Normally, the check digit is computed from the other digits in the string. A check digit helps digital systems detect changes when data is transferred from transmitter to receiver.

Validation technique that involves calculating an additional digit from the ones that precedes it.

Following two Methods are used to calculate check digit

Modulo-11 Method:

(i) The position of each digit is first considered:

10	9	8	7	6	5	4	3	2	1 ← Digit Position
0	2	2	1	4	3	2	5	6	? ← Number

(ii) Each digit in the number is then multiplied by it's digit position and the totals are added together:
i.e. (0x10) + (2x9) + (2x8) + (1x7) + (4x6) + (3x5) + (2x4) + (5x3) + (6x2)
= 0+18+16+7+24+15+8+15+12
= 115 total

(iii) The total is then divided by 11 (modulo 11) and the remainder, if any, is subtracted from 11. The answer then gives the check digit.
i.e. 115/11 = 10 remainder 5
i.e. 11 – 5 = 6 (check digit)
hence, the final number is: 0-221-43256-6

(iv) If Check digit = 10 then it will be represented by X (a representation of 10 in ROMAN)

Modulo-10 Method:

Modulo-10 method is used in check digit calculation in ISBN 13, where the 13th digit of theISBN code is calculated using the following algorithm.

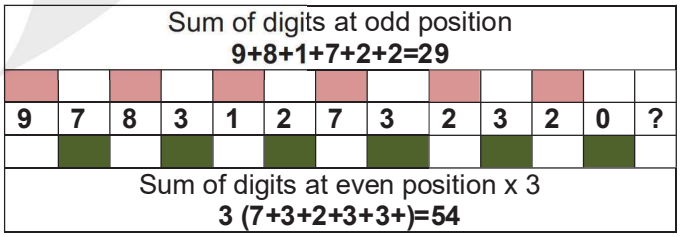
Steps

1. **Find sum of digits at odd position**

Example 978-3-12-732320-?

2. **Find sum of digits at even position and multiply result by 3**

ISBN 978-0747595823



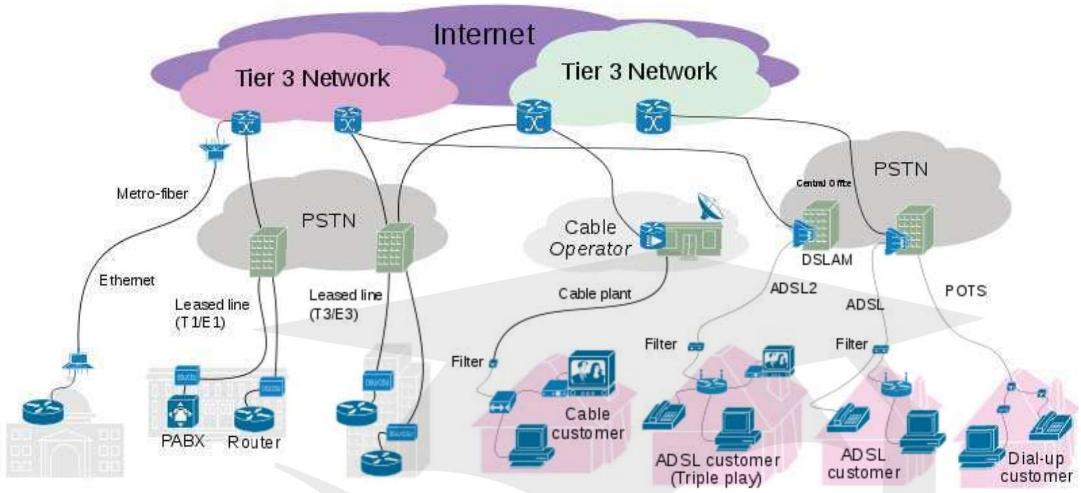
3. **Add both sums** — **29+54=83**
4. **Find Mod10** — **83 MOD 10=3**
5. **If remainder=0 then**
   Check digit=0
   Else
   Check digit=10-Remainder — **Check digit 10-3=7**
   ENDIF

Sort the steps for Check Digit into order. Write the correct number in the column Step No.

Steps of Check Digit	Step No.
The human will be asked by computer to re-enter the numerical code	
A cashier at point of sale, scans the barcode of the product	
The check digit is calculated and added to the barcode, product code at the point of manufacture.	
The computer then compares its calculated check digit with the check digit scanned.	
If the two don't match, then the there is an error in entering or scanning bar code	
The computer calculates check digit	

1.2.3 Internet principles of operation

Internet Service Provider (ISP):



https://en.wikipedia.org/wiki/Internet_service_provider

An **Internet service provider** (**ISP**) is an organization that provides services for accessing, using, or participating in the Internet. Internet service providers may be organized in various forms, such as commercial, community-owned, non-profit, or otherwise privately owned.

Internet services typically provided by ISPs include Internet access, Internet transit, domain name registration, web hosting, Usenet service etc.

Web browser

https://www.techopedia.com/definition/288/web-browser

A web browser is a software program that allows a user to locate, access, and display web pages. In common usage, a web browser is usually shortened to "browser." Browsers are used primarily for displaying and accessing websites on the internet, as well as other content created using languages such as Hypertext Markup Language (HTML) and Extensible Markup Language (XML).

Browsers translate web pages and websites delivered using Hypertext Transfer Protocol (HTTP) into human-readable content. They also have the ability to display other protocols and prefixes, such as secure HTTP (HTTPS), File Transfer Protocol (FTP), email handling (mailto:), and files (file:). In

addition, most browsers also support external plug-ins required to display active content, such as in-page video, audio and game content.

IP Addressing

An Internet Protocol (IP) address is a unique 32-bit reference number that is allocated to devices on a computer network that uses the Internet Protocol.

Although IP addresses are stored as 32-bit numbers, for our convenience they are usually displayed as a series of 4 decimal numbers, each one representing 8 bits of the original binary address.

32-bit binary version: 11001001101000000101101101111111

Decimal version: 201.64.182.255

Some IP addresses are reserved for private network ranges e.g.

10.0.0.0 - 10.255.255.255

172.16.0.0 - 172.31.255.255

192.168.0.0 - 192.168.255.255

IPv4

IPv4 is the most widely deployed Internet protocol used to connect devices to the Internet. IPv4 uses a 32-bitaddress scheme allowing for a total of 2^32 addresses (just over 4 billion addresses).

IPv6

IPv6 addresses are 128-bit IP address for a total of 3.4x10^38 computers.

IPv6 is written in hexadecimal and separated by colons.

An example IPv6 address could be written like this: **3ffe:1900:4545:3:200:f8ff:fe21:67cf**

Example Question 2.3:

The table shows four statements about IP addresses.

Tick (✓) to show which of the statements are true.

Statement	True (✓)
The IP address consists of any number of digits separated by single dots (.)	
Each number in an IP address can range from 0 to 255	
IP addresses are used to ensure that messages and data reach their correct destinations	
Public IP addresses are considered to be more secure than private IP addresses	

Internet Server

Internet server (web server) is a special computer, on which websites are stored. Web Server is constantly switched on and connected to the Internet so that each Internet user around the world can access website at all times. This computer is built up with selected high quality components, which can endure incessant work and high load.

Internet **servers** make the Internet possible. All of the machines on the Internet are either servers or **clients**. The machines that provide services to other machines are servers. And the machines that are used to connect to those services are clients. There are Web servers, e-mail servers, FTP servers and so on serving the needs of Internet users all over the world.

When you connect to www.ruknuddin.com to read a page, you are a user sitting at a client's machine. You are accessing the Ruknuddin Web server. The server machine finds the page you requested and sends it to you. Clients that come to a server machine do so with a specific intent, so clients direct their requests to a specific software server running on the server machine. For example, if you are running a Web browser on your machine, it will want to talk to the Web server on the server machine, not the e-mail server.

A server has a static IP address that does not change very often. A home machine that is dialing up through a modem, on the other hand, typically has an IP address assigned by the ISP every time you dial in. That IP address is unique for your session -- it may be different the next time you dial in. This way, an ISP only needs one IP address for each modem it supports, rather than one for each customer.

HTTP

Short for ***H**yper **T**ext **T**ransfer **P**rotocol*, the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands. For example, when you enter a URL in your browser, this actually sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page.

Uniform Resource Locator (URL):

URL stands for Uniform Resource Locator. It is the address of a web page. Each page has its own unique web address (URL).

This is how a computer locates the web page that user is trying to find.

An example of a URL is: http://inqilabpatel.com/computer2210.html.

In this example

- “http” enables browser to know what protocol is being used to access information in the domain
- “ruknuddin.com” is called the domain name.
- "computer2210.html" refers to the specific page.

URL encoding:

Web addresses can be written using hexadecimal rather than denary. Hexadecimal codes are preceded by a % sign. For example, the word "**www.ruknuddin.com"** is written as:

	r	u	k	n	u	d	d	i	n
in hex	%72	%75	%6B	%6E	%75	%64	%64	%69	%6E

w	w	W	.	r	u	k	n	u	d	d	i	n	.	c	o	m
%77	%77	%77	%2E	%72	%75	%6B	%6E	%75	%64	%64	%69	%6E	%2E	%63	%6F	%6D

Some characters are not allowed in URL. URL encoding converts characters into a format that can be transmitted over the Internet.

For example

- %20 – is used in URL in place of <space> not allowed in a URL, %20 is the coding for a space (32 in denary)
- ? – separates the URL from all parameters or variables
  e.g. for query to search Inqilabpatel in Google

https://www.google.com.pk/search?q=inqilab%20patel

here **"q"** is variable for query "**?**" separates it from URL

"https://www.google.com.pk/search"

while**"%20"** is used for the space between **"inqilab" and "patel"**

Example Question 2.4:

Consider the URL:

http://cie.org.uk/computerscience.html

(i) Give the meaning of the following parts of the URL.

http .....

.....

cie.org.uk .....

.....

.....

computerscience.html .....

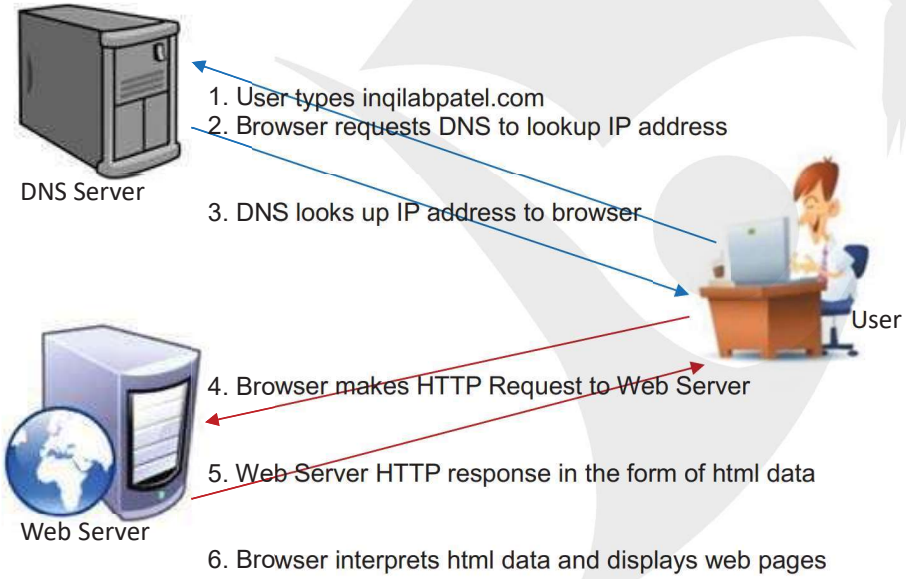
.....

..... [3]

Domain Name Server (DNS):

Domain Name Servers (DNS) are the Internet's equivalent of a phone book. They maintain a directory of domain names and translate them to Internet Protocol (IP) addresses.

1. User types URL of a website in web browser address bar.
2. The web browser sends the request of URL to DNS of internet service provider (ISP).
3. DNS searches the IP address of the URL.
4. URL is translated into machine friendly IP address by DNS.
5. The translated IP address is sent to browser.
6. Browser sends http get command to the server of the IP address where website is hosted.
7. The web server sends HTML data to the client web browser.
8. Web page is displayed on client's browser.



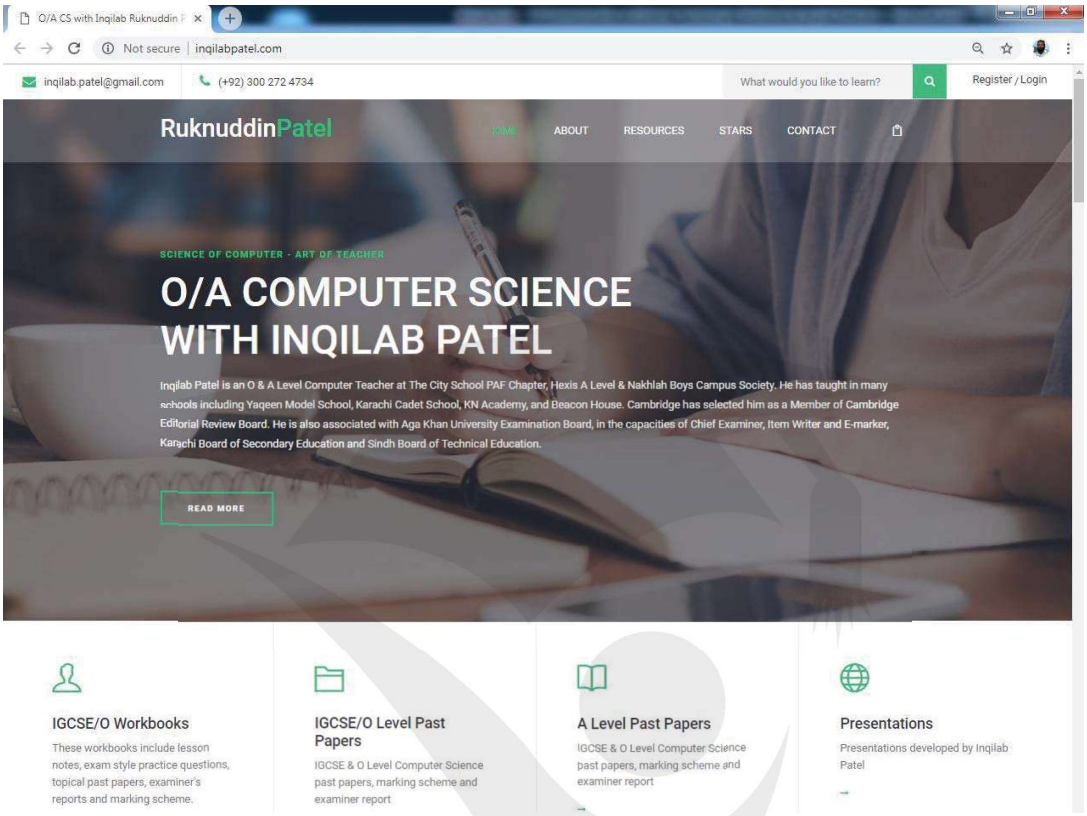
Example Question2.5:

A web page offers a link for users to request another web page. The requested web page contains HTML code.

Put each statement in the correct sequence by writing the numbers 1 to 5 in the right-hand column.

Statement	Sequence No
The requested web page is displayed on the client computer	
The user clicks on the hyperlink and the web page is requested from the web server	
The requested web page content is transmitted to the client computer	
The client computer processes the html code using the web browser software	
The web server locates the requested web page	

WEB DESIGN



A web page is created by writing code in a language called HTML.

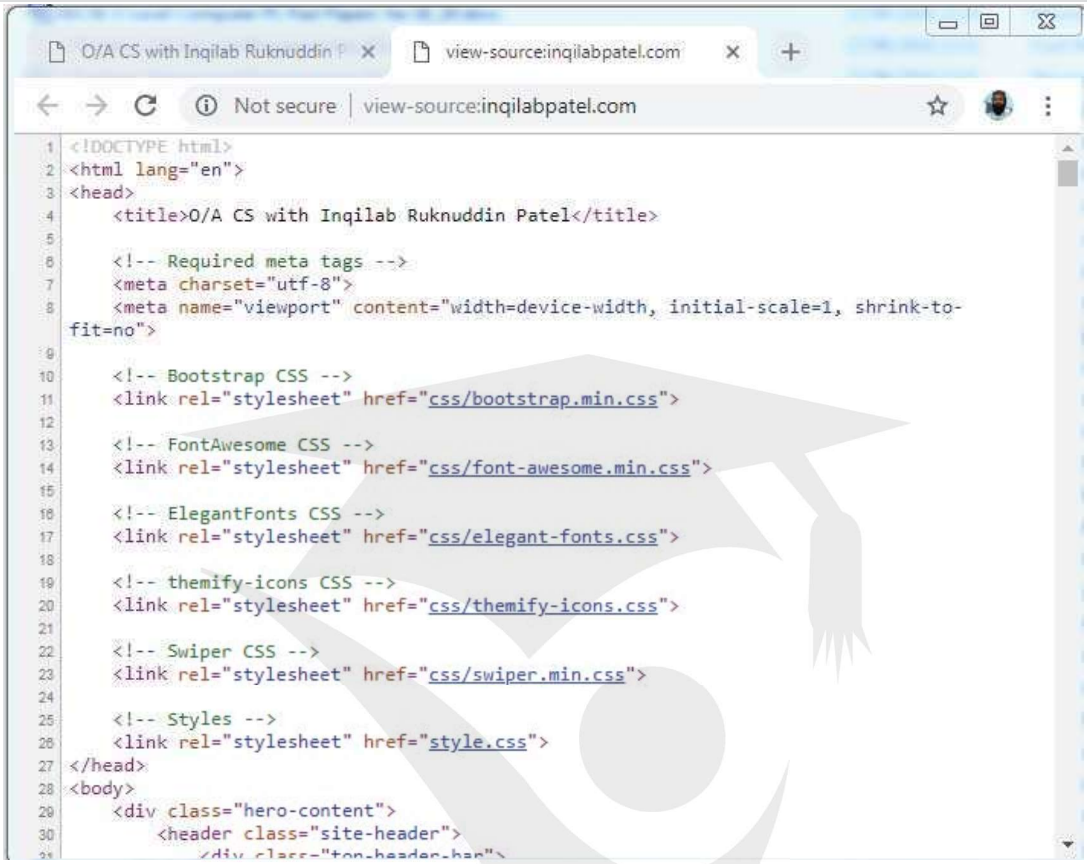
HTML stands for Hyper Text Mark-up Language. It was developed especially to create web pages.

You may be looking at a web page right now and thinking "where is this HTML" - I can't see it.

To see the HTML code of most web pages take these steps:

1. View the page in a web browser.
2. Right click your mouse over the page text and a small menu will appear close to the mouse (right clicking over a picture gives you a different menu) Click on the "View Source" in the menu list.
3. A page full of words and symbols will appear in a separate window

This is the HTML code that makes up the web page you are viewing.



This is what html looks like.

All the coloured text surrounded by **<>** are html 'tags'.

Creating pages using a text editor

Advantages	Disadvantages
Very flexible as you have complete control of the HTML code	You have to know a lot about HTML code
Low cost - Notepad is free with Windows. And there are plenty of 'freeware' text editors available on the Internet.	Slow, as all the code has to be written by hand.
	Easy to make a mistake.
	You have to save the file and look at it in a web browser to see what it actually looks like.

HTML STRUCTURE is the essential part of the HTML document; it includes the semantics (meaning) and structural mark-up of the document.

HTML PRESENTATIONis the style of the document; i.e. how the document will look (or even sound if it includes multimedia elements).

HTML presentation is format of webpage.
CSS is used to define presentation for web pages, including the design and variations in display for different devices and screen sizes.

When a browser reads a style sheet, it will format the HTML document according to the information in the style sheet.

When a browser reads a style sheet, it will format the HTML document according to the information in the style sheet.

Three Ways to Insert CSS

There are three ways of inserting a style sheet:

- External style sheet
- Internal style sheet
- Inline style

External Style Sheet

With an external style sheet, you can change the look of an entire website by changing just one file!

Each page must include a reference to the external style sheet file inside the <link> element. The <link> element goes inside the <head> section:

```
<html>
<head>
<link rel="stylesheet" type="text/css" href="mystyle.css">
</head>
<body>

<h1>In the name of Allah</h1>
<p>TheCity School, PAF Chapter</p>

</body>
</html>
```

An external style sheet can be written in any text editor. The file should not contain any html tags. The style sheet file must be saved with a .css extension.

Here is how the "myStyle.css" looks:

```
body   {
          background-color: #0000ff;
        }

h1       {
        color: 000089;
        margin-left: 20px;
        }
```

Internal Style Sheet

An internal style sheet may be used if one single page has a unique style.

Internal styles are defined within the <style> element, inside the <head> section of an HTML page:

Example:

```
<html>
<head>
<style>
        body {
                background-color: #0000ff;
                }
        h1 {
                color: #980000;
                margin-left: 40px;
        }
</style>
</head>
<body>

        <h1>In the name of Allah</h1>
        <p>The City School, PAF Chapter. </p>

</body>
</html>
```

Inline Styles

An inline style may be used to apply a unique style for a single element.

To use inline styles, add the style attribute to the relevant element. The style attribute can contain any CSS property.

The example below shows how to change the color and the left margin of a <h1> element:

```
<html>
<body>

<h1 style="color: #0000f8; margin-left: 30px ;"> In the name of Allah</h1>
<p>The City School PAF Chapter. </p>

</body>
```

```
</html>
```

Example Question2.6:
HTML code for a website is given below:

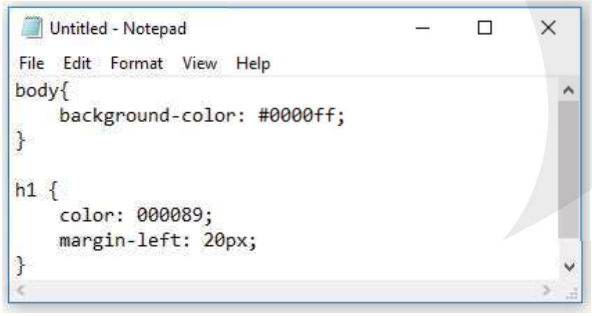
```
<html>
<head>
<title> O Level Computer Science with Inqilab Patel</title>
<style>
body {
    background-color: #0000ff;
}
h1 {
    color: #980000;
    margin-left: 40px;
}
</style>
</head>
<body>

<h1>In the name of Allah</h1>
<p>The Cambridge O Level Computer Science syllabus enables learners
to develop an interest in computing and gain confidence in computational
thinking and programming. Cambridge O Level Computer Science
is an ideal foundation for further study at Cambridge International
A Level, and the skills learnt can also be
used in other areas of study and in everyday life.</p>

</body>
</html>
```

Which lines in the webpage script are related to presentation (style) code?

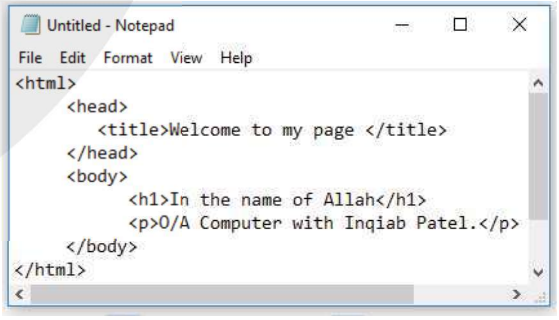
…… [1]

3 Look at the following two types of files.

a



b



a. Which of the above parts shows the .css file?

…… [1]

Using parts (a) and (b) above differentiate between HTML structure and presentation.

……

……

……

…… [2]

b. Show how a tag is closed

…… [1]

Candidate Example response

Example candidate response – high

5 Parity checks are often used to check for errors that may occur during data transmission.

(a) A system uses **even parity**.

Tick (✓) to show whether the following three bytes have been transmitted correctly or incorrectly.

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
11001000		✓
01111100		✓
01101001	✓	

[3]

(b) A parity byte is used to identify which bit has been transmitted incorrectly in a block of data.

The word "F L O W C H A R T" was transmitted using nine bytes of data (one byte per character). A tenth byte, the parity byte, was also transmitted.

The following block of data shows all ten bytes received after transmission. The system uses **even parity** and column 1 is the parity bit.

	letter	column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8
byte 1	F	1	0	1	0	0	1	1	0
byte 2	L	1	0	1	0	1	1	0	0
byte 3	O	1	0	1	0	1	1	1	1
byte 4	W	1	0	1	1	0	1	1	1
byte 5	C	1	0	1	0	0	0	1	1
byte 6	H	0	0	1	0	1	0	0	0
byte 7	A	0	0	1	0	0	1	0	1
byte 8	R	1	0	1	1	0	0	1	0
byte 9	T	1	0	1	1	0	1	0	0
parity byte		1	0	1	1	1	1	1	0

(i) **One** of the bits has been transmitted incorrectly.

Write the byte number and column number of this bit:

Byte number ..... 7 .....

Column number ..... 6. .....

[2]

Example candidate response – high, continued

(ii) Explain how you arrived at your answer for **part (b)(i)**.

Out of the ten bytes, only byte 7 had an odd number of bits with value of 1, and out of the eight columns only column 6 had odd number of bits with value of 1. [2]

(c) Give the denary (base 10) value of the byte: **1 0 1 1 1 1 1 0**

$2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^7 = 2 + 4 + 8 + 16 + 32 + 128 = 190.$

$(190)_{10}$. [1]

(d) A parity check may not identify that a bit has been transmitted incorrectly.

Describe **one** situation in which this could occur.

When an even number of bits are transmitted ~~incorrectly~~ incorrectly, such as in cases a zero and one replaces each other. [1]

Examiner comment – high

In part **(a)**, the candidate demonstrated their knowledge of even parity by correctly identifying which bits were correctly and incorrectly transmitted.

In part **(b)(i)** the candidate identified the correct column and the correct byte for the error.

In part **(b)I(ii)** the candidate correctly states that byte 7 and column 6 had odd parity and it should have been even.

In part **(c)** the candidate has correctly converted the binary number to denary. They have shown the calculation they have used to do this, which is often a good practice to do.

In part **(d)** the candidate has correctly described when an error would occur. Candidates need to make sure they state it would be an even number of bits for the error to go unnoticed.

Marks awarded for **(a)** = 3 out of 3
Marks awarded for **(b)(i)** = 2 out of 2
Marks awarded for **(b)(ii)** = 2 out of 2
Marks awarded for **(c)** = 1 out of 1
Marks awarded for **(d)** = 1 out of 1

Total mark awarded = 9 out of 9

Example candidate response – middle

5 Parity checks are often used to check for errors that may occur during data transmission.

(a) A system uses **even parity**.

Tick (✓) to show whether the following three bytes have been transmitted correctly or incorrectly.

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
11001000		✓
01111100		✓
01101001	✓	

[3]

(b) A parity byte is used to identify which bit has been transmitted incorrectly in a block of data.

The word "F L O W C H A R T" was transmitted using nine bytes of data (one byte per character). A tenth byte, the parity byte, was also transmitted.

The following block of data shows all ten bytes received after transmission. The system uses **even parity** and column 1 is the parity bit.

	letter	column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8
byte 1	F	1	0	1	0	0	1	1	0
byte 2	L	1	0	1	0	1	1	0	0
byte 3	O	1	0	1	0	1	1	1	1
byte 4	W	1	0	1	1	0	1	1	1
byte 5	C	1	0	1	0	0	0	1	1
byte 6	H	0	0	1	0	1	0	0	0
byte 7	A	0	0	1	0	0	1	0	1
byte 8	R	1	0	1	1	0	0	1	0
byte 9	T	1	0	1	1	0	1	0	0
parity byte		1	0	1	1	1	1	1	0

(i) **One** of the bits has been transmitted incorrectly.

Write the byte number and column number of this bit:

Byte number ..7..

Column number ..7..

[2]

Example candidate response – middle, continued

(ii) Explain how you arrived at your answer for **part (b)(i)**.

~~The third it [illegible]~~ This row and column follows odd parity.

[2]

(c) Give the denary (base 10) value of the byte: 128 64 32 16 8 4 2 1
1 0 1 1 1 1 1 0

190

[1]

(d) A parity check may not identify that a bit has been transmitted incorrectly.

Describe **one** situation in which this could occur.

The bits could be muddled up and sends wrong bit with in wrong transmission because of resistence of the conductors.

[1]

Examiner comment – middle

In part **(a)**, the candidate demonstrated their knowledge of even parity by correctly identifying which bits were correctly and incorrectly transmitted.

In part **(b)(i)**, the candidate identified the correct byte, but not the correct column. They may have identified the column as 7 rather than 6 by including the letter column in the counting of the columns. They needed to refer to the title at the top of the column, this should have been 6.

In part **(b)(ii)**, the candidate was able to gain a mark from stating the row and column followed odd parity, but this was too vague for a second mark, as it did not refer to how the odd parity was identified.

In part **(c)** the candidate gave the correct denary number.

In part **(d)** the candidate is too vague in their answer. They start to possibly explain by saying the bits could be muddled up. But to get a mark they would need to state that it was an even number of bits that were changed.

Marks awarded for **(a)** = 3 out of 3
Marks awarded for **(b)(i)** = 1 out of 2
Marks awarded for **(b)(ii)** = 1 out of 2
Marks awarded for **(c)** = 1 out of 1
Marks awarded for **(d)** = 0 out of 1

Total mark awarded = 6 out of 9

Example candidate response – low

5 Parity checks are often used to check for errors that may occur during data transmission.

(a) A system uses **even parity**.

Tick (✓) to show whether the following three bytes have been transmitted correctly or incorrectly.

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
11001000	✓	
01111100	✓	
01101001		✓

[3]

(b) A parity byte is used to identify which bit has been transmitted incorrectly in a block of data.

The word "F L O W C H A R T" was transmitted using nine bytes of data (one byte per character). A tenth byte, the parity byte, was also transmitted.

The following block of data shows all ten bytes received after transmission. The system uses **even parity** and column 1 is the parity bit.

	letter	column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8
byte 1	F	1	0	1	0	0	1	1	0
byte 2	L	1	0	1	0	1	1	0	0
byte 3	O	1	0	1	0	1	1	1	1
byte 4	W	1	0	1	1	0	1	1	1
byte 5	C	1	0	1	0	0	0	1	1
byte 6	H	0	0	1	0	1	0	0	0
byte 7	A	0	0	1	0	0	1	0	1
byte 8	R	1	0	1	1	0	0	1	0
byte 9	T	1	0	1	1	0	1	0	0
parity byte		1	0	1	1	1	1	1	0

(i) **One** of the bits has been transmitted incorrectly.

Write the byte number and column number of this bit:

Byte number ..... 5 .....

Column number ..... 8 .....

[2]

Example candidate response – low, continued

(ii) Explain how you arrived at your answer for **part (b)(i)**.

In each column if there is number "1" the parity byte is 1, however, in column 8 the parity code is "0".

[2]

(c) Give the denary (base 10) value of the byte: **1 0 1 1 1 1 1 0**

54

[1]

(d) A parity check may not identify that a bit has been transmitted incorrectly.

Describe **one** situation in which this could occur.

[1]

Examiner comment – low

In part **(a)**, the candidate has managed to confuse odd parity with even parity. Therefore they have reversed the answer that should have been given.

In part **(b)(i)**, the candidate has not been able to identify a correct byte or column for the error.

In part **(b)(ii)**, the candidate has mistakenly thought that the parity byte at the bottom of column 8 is incorrect as all the others with 1's in them are 1. They are not able to demonstrate an understanding of odd and even parity.

In part **(c)** they did not give the correct number for the conversion.

In part **(d)** they were not able to provide an answer. Wherever possible, candidates should try and provide some attempt at an answer. If they are able to show some basic knowledge, they may be able to gain a mark.

Marks awarded for **(a)** = 0 out of 3
Marks awarded for **(b)(i)** = 0 out of 2
Marks awarded for **(b)(ii)** = 0 out of 2
Marks awarded for **(c)** = 0 out of 1
Marks awarded for **(d)** = 0 out of 1

Total mark awarded = 0 out of 9

Question 6a

Example Candidate Response – high	Examiner Comments
6 Priya creates a website to sell her old comic books and superhero figures. (a) She uses HTML to create her website. The HTML she produces has both structure and presentation. Explain what is meant by HTML **structure** and **presentation**. Include an **example** of each. Structure ...it is the layout (1) of the website... It determines where things are placed... on a website. Example: Title at the top, ...subtitle below title (2) Presentation ...presentation is the design (3) of the website. It is about how the website looks aesthetically. An example of this is a ...background colour (4) CSS can be used for presentation (5)... [4]	1 The first mark is awarded for stating the structure is the layout. 2 The second mark is awarded for a viable example of layout. 3 The candidate states it is the design. The layout is also part of the design, so this is not specific enough. 4 The candidate is awarded a third mark for stating a valid example of presentation. 5 The candidate is awarded a fourth mark for stating that CSS can be used for presentation. **Total mark awarded = 4 out of 4**

How the candidate could have improved their answer

The candidate could have been more specific in their description of presentation. The design could also have referred to the layout.

Example Candidate Response – middle	Examiner Comments
6 Priya creates a website to sell her old comic books and superhero figures. (a) She uses HTML to create her website. The HTML she produces has both structure and presentation. Explain what is meant by HTML **structure** and **presentation**. Include an **example** of each. Structure It's the layout 1 of the document. It contains the semantics (meaning) of document. It contains the html tags and codings 2 Presentation It's the format 3 of the document for ex = the style of the document, how it looks or sounds if it contains multi-media elements 4 [4]	1 The first mark is awarded for stating structure is the layout. 2 The example given is not specific enough. Presentation is also contained in HTML tags. 3 A second mark is awarded for understanding that presentation is how it is formatted. 4 Multimedia is not a correct example of presentation. **Total mark awarded = 2 out of 4**

How the candidate could have improved their answer

The candidate showed understanding of what each aspect was but was not able to provide a specific or correct example. When asked to provide an example, the candidate should have made sure it was something specific, such as the placement of a heading, rather than having stated it contained tags.

Example Candidate Response – low	Examiner Comments
6 Priya creates a website to sell her old comic books and superhero figures. (a) She uses HTML to create her website. The HTML she produces has both structure and presentation. Explain what is meant by HTML **structure** and **presentation**. Include an **example** of each. Structure It is the lay-out of the pages 1 like colour of, Heading etc of we and the Colours of the website etc like colours 2 Heading of website. Presentation It is the content which is writen in the program or the body of the progam like style 3 and content writen in the pragem [4]	1 The candidate cannot be awarded the mark for layout as they state it is the layout of the program. This is incorrect as it is the layout of the web page. 2 The first example given is an example of presentation and not structure. 3 The candidate is given the benefit of the doubt for their response that it is the style of the content. A mark is awarded for this. **Total mark awarded = 1 out of 4**

How the candidate could have improved their answer

- The candidate demonstrated misunderstanding; they thought the structure and presentation referred to the code for the web page, rather than the content of the actual webpage.
- The candidate also provided an incorrect example of structure. They should have stated an example such as where a paragraph of text was placed.

Common mistakes candidates made in this question

Candidates often used vague terms to describe each section, such as design, or the way the page looked. Both descriptions could have applied to either structure or presentation and not specifically to either one. Formatting could have been used for presentation, as this could specifically have referred to the formatting of text, which was the font, style, or colour of the text.

Question 6c

Example Candidate Response – high	Examiner Comments
(c) Priya stores her website on a webserver. To transmit the website data to the webserver she uses parallel duplex data transmission. Describe how data is transmitted using parallel duplex data transmission. Data is sent through multiple ~~wire~~ wires, multiple bits at a time. Data can be transmitted in both directions at the same time. (1) (simultaneously.) [4]	(1) The candidate provides a very succinct response to the question. **Total mark awarded = 4 out of 4**

How the candidate could have improved their answer

The candidate provided a very succinct answer to the question that could not have been improved.

Example Candidate Response – middle	Examiner Comments
(c) Priya stores her website on a webserver. To transmit the website data to the webserver she uses parallel duplex data transmission. Describe how data is transmitted using parallel duplex data transmission. parallel duplex data : sends multiple bytes (1) over multiple wires (2) • sends them in both directions (3) [4]	1 The candidate is missing information from their response. Multiple bytes can be sent using serial as well; they just cannot be sent at the same time. It is important for the candidate to state that the bytes are sent at the *same time*. 2 A mark is awarded for the use of multiple wires. 3 A second mark is awarded for data sent in both directions. If the candidate had added that this can be done at the same time, a further mark could have been awarded. **Total mark awarded = 2 out of 4**

How the candidate could have improved their answer

If the candidate had stated that the multiple bytes were sent at the same time, they could have gained a further mark. If the candidate had also said that the data sent in both directions could have been sent at the same time, they could also have gained a further mark.

Example Candidate Response – low	Examiner Comments
(c) Priya stores her website on a webserver. To transmit the website data to the webserver she uses parallel duplex data transmission. Describe how data is transmitted using parallel duplex data transmission. In parallel data transmission, 8 bits of data is sent to the Reciever 1 over several wires Or channels. Parallel duplex data transmission sent data over a long distance and that's why it is very suitable. Furthermore, data is sent ~~a~~ ~~continuous~~ stream simultaneously 2 for e.g. A broadband connection to the Internet 3 [4]	1 The candidate is not specific enough in their answer. The candidate needs to state that the bits are sent at the same time. 2 This reference to data sent simultaneously is also too vague. It is not clear if the candidate means the 8 bits of data, or the directions of the data. 3 This is a use of parallel data transmission, but the question requires the candidate to describe the operation. **Total mark awarded = 1 out of 4**

How the candidate could have improved their answer

The candidate gained one mark for noting that data was sent over several wires. If the candidate had stated that the 8 bits were sent at the same time, they could have gained a further mark.

Common mistakes candidates made in this question

Candidates often stated that multiple bits were sent, but many didn't state that this happened at the same time. It was important that they made this distinction, as although multiple bits were sent in serial data transmission, they were not sent at the same time.

Question 6d

Example Candidate Response – high	Examiner Comments
(d) Priya has a URL for her website. State what is meant by a URL. Uniform Resource Locater 1 [1]	1 This is a correct expansion of the acronym. **Total mark awarded = 1 out of 1**

How the candidate could have improved their answer

The candidate gave the correct expansion of the acronym. This answer could not have been improved.

Example Candidate Response – middle	Examiner Comments
(d) Priya has a URL for her website. State what is meant by a URL. it is a link that can be used to access the website it is directed to. 1 [1]	1 The candidate misunderstands a URL to be a hyperlink. **Total mark awarded = 0 out of 1**

How the candidate could have improved their answer

The candidate misunderstood a URL to be a hyperlink. If the candidate had stated that it was an address for the website, rather than a link, this could have been awarded a mark.

Example Candidate Response – low	Examiner Comments
(d) Priya has a URL for her website. State what is meant by a URL. Universal Reffered Language 1 [1]	1 This is not the correct expansion of the acronym. **Total mark awarded = 0 out of 1**

How the candidate could have improved their answer

The candidate had an acceptable term for the U of the acronym, but they didn't provide the correct terms for the R and the L.

Common mistakes candidates made in this question

Candidates often stated that the URL was a link. This was a common misunderstanding and candidates should have been aware that it was a hyperlink that was the link, and the URL was an address for the website.

Question 9

Example Candidate Response – high	Examiner Comments

9 The contents of three binary registers have been transmitted from one computer to another. **Even parity** has been used as an error detection method.

The outcome after transmission is:

Register A and **Register C** have been transmitted **correctly**.

Register B has been transmitted ***incorrectly***.

Complete the **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A	1	0	1	0	0	1	0	1
Register B	1	1	0	0	0	0	0	1
Register C	1	1	0	0	0	0	1	1

1

[3]

1 Three correct parity bits are provided.

Total mark awarded = 3 out of 3

How the candidate could have improved their answer

The candidate has provided three correct parity bits. Therefore, they could not have improved their answer.

Example Candidate Response – middle	Examiner Comments

9 The contents of three binary registers have been transmitted from one computer to another. **Even parity** has been used as an error detection method.

The outcome after transmission is:

Register A and **Register C** have been transmitted **correctly**.

Register B has been transmitted **incorrectly**.

Complete the **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A	1	0	1	0	0	1	0	1
Register B	0	1	0	0	0	0	0	1
Register C	1	1	0	0	0	0	1	1

[3]

1 This parity bit is incorrect. The candidate provides the correct parity bit that would be used if the register is transmitted correctly, but the question states it is transmitted incorrectly.

Total mark awarded = 2 out of 3

How the candidate could have improved their answer

The second parity bit was incorrect. The candidate provided the correct parity bit that would have been used if the register had been transmitted correctly, but the question stated it had been transmitted incorrectly.

Example Candidate Response – low	Examiner Comments

9 The contents of three binary registers have been transmitted from one computer to another. **Even parity** has been used as an error detection method.

The outcome after transmission is:

Register A and **Register C** have been transmitted **correctly**.

Register B has been transmitted **incorrectly**.

Complete the **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A	1	0	1	0	0	1	0	1
Register B	1	1	0	0	0	0	0	1
Register C	1	1	0	0	0	0	1	1

[3]

1 This parity bit is incorrect.

Total mark awarded = 2 out of 3

How the candidate could have improved their answer

The first parity bit was incorrect; it should have been 1.

Common mistakes candidates made in this question

Candidates needed to make sure that they had thoroughly read the question. In this case, candidates should have noted from the question that register B was transmitted incorrectly, and not correctly. Some candidates gave the parity bit for correct transmission.

Topical Questions from Past Papers

Q 1) Summer 2015 P11

1 **(a)** State what is meant by the terms:
Parallel data transmission: .....
.....
Serial data transmission: .....
..... [2]
(b) Give **one** benefit of each type of data transmission.
Parallel data transmission
Benefit: .....
.....
Serial data transmission
Benefit: .....
..... [2]
(c) Give **one** application of each type of data transmission. Each application must be different.
Parallel data transmission
Application: .....
.....
Serial data transmission
Application: .....
..... [2]

Examiner's Comments on Question 1 (a), (b) and (c)

In part (a) many candidates provided a good standard of answer and gained both marks. Some candidates provided answers that were not precise enough, making references to pieces of data rather than bits. Some candidates also referred to bytes of data rather than bits. Candidates also gained marks for reference to single and multiple wires, but not single and multiple cables, as only one cable would be used in each case.
In part (b) some candidates provided an answer for parallel transmission that gained marks, mostly by making reference to it being a faster method than serial. Candidates mainly gave an answer that needed more reference for serial. Many stated it was more reliable, but did not refer to what it was more reliable than, or in what situation it was more reliable, e.g. over longer distances.
In part (c) candidates gave hardware devices as a demonstration of serial and parallel data transmission, rather than an application. A reference to 'printers' or 'the internet' was not adequate as an application of data transmission, an application such as 'sending a file from a computer to a printer' would improve their answer.

2 (a) State what is meant by the term USB.
.....
..... [1]
(b) Describe **two** benefits of using USB connections between a computer and a device.
1: .....
.....
.....

2: .....
.....
..... [2]

Examiner's Comments on Question 2 (a) and (b)

Most candidates gained a mark for their answer to part (a). This was mainly through stating Universal Serial Bus as the full name for USB. Those candidates that did not provide the name, but instead gave a description also gained a mark. Some candidates in their description mistook USB as a device rather than a method of connection.
In part (b) candidates mainly gained marks by stating that many computers have the ability to connect using USB as it has become a universal and industry standard connection. Most candidates referred to the benefits of a USB device rather than the connection and were unable to gain marks as a result.

4 Choose **six** correct terms from the following list to complete the spaces in the paragraphs below:

- encryption
- file name
- firewall
- HTML tags/text
- IP address
- protocol
- proxy server
- SSL certificate
- web server name

A user enters a URL. The web browser breaks up the URL into **three** components:

1 .....

2 .....

3 .....

The web server returns the selected web page.

The web browser reads the ..... from the selected page and shows the correctly formatted page on the user's screen.

A ..... is used between the user's computer and the network to examine the data traffic to make sure it meets certain criteria.

To speed up the access to the web pages next time, a ..... is used between the computer and web server; this device uses a cache to store the website home page after it has been accessed for the first time. [6]

Examiner's Comments on Question 4

The full range of marks were awarded to candidates for this question. It was clear some candidates knew the process and gained full marks, but most candidates achieved two or three marks.

Q 2) Summer 2015 P12

5 Parity checks are often used to check for errors that may occur during data transmission.

(a) A system uses **even parity**.

Tick (✓) to show whether the following three bytes have been transmitted correctly or incorrectly.

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
1 1 0 0 1 0 0 0		
0 1 1 1 1 1 0 0		
0 1 1 0 1 0 0 1		

(b) A parity byte is used *to identify which bit has been* transmitted *incorrectly* in a block of data.

The word "F L O W C H A R T" was transmitted using nine bytes of data (one byte per character). A tenth byte, the parity byte, was also transmitted.

The following block of data shows all ten bytes received after transmission. The system uses **even parity** and column 1 is the parity bit.

	letter	column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8
byte 1	F	1	0	1	0	0	1	1	0
byte 2	L	1	0	1	0	1	1	0	0
byte 3	O	1	0	1	0	1	1	1	1
byte 4	W	1	0	1	1	0	1	1	1
byte 5	C	1	0	1	0	0	0	1	1
byte 6	H	0	0	1	0	1	0	0	0
byte 7	A	0	0	1	0	0	1	0	1
byte 8	R	1	0	1	1	0	0	1	0
byte 9	T	1	0	1	1	0	1	0	0
parity byte		1	0	1	1	1	1	1	0

(i) **One** of the bits has been transmitted incorrectly.

Write the byte number and column number of this bit:

Byte number .....Column number .....[2]

(ii) Explain how you arrived at your answer for **part (b)(i)**.

.....

.....

.....

.....[2]

(c) Give the denary (base 10) value of the byte: **1 0 1 1 1 1 1 0**

.....

.....[1]

(d) A parity check may not identify that a bit has been transmitted incorrectly.

Describe **one** situation in which this could occur.

.....

.....

.....[1]

Examiner's comments on Questions 5(a), 5(b), 5(c) and 5(d)

In part (a) many candidates gained full marks. The most common error was candidates inverting the responses and getting all three incorrect.

In part (b)(i) the full range of marks were awarded. Most candidates chose the correct byte number but a range of answers were given for the column number with only some candidates giving the correct column.

In part (b)(ii) some candidates were able to give a clear description how they had arrived at their answer through counting the number of 1's in a byte/column and checking if this was odd/even. However some candidates struggled to explain how they had arrived at their answer giving a vague description or referring to counting zeroes rather than ones.

Many candidates were able to give a correct answer for part (c) and demonstrated a good understanding of binary conversion. Some candidates seemed to correctly map out the calculation needed but noted an incorrect response as their answer so a mark could not be awarded.

In part (d) most candidates demonstrated some understanding that if bits were transposed an error may not be detected, but candidates needed to describe that it would need to be an even number of bits that were transposed, and some were too vague in their response due to this.

Q 3) Winter 2015 P12

6 (a) Explain what is meant by HTML.

.....

.....

.....

.....

.....

..... [3]

(b) HTML uses both structure and presentation.

Describe what is meant by the two terms.

Structure: .....

.....

.....

Presentation: .....

.....

..... [2]

(c) Explain the function of a web browser.

.....

.....

.....

.....

.....[3]

Examiners' Comments Question 6(a) (b) and (c)

In part (a) many candidates were able to identify that HTML is hypertext mark-up language, and that it is used to create webpages. Very few candidates demonstrated knowledge beyond this.

In part (b) most candidates could not give a specific description of these terms. The responses given were very vague and did not identify a convincing difference between the two terms. Most candidates gave a vague definition referring to the way the website looks.

In part (c) most candidates gained a mark by stating that the web browser displays webpages. Many candidates stated an incorrect response, that a web browser allows people to surf the internet. Candidates need to remember the internet is an infrastructure and is not the World Wide Web.

7 (a) Check digits are used to ensure the accuracy of input data.
A 7-digit code number has an extra digit on the right, called the check digit.
Digit position 1 2 3 4 5 6 7 8
Digit– – – – – – – –
The check digit is calculated as follows:
• each digit in the number is multiplied by its digit position
• the seven results are then added together
• this total is divided by 11
• the remainder gives the check digit (if the remainder = 10, the check digit is X)

(i) Calculate the check digit for the following code number. Show all your working.
4 2 4 1 5 0 8 …
……
……
……
Check digit ……[2]
(ii) An operator has just keyed in the following code number:
3 2 4 0 0 4 5 X
Has the operator correctly keyed in the code number?
……
Give a reason for your answer.
……
……
……
……[3]
(b) When data are transmitted from one device to another, a parity check is often carried out on each byte of data. The parity bit is often the leftmost bit in the byte.
(i) If a system uses even parity, give the parity bit for each of the following bytes:

parity bit							
	1	1	0	0	1	1	0

parity bit							
	0	0	0	0	0	0	1

[2]
(ii) A parity check can often detect corruption of a byte.
Describe a situation in which it **cannot** detect corruption of a byte.
……
……
……[1]

Examiners' Comments Question 7(a) and (b)

In part (a) some candidates correctly followed the instructions and gained the marks for a correct answer.
In part (a)(ii) some candidates gave a correct response but were too vague in their reason as to why. They just stated that the remainder was not 10, rather that demonstrating what they had calculated the remainder to be.
In part (b) most candidates were able to give the correct parity bits.

Q 5) Winter 2015 P11

4 Six computer terms and six descriptions are shown below.
Draw a line to link each term to its appropriate description.[5]

Browser	Signal sent to a processor which may cause a break in execution of the current routine, according to priorities
HTML	Company that provides individual's access to the Internet and other services such as webhosting and emails
Internet service provider	Software application used to locate, retrieve and display content on the World Wide Web e.g. web pages, videos and other files
Interrupt	Hardware identification number that uniquely identifies each device on a network; it is manufactured into every network card and cannot be altered
IP address	Authoring language used to create documents on the World Wide Web; uses tags and attributes
MAC address	Location of a given computer/device on a network; can be a static or dynamic value

Examiners' Comments Question 4

Many candidates demonstrated a good level of knowledge about the computer terms, correctly matching a term to the most suitable definition.

12 Parity checks are used to check for errors during data transmission. A system uses **odd** parity.
(a) Complete the following two bytes of data so that they both have **odd** parity:

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

(b) Name and describe another method which can be used to check whether data has been correctly transmitted.
Name of method: .....
Description: .....
.....
.....[2]

Examiners' Comments Question 12(a) and (b)

In part (a) many candidates were able to provide the correct parity bits.
In part (b) some candidates made an error in stating that even parity would be another method of error checking. The method of error checking is parity bit, this covers both odd and even parity, so even parity was not a viable other method. Candidates were required to

state another type of error checking method, such as checksum.

Q 6) Summer 2016 P11 & P13

4 (a) Nikita wishes to print out some documents and connects her printer to the computer using one of the USB ports.

(i) Identify what type of data transmission is being used.

.....[1]

(ii) Give three reasons for using a USB port.

1 .....

.....

2 .....

.....

3 .....

..... [3]

9 Check digits are used to ensure the accuracy of entered data.

A 7-digit number has an extra digit on the right, called the check digit.

digit position:	1	2	3	4	5	6	7	8
digit:	–	–	–	–	–	–	–	–

↑ check digit

The check digit is calculated as follows:

- each digit in the number is multiplied by its digit position
- the seven results are then added together
- this total is divided by 11
- the remainder gives the check digit (if the remainder = 10, the check digit is X)

(a) Calculate the check digit for the following number. Show all your working.

4 2 4 1 5 0 8 …

.....

.....

.....

Check digit ..... [2]

(b) An operator has just keyed in the following number:

3 2 4 0 0 4 5 X

Circle below correct if the check digit is correct OR incorrect if the check digit is incorrect.

Correct incorrect

Explain your answer.

.....

.....

.....

..... [3]

Examiner Report Question 9 (a) and (b)

In part (a) some candidates were able to carry out the first section of the calculation correctly. Some candidates were able to achieve the correct calculation for the final check digit. Candidates need to thoroughly check their calculations. Most incorrect check digits

were as a result of addition and division errors and not using the method incorrectly.
In part (b) many candidates were able to identify the check digit was incorrect. Some candidates were then able to explain what the correct check digit would be using the same calculation method. A common mistake that was made was candidates stating the check digit was incorrect because it was a letter.

Q 7) Summer 2016 P12

6 (a) Three descriptions of data transmission are given below. [6]
Tick (✓) the appropriate box in each table to show the:
• type of transmission
• method of transmission

Description 1:
Data is transmitted several bits a a time down several wires in both directions simultaneously.

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

Method	Tick (✓)
serial	
parallel	

Description 2:
Data is transmitted in one direction only, one bit at a time, down a single wire.

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

Method	Tick (✓)
serial	
parallel	

Description 3:
Data is transmitted one bit at a time down a single wire; the data is transmitted in both directions but not at the same time.

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

Method	Tick (✓)
serial	
parallel	

(b) Give **two** reasons why serial transmission, rather than parallel transmission, is used to connect devices to a computer.

1 .....
.....
2 .....
.....[2]

Examiner Report Question 6 (a) and (b)
In part (a) many candidates were able to provide both a correct type and method of transmission.
In part (b) some candidates gained marks for a full description of two reasons why serial is used. Many candidates were too vague in their answer. The most common of these being candidates stating that it is cheaper, but not relating this to the fact that it has a single wire rather than several.

11 Describe the use of structure and presentation in a HTML document.

.....
.....
.....
.....
.....
.....
.....
.....[4]

Examiner Report Question 11

Some candidates were able to provide a detailed understanding of the difference between presentation and structure. Many candidates gave a vague description of each, or described what HTML was. This could not gain marks. Very few candidates wrote about presentation often being defined in a CSS.

Q 8) Winter 2016 P12

3 (a) Explain what is meant by:

(i) Serial data transmission

.....
.....
.....
.....[2]

(ii) Parallel data transmission

.....
.....
.....
.....[2]

(b) A computer in a factory is connected to a printer. The printer is located in an office 1km away from the factory.

Identify which data transmission method would be most suitable for this connection.

.....

Give two reasons for your choice.

1 .....
.....
.....

2 .....
.....
..... [3]

Examiner Report

In parts **(a)(i)** and **(a)(ii)** candidates gave some good descriptions about the different transmission methods. Candidates need to be careful when referring to the transmission media, some candidates referred to single and multiple cables, which isn't accurate enough.

In part **(b)** some candidates opted for the correct transmission, but many candidates incorrectly opted for parallel. Of those candidates that did opt for serial, few could provide full reasons why. Some gave a vague reference to it being cheaper, but without reference as to why. Some also referred to it being better over longer distances, but without reference as to why.

4 Nine bytes of data are transmitted from one computer to another. Even parity is used. An additional parity byte is also sent.
The ten bytes arrive at the destination computer as follows:

	parity bit	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8
byte 1	1	1	1	0	1	1	1	0
byte 2	0	0	0	0	0	1	0	1
byte 3	0	1	1	1	1	0	0	0
byte 4	1	1	0	0	0	0	0	0
byte 5	1	0	1	1	1	1	1	0
byte 6	0	1	0	1	1	0	0	1
byte 7	0	1	1	1	0	0	1	1
byte 8	0	0	1	1	0	1	1	0
byte 9	1	1	0	0	0	0	1	1
parity byte	0	0	1	0	0	0	1	0

One of the bits was corrupted during the data transmission.
(a) Circle the corrupt bit in the corrupt byte in the table above. [1]

(b) Explain how the corrupted bit was found.

.....
.....
.....
.....
.....
.....[2]

Examiner Report
In part **(a)** many candidates could identify the corrupt bit. Some candidates circled either a single row or a single column, but not intersecting them or identifying a single bit, this was not specific enough for that mark.
In part **(b)** some candidates could provide an accurate description of how they found the corrupt bit. Many gave a vague response and did not accurately refer to counting the bits, locating the bit and byte with odd numbers and finding the intersection of them.

10 (a) Describe what is meant by HTML.

.....
.....
.....
.....
.....
.....[3]

(b) The following URL is typed in:

http://www.cie.org.uk/ComputerSciencePapers

This URL is composed of three parts.
State the part of this URL that is the:
File name .....
Protocol .....
Web server name ..... [3]

Q 9) Winter 2016 P11& 13

3 Five computer terms and **seven** descriptions are shown below.

Draw a line to connect each computer term to its correct description. [5]

Computer term	Description
Serial, simplex data transmission	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
Parallel, half-duplex data transmission	
	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
Parity check	
	An additional digit placed at the end of a number to check if the number has been entered correctly
Automatic repeat request (ARQ)	
	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
Checksum	
	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

Examiner Report

Some candidates could correctly identify all five computer terms. The most common errors were candidates incorrectly identifying parity check and checksum. Candidates need to make sure that they thoroughly read the question. Some candidates drew more than one line from a computer term to a description. If the question states draw a line, candidates must only have a single connecting line. Questions that require multiple lines to be drawn from a box will indicate to draw lines.

5 (c) A microprocessor regularly samples the output, X. Each sample value is stored in an 8-bit register as shown below. One bit of this register is reserved as a parity bit.
Five consecutive output values of 1 indicate a fault condition.
Identify which of the following registers shows a fault condition.

Parity bit								
1	1	1	1	1	0	0	1	**Register Y**
0	1	0	1	1	1	1	1	**Register Z**

Register ..... [1]

(d) When eight bytes of data have been collected, they are transmitted to a computer 100km away. Parity checks are carried out to identify if the data has been transmitted correctly. The system uses **even parity** and column 1 is the parity bit.
The eight bytes of data are sent together with a ninth parity byte:

	parity bit	**column 2**	**column 3**	**column 4**	**column 5**	**column 6**	**column 7**	**column 8**
byte 1	1	0	0	0	0	1	0	0
byte 2	1	1	1	1	0	0	1	1
byte 3	0	1	0	0	1	0	0	0
byte 4	0	1	1	1	0	0	0	1
byte 5	1	0	0	0	1	1	1	1
byte 6	0	0	0	0	0	0	0	0
byte 7	1	1	1	0	1	0	0	0
byte 8	1	0	0	0	1	1	1	0
Parity byte	1	0	1	1	0	1	1	1

(i) Identify which of the eight bytes contains an error.
byte .....[1]

(ii) Identify which column contains an error.
column .....[1]

(iii) The incorrect bit is indicated where the byte number and column cross.
Give the corrected byte. [1]

(iv) Calculate the denary value of the corrected byte.
.....
.....[1]

(v) Considering the fault condition given in **part (c)**, explain why it is very important that the incorrect bit is located and corrected.
.....
.....
.....

.....[2]

Examiner Report

In part **(a)** many candidates could draw a correct logic circuit. A small number of candidates used circles to represent a logic gate. Candidates must ensure that they use the correct logic gate symbols, and that they are drawn clearly and accurately.

In part **(b)** many candidates could correctly complete the truth table.

In part **(c)** some candidates could correctly identify register Z, however many candidates identified an incorrect register. This is perhaps because candidates did not fully read the question and mistakenly included the parity bit in their identification of a fault condition.

In part **(d)(i)**, **(ii)**, **(iii)** and **(iv)** many candidates correctly identified the error in the data transmission, providing the correct byte, correct column, the corrected byte and converting this to denary. Some candidates identified the correct column for the error, but identified the byte as the parity byte. Candidates must make sure they identify the byte the error is located in, that causes the error in the parity byte. In part **(d)(v)** most candidates did not identify that if the error was not found then a fault condition would be missed.

Many candidates gave a very general answer about the need to have accurate data and any errors should be corrected. Candidates are reminded to refer to the context they are given when answering questions.

Q 10) March 2017 India

3 A company has a number of offices on one site. Data are transmitted, using a wired network, from one office and stored at another office.

(a) State, with reasons, which data transmission, serial or parallel, should be used.

Type .....

Reasons .....

.....

..... [3]

(b) The two registers' contents shown include parity bits.

	Parity bit							
Register 1	1	0	0	1	0	1	1	1
Register 2	1	0	0	0	0	1	1	1

State which type of parity each register is using.

Register 1 .....

Register 2 ..... [2]

(c) Give one method, other than parity checking, that could be used for checking for errors in the transmission of data.

Method .....

.....[1]

Examiner Report

(a) Most candidates correctly identified serial transmission and could state at least one correct reason for their choice.

(b) Nearly all candidates identified the correct parity for each register.

(c) Nearly all candidates gave another correct method for checking for errors in the transmission of data.

5 Give the meaning of the following terms.

HTML .....

.....

http .....

.....

https .....

..... [3]

Q 11) Summer 2017 P11

4 Five statements about **serial half-duplex** data transmission are shown in the table below. Tick (3) t o show whether each statement is **true** or **false**. [5]

Statement	true	false
Data is transmitted in one direction only, one bit at a time.		
Data is transmitted in both directions, multiple bits at a time.		
Data is transmitted in one direction only, multiple bits at a time.		
Data is transmitted in both directions, but only one direction at a time. Data is transmitted one bit at a time.		
Data is transmitted in both directions, but only one direction at a time. Data is transmitted multiple bits at a time.		

Examiner Comment on Q 4

Most candidates correctly identified the single correct true statement, marking all the other as false. Themost common incorrect answer given was the fir st statement. Candidates had confused the operations ofsimplex and half-duplex in this instance. Candidates are reminded to follow the instruction given and tick (✔)the appropriate box. Some candidates used crosses (✘) instead or a mixture of both.

5 (a) Parity checks are often used to detect errors that may occur during data transmission.
The received bytes in the table below were transmitted using **odd parity**.
Tick to show whether each byte has been **corrupted during transmission** or **not corrupted during transmission**. [3]

Received byte	Corrupted during transmission	not corrupted during transmission
10110100		
01101101		
10000001		

(b) Another method of error detection is Automatic Repeat reQuest (ARQ).
Explain how ARQ is used in error detection.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

Examiner Comment on Q 5(a)
Some candidates correctly identified which parity bits had been corrupted during transmission, and which had been transmitted correctly. Some candidate used the incorrect parity and there gave the reverse answerand could not be awarded marks. Candidates are reminded to follow the instruction given and tick (✓) theappropriate box. Some candidates used crosses (✗) instead or a mixture of both.
Examiner Comment on Q 5(b)
Candidates found this question challenging. Some candidates demonstrated the knowledge that ARQ usesacknowledgement and time out. It would be beneficial for candidates to demonstrate further understandingabout how the acknowledgement and time out operate. Many candidates demonstrated a misconception thatARQ is the same as echo checking, describing echo checking instead of ARQ.

Q 12) Summer 2017 P12

4There are various methods used to detect errors that can occur during data transmission and storage.

Describe each of the following error detection methods.

Parity check .....
.....
.....
.....

Check digit .....
.....
.....
.....

Checksum .....
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.....
.....

Automatic Repeat request (ARQ) .....
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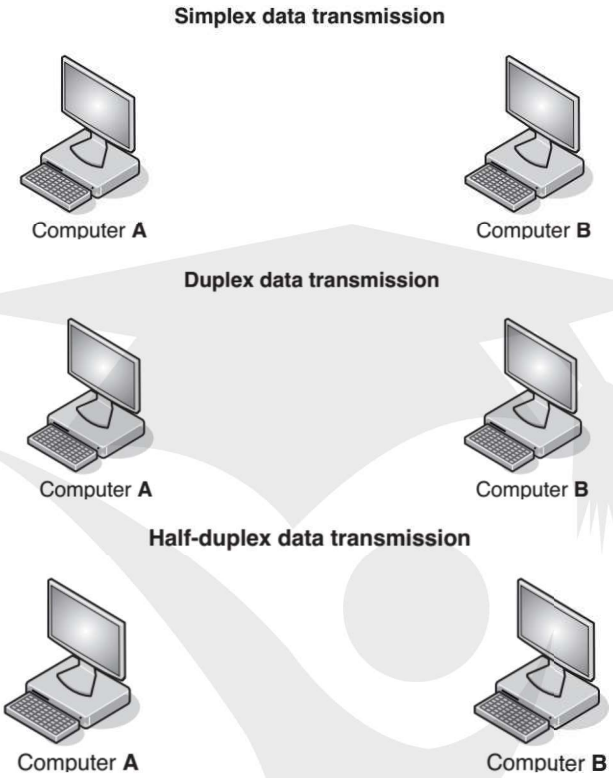
.....
..... [8]

Examiner Comment on Q 4
Candidates found this question very challenging. Some candidates provided a basic understanding of aparity check. Few candidates provided any relevant statements about a checksum and an automatic repeatrequest. Many candidates had a misconceived idea that a check digit is used in data transmission and manyreferred to recalculating and checking the digits after transmission. Many candidates had a misconceivedidea that an echo check is the same as an automatic repeat request and described an echo check insteadfor the answer relating to automatic repeat request. It would be beneficial for candidates to have an accurateunderstanding of the operations of error checking methods.

7 Computer A is communicating with computer B.

(a) Draw an arrow or arrows to show simplex, duplex and half-duplex data transmission. The **direction** of the data transmission must be fully **labelled**.



(b) State a use for the following data transmission methods. The use must be different for each data transmission method.

Simplex .....
.....
Duplex .....
..... [2]

(c) A computer includes an Integrated Circuit (IC) and a Universal Serial Bus (USB) for data transmission.

Describe how the computer uses these for data transmission, including the type of data transmission used.

IC .....
.....
.....
.....

USB .....

.....

.....

..... [4]

Examiner Comment on Question 7(a)

Many candidates correctly drew arrows to represent the direction of data transmission, some candidates didnot fully answer the question, which required them to provide labels for each arrow. Some candidates did notprovide an accurate label e.g. half duplex, data goes both ways

Examiner Comment on Q 7(b)

Many candidates provided a suitable example. Some candidates misunderstood the question and provided adescription of simplex and duplex data transmission.

Examiner Comment on Q 7(c)

Some candidates identified the correct data transmission method for each example. Few candidatesdescribed what the examples were used for. It would be beneficial for candidates to understand whatintegrated circuits and USB are used for. Many candidates also had a misconception that the reference toUSB was a device, rather than a transmission method. It would be beneficial for candidates to understandthe difference between USB and USB flash memory.

11 A company sells smart phones over the Internet.

Explain how the information stored on the company's website is requested by the customer, sent to the customer's computer and displayed on the screen.

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.....[7]

Examiner Comment on Q 11

Candidates found this question challenging. Some candidates described using a web browser and entering aURL, but after this their answer lacked detai l of the process involved. It would be beneficial for candidates tohave a greater understanding of how data is retrieved for a web page, and how it is displ ayed on the user'sscreen. Some candidates misunderstood the question and described the operations of security certificates.

Q 13) Winter 2017 P12

4 A file server is used as a central data store for a network of computers.
Rory sends data from his computer to a file server that is approximately 100 metres away. It is important that the data is transmitted accurately. Rory needs to be able to read data from and write data to the file server at the same time.

(a) (i) Use ticks (3) to identify the most suitable data transmission methods for this application. [2]

Method 1	Tick (✓)	**Method 2**	Tick (✓)
Serial		Simplex	
Parallel		Half-duplex	
		Duplex	

(ii) Explain why your answer to **part (a)(i)** is the most suitable data transmission.

.....

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.....[4]

(b) Identify and describe **two** methods of error checking that can be used to make sure that the data s tored after transmission is accurate.

Method 1 .....

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Method 2 .....

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..... [6]

5 Raj is using the Internet to do some online shopping. He visits a website that tells him that it uses c ookies.

(a) Explain what is meant by the term **cookies**.

Method 1 .....

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.....

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..... [4]

(b) Give **two** examples of the use of cookies.

Example 1 .....

.....

.....

Example 2 .....

.....

.....[2]

Q 14) Winter 2017 P13

3 (a) An example of a Uniform Resource Locator (URL) is:

http://www.cie.org.uk/index.htm

Part 1 Part 2 Part 3

Identify the three parts that make up this URL.

Part 1 .....

Part 2 .....

Part 3 .....[3]

(b) Describe what is meant by an Internet Protocol (IP) address.

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..... [4]

Q 15) March 2018 P12 (India)

3 Parity checks can be used to check for errors during data transmission.

One of the bytes has been transmitted incorrectly.

Byte 1	Byte 2	Byte 3	Byte 4
10110011	10101000	10110100	10110101

(a) State which byte was incorrectly transmitted.

.....[1]

(b) Explain how you identified the incorrectly transmitted byte.

.....

.....

.....

.....

.....

.....[3]

Comments on Question 3

(a) and (b) *Many candidates answered this question well. It was pleasing to see that candidates coul d use problem solving skills to find the correct answer and explain how they did this effectively.*

8(a) Three descriptions and **two** methods of data transmission are given.

Tick (✓) the correct box to show the **Method** of data transmission for each description. [3]

Description	**Method**	
	Serial	Parallel
Multiple bits are sent and received at the same time.		
Bits are sent one at a time in a single direction.		
Bits are sent using a single wire. Data can be sent or received, but not at the same time.		

(b) Three descriptions and **three** types of data transmission are given.

Tick (✓) the correct box to show the **Type** of data transmission for each description. [3]

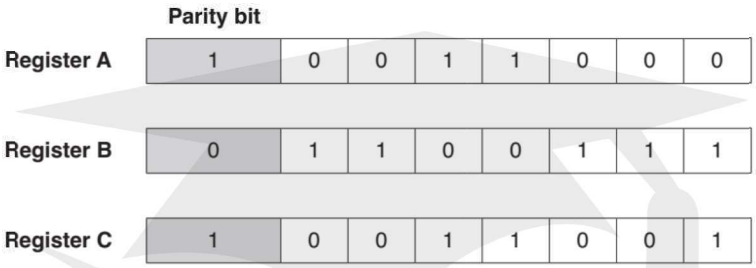
Description	**Type**		
	Simplex	Half-duplex	Duplex
Multiple bits are sent and received at the same time.			
Bits are sent one at a time in a single direction.			
Bits are sent using a single wire. Data can be sent or received, but not at the same time.			

Comments on Question 8

(a) and (b) Many candidates provided a correct response for these questions, demonstrating an excellent level of knowledge of data transmission.

Q 16) Summer 2018 P11

3 The three binary numbers in the registers A, B and C have been transmitted from one computer to another.



One binary number has been transmitted incorrectly. This is identified through the use of a parity bit. Identify which register contains the binary number that has been transmitted **incorrectly**. Explain the reason for your choice.

The binary number that has been transmitted incorrectly is in **Register** .....

Explanation .....

.....

.....

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..... [4]

10 RockICT is a music business that has a website to allow customers to view and buy the products it sells. The website consists of web pages.

(a) Describe what is meant by HTML structure and presentation for a web page.

.....

.....

.....

.....

.....

..... [4]

(b) The URL for the music company's website is:

https://www.rockict.net/index.htm

Part 1 Part 2

(i) Identify what **Part 1** and **Part 2** represent in this URL.

Part 1 .....

Part 2 .....[2]

(ii) Describe what is meant by **https**.

.....

.....

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..... [2]

(c) When a customer enters the website, a message is displayed:

"RockICT makes use of cookies. By continuing to browse you are agreeing to our use of cookies. "Ex plain why the music company uses cookies.

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.....[2]

Q 17) Summer 2018 P12

4 Jafar is using the Internet when he gets the message:

"D03, page is not available"

Jafar remembers that hexadecimal is often used to represent binary values in error codes.

Convert the hexadecimal number in the error message into 12-bit binary. [3]

5 The three binary numbers in the registers X, Y and Z have been transmitted from one computer to another.

								Parity bit
Register X	1	0	0	1	0	0	1	0
Register Y	1	1	1	0	0	1	1	1
Register Z	1	1	1	0	1	0	0	1

Only **one** binary number has been transmitted correctly. This is identified through the use of a parity bit. Identify which register contains the binary number that has been transmitted **correctly**. Explain the reason for your choice.

The binary number that has been transmitted correctly is in **Register** .....

Explanation .....

.....

.....

.....[4]

12 (b) Selma wants to make sure that the information received is correct.

A parity check can be used to detect errors.

Describe another error detection method that can be used to check the information received is correct.

Error detection method .....

Description .....

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..... [3]

Q 18) Winter 2018 P12

7 Six internet terms and **six** definitions are listed. Draw a line to connect each term to a correct definition. [5]

Internet term	Definition
Browser	A program that allows a user to view web pages
Internet Service Provider (ISP)	The main protocol that governs the transmission of data using the Internet
Hyper Text Transfer Protocol (HTTP)	The website address that is typed into the address bar
Uniform Resource Locator (URL)	An address given to each device on a network. It is provided by the network
MAC address	A unique address given to a device on a network. It is provided by the manufacturer
IP address	A company that provides a connection to access the Internet

9 (a) Computers can transmit data using different methods.

Describe the **three** data transmission methods given.

(i) Serial data transmission

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..... [2]

(ii) Parallel data transmission

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.....

..... [2]

(iii) Duplex data transmission

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.....[2]

(b) Data can sometimes be corrupted when it is transmitted from one computer to another, causing errors to be present in the data.

Identify and describe **three** methods of error detection that could be used to see if an error has occurred.

Error detection method 1 .....

Description .....

.....

.....

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Error detection method 2 .....

Description .....

.....

.....

.....

Error detection method 3 .....

Description .....

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..... [9]

Q 19) Winter 2018 P13

2 Parity checks and Automatic Repeat reQuests (ARQ) can be used to check for errors during data transmission and storage.

(a) A system uses **even parity**. Write the appropriate parity bit for each byte. [2]

Parity Bit							
	1	0	1	0	0	1	1
	1	0	1	1	1	1	1
	1	0	1	0	0	0	1

(b) Explain how Automatic Repeat reQuests (ARQ) are used in data transmission and storage.

.....

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.....

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.....[2]

(c) State one other method that could be used to check for transmission errors.

..... [1]

5 Data can be transferred using half-duplex serial transmission. (a) Describe serial transmission.

.....

.....

.....

..... [2]

(b) Give one application of serial data transmission.

.....

.....[1]

(c) Describe half-duplex data transmission.

.....

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..... [2]

8 Alice enters a URL into a web browser to access a webpage. (a) State what URL represents.

U ..... R ..... L ..... [1]

(b) Explain how the web browser uses the URL to access the webpage.

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.....[4]

Q 20) March 2019 P12

4 Darius is writing a computer program that allows binary values to be calculated.

Darius is sending several programs that he has created to his friend Selma.

(d) Errors can occur when data is transmitted, stored or entered into a system.

Darius could use an error detection method to find whether errors have occurred.

One error detection method he could use is a checksum.

(i) Describe how a checksum detects errors.

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..... [5]

(ii) State **three** other error detection methods that Darius could use.

Method 1 .....

Method 2 .....

Method 3 ..... [3]

6 Nadia purchases a printer to print out her homework.

She connects the printer to her computer using USB.

(a) Explain what is meant by USB.

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..... [3]

Q 21) Summer 2019 P11

1 (b) Explain what is meant by a MAC address.

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..... [4]

Q 22) Summer 2019 P12

6 Priya creates a website to sell her old comic books and superhero figures.

(a) She uses HTML to create her website. The HTML she produces has both structure and presentation.

Explain what is meant by HTML **structure** and **presentation**. Include an **example** of each.

Structure .....

.....

.....

Presentation .....

.....

.....

..... [4]

(b) Priya uses cookies in her website. **Five** statements are given about cookies.

Tick (✓) to show if the statement is **True** or **False**. [5]

Statement	True (✓)	False (✓)
Cookies can be used to store a customer's credit card details		
Cookies can be used to track the items a customer has viewed on a website		
Cookies will corrupt the data on a customer's computer		
Cookies are downloaded onto a customer's computer		
Cookies can be deleted from a customer's computer		

(c) Priya stores her website on a web server.

To transmit the website data to the web server she uses parallel duplex data transmission.

Describe how data is transmitted using parallel duplex data transmission.

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..... [4]

(d) Priya has a URL for her website.

State what is meant by a URL.

.....

..... [1]

(e) Priya is concerned about a denial of service attack (DoS) occurring on her web server.

(i) Explain what is meant by a denial of service attack.

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..... [4]

(ii) Give **one** security device that can be used to help prevent a denial of service attack.

..... [1]

9 The contents of three binary registers have been transmitted from one computer to another. **Even parity** has been used as an error detection method.

The outcome after transmission is:

Register A and **Register C** have been transmitted **correctly**.

Register B has been transmitted **incorrectly**.

Complete the **Parity bit** *for* each register to show the given outcome. [3]

	Parity bit							
Register A		0	1	0	0	1	0	1
Register B		1	0	0	0	0	0	1
Register C		1	0	0	0	0	1	1

Q 23) Winter 2019 P13

1 A library has a system that allows customers to check out the books that they want to borrow.

Each book has a barcode that can be used to identify the book.

(iii) The library's archive system uses an error detection and correction system that combines a parity check with an automatic repeat request (ARQ).

Describe how this system uses the parity check and ARQ.

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..... [6]

(c) The library has a website that customers can use to search for a book.

(i) The website has a background colour with the hexadecimal colour code #F92A10The colour code is stored in two 12-bit binary registers. [6]

Show how the colour code would be stored in the registers.

F92 | | | | | | | | | | | | |

A10 | | | | | | | | | | | | |

(ii) Videos on the library website show customers which books the library will soon have in stock.

The library wants the file size of a video to be as small as possible.

Identify **and** describe a method the library could use to reduce the file size of a video as much as pos sible.

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..... [4]

3 Blair writes a paragraph about data transmission in her Computer Science examination.

Use the list given to complete Blair's paragraph by inserting the correct **five** missing terms. Not all ter ms will be used. Terms can be used more than once.

• duplex • half-duplex • parallel • serial • simplex

..... data transmission is when data is transmitted a single bi t at a time. ..... data transmission is when multiple bits of dat a are sent all at once. If a user wants to transmit data over a long distance, with the highest chance of accuracy, ...data transmission should be used. If data need s to be transmitted in one direction only, for example from a computer to a printer,..... ..... data transmission should be used. If a user has a large amount of data to transmit and th is needs to be done as quickly as possible..... data transmission should be used. [5]

5 The contents of three binary registers have been transmitted from one computer to another. **Odd parity** has been used as an error detection method. The outcome after transmission is:

• **Register A** and **Register B** have been transmitted **correctly**.

• **Register C** has been transmitted **incorrectly**.

Write the appropriate **Parity bit** for each register to show the given outcome. [3]

	Parity bit							
Register A		0	1	0	0	0	1	1
Register B		0	0	0	0	1	1	1
Register C		0	0	0	0	0	1	1

Q 24) Winter 2019 P12

7 Gerald uses a keyboard to enter a website address into the address bar of his browser.

(a) Describe how Gerald's key presses on his keyboard are processed by the computer.

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..... [4]

(b) State **three** functions of a browser.

1 .....

.....

2 .....

.....

3 .....

..... [3]

(c) The website Gerald visits uses https.

Explain what is meant by https.

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..... [3]

9 Maisey purchases a new router and attaches it to her computer. The connection she sets up uses duplex data transmission.

(a) Five statements are given about duplex data transmission.

Tick (✓) to show if the statement is **True** or **False**. [5]

Statement	**True (✓)**	**False (✓)**
Duplex data transmission can be either serial or parallel		
Duplex data transmission is when data is transmitted both ways, but only one way at a time		
Duplex data transmission is always used to connect a device to a computer		
Duplex data transmission is when data is transmitted both ways at the same time		
Duplex data transmission automatically detects any errors in data		

(b) Maisey's computer uses an integrated circuit (IC) for data transmission that sends multiple bits at the same time.

State whether the IC uses **serial** or **parallel** data transmission.

..... [1]

(c) Maisey purchases a new printer and connects it to her computer using the USB port.

Explain **two** benefits of using a USB connection.

Benefit 1 .....

.....

.....

.....

Benefit 2 .....

.....

.....

..... [4]

10 Data is valuable to a company.

(a) Companies use error detection methods to make sure that data is accurate.

One error detection method is the use of a check digit.

Explain what is meant by a check digit and how it is used to detect errors.

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..... [4]

Q 25) March 20 P12

2 A school network is used to transmit and store data about students.

(a) Different types and methods of transmission can be used to send data across the network.

Three descriptions about data transmission are given.

Tick (✓) **one Method** and tick (✓) **one Type** for each description. [3]

Description	Method		Type		
	Serial (✓)	Parallel (✓)	Simplex (✓)	Half duplex (✓)	Duplex (✓)
Data is sent down a single wire in a single direction only.					
Data is sent down multiple wires in both directions, at the same time.					
Data is sent down a single wire in both directions, but never at the same time.					

(b) Parity bits are used to help detect errors in data transmission. A parity bit is added to each binary value before transmission.

Three binary values are to be transmitted using **even** parity.

(i) Complete the parity bit that would be added to each binary value for even parity. [3]

Binary value							Parity bit
1	1	0	0	1	1	1	
1	0	1	0	1	0	1	
0	1	1	0	1	0	0	

(ii) A number of errors occurred during data transmission.

State why a parity check may **not** detect transmission errors.

.....

..... [1]

8 A student website provides research support and software downloads.

(a) Students use a browser to access the web pages. Explain the role of a browser in this process.

.....

.....

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..... [5]

Q 26) Summer 20 P12

5 Meena uses a browser to research information for her business.

(a) Give **three** functions of a browser.

1 .....

2 .....

3 ..... [3]

8 Leonard has a new laser printer to print letters for his business.

Leonard connects his printer to his computer using the USB port.

(a) Give **three** benefits of using the USB port to connect the printer to the computer.

Benefit 1 .....

.....

Benefit 2 .....

.....

Benefit 3 .....

..... [3]

Q 27) 15a Summer 20 P11

3 Carla's computer has a USB port.
Carla uses the USB port to connect her mobile device to her computer, to transfer her photos.
(a) Give **three** benefits of using a USB port to connect the mobile device to the computer.
Benefit 1 .....
.....
Benefit 2 .....
.....
Benefit 3 .....
..... [3]

(b) State the type of data transmission used when transferring data using a USB port.
..... [1]
(c) Carla wants to reduce the file size of the photos she has transferred to her computer.
She does not want the quality of the photos to be reduced, so she uses lossless compression.
Describe how lossless compression reduces the file size of the photos.
.....
.....
.....
.....
.....
.....
.....
..... [4]

4 Two error detection methods that Allison's computer uses are check digit and checksum.
(a) Give **two** similarities between the check digit and checksum methods.
1 .....
.....
2 .....
..... [2]
(b) Identify **one other** error detection method that Allison's computer could use.
Describe how the method checks for errors.
Method .....
Description .....
.....
.....

.....
.....
..... [4]

Q 28) Winter 20 P12

1 Tina is creating a website for charity events. She uses HTML to create the website.

(a) State what is meant by HTML.

.....
..... [1]

(b) She uses the hexadecimal colour code #43B7F0 as the background colour for her website.

(i) State whether background colour is an example of **structure** or **presentation**, in the website.

..... [1]

(ii) The hexadecimal colour code #**43B7F0** is stored in three **8-bit** registers.

Give the **8-bit binary** values for each part of the hexadecimal code. [6]

43								
B7								
F0								

2 Four 7-bit binary values are transmitted from one computer to another. A parity bit was added to each binary value creating 8-bit binary values. All the binary values have been transmitted correctly.

(a) Tick (✓) to show whether an **Even** or an **Odd** parity check has been used for each binary value. [4]

8-bit binary value	Even (✓)	Odd (✓)
11111111		
01100110		
01111011		
10000000		

(b) The data will also be checked using a checksum.

Describe how a checksum can be used to check that the data has been transmitted correctly.

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..... [5]

Q 29) Winter 20 P13

3 (a) Four denary to 8-bit binary conversions are given.

Tick (✓) to show if each denary to 8-bit binary conversion is **Correct** or **Incorrect**. [4]

Denary	Binary Conversion	Correct (✓)	Incorrect (✓)
145	10010001		
179	10110101		
11	00010011		
100	01100010		

(b) Convert the **12-bit** binary number into hexadecimal.

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

..... [3]

4 Eugene has a web server that stores his online shopping website.

Customers access the website using a browser.

(a) Describe how the webpages are requested and displayed on the customer's computer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) State **three** online security threats to Eugene's web server.

Threat 1 .....

Threat 2 .....

Threat 3 ..... [3]

5 Arjun uses a scanner to create digital versions of some printed documents.
The scanner is attached to his computer using a USB connection.

(a) Tick (✓) to show if the USB connection uses **Parallel** or **Serial** data transmission.
Describe your chosen method of data transmission.

Parallel ☐
Serial ☐

Description

.....
.....
.....
..... [3]

(b) Give **three** benefits of a USB connection.

Benefit 1 .....
.....
Benefit 2 .....
.....
Benefit 3 .....
..... [3]

(c) Arjun uses the Internet to send the digital documents to his friend. He wants to make sure the documents are sent securely.
Identify **two** protocols that can be used to transfer data securely.

Protocol 1 .....
Protocol 2 ..... [2]

7 Four 7-bit binary values are transmitted from one computer to another. A parity bit was added to each binary value creating 8-bit binary values. All the binary values have been transmitted correctly.

(a) Tick (✓) to show whether an **Even** or an **Odd** parity check has been used for each binary value. [4]

8-bit binary value	Even (✓)	Odd (✓)
10000001		
10000010		
00101001		
00101000		

(b) A parity check may not always detect errors that have occurred in data transmission.
State why a parity check may not detect data transmission errors.

..... [1]

(c) Give **one** other error checking method that could be used to check for errors in data transmission.

..... [1]

12 Warner says that he has a very good Internet Service Provider (ISP) that provides several services.
Five statements about ISPs are given.
Tick (✓) to show if each statement is **True** or **False**. [5]

Statement	True (✓)	False (✓)
Provides access to the Internet for customers		
Can determine the maximum bandwidth available for customers		
Monitors the volume of data downloaded by customers		
Can provide an IP address for the customer		
Stores the content for all web pages available on the Internet		

Q 30) March 20 P12

1 A hockey club records the number of people that watch each match.
(d) Electronic data about the final score for the match is transmitted to a central computer 30 kilometres away, using serial transmission.
(i) Explain why serial transmission is more appropriate than parallel transmission in this scenario.
.....
.....
.....
.....
.....
..... [3]

(ii) The data transmission is also half-duplex.
Describe half-duplex data transmission.
.....
.....
.....
..... [2]

(iii) The data transmission uses checksums.
Describe how checksums are used to detect errors in data transmission.
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.....
.....
..... [3]

2 Gurdeep takes high definition photographs using a digital camera. She has set up a website where users can view thumbnails of her photographs. A thumbnail is a small version of the high definition photograph.
(a) Gurdeep compresses the high definition photographs to create the thumbnails. She uses lossy compression.
Describe how lossy compression creates the thumbnails.
.....
.....
.....
.....
.....
..... [3]

(b) Gurdeep sets up a web server to host her website. She reads about an Internet Protocol (IP) address, a Media Access Control (MAC) address and a Uniform Resource Locator (URL).
Draw a line to connect each term to the correct example. [2]

Term	Example
IP address	192.168.0.255
MAC address	https://www.cambridgeinternational.org
URL	00:15:E9:2B:99:3C

Marking Scheme

Q 1) Summer 2015 P11

1 (a) **parallel**

any **one** from:

- 8 bits/1 byte/multiple bits sent at a time
- using many/multiple/8 wires/lines

serial

any **one** from:

- one bit sent at a time
- over a single wire

(b) **parallel**

- faster rate of data transmission

serial

any **one** from:

- more accurate/fewer errors over a longer distance
- less expensive wiring
- less chance of data being skewed/out of synchronisation/order

(c) **parallel**

any **one** from:

- sending data from a computer to a printer
- internal data transfer (buses)

serial

- connect computer to a modem

2 (a)
- universal serial bus
- description of USB

(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

4 1 mark per correct word

1 protocol

2 web server name

3 file name

accept these three items in any order

HTML tags/text

firewall

proxy server

Q 2) Summer 2015 P12

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge O Level – May/June 2015	2210	12

5 **(a)** 1 mark per correctly placed tick

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
1 1 0 0 1 0 0 0		✓
0 1 1 1 1 1 0 0		✓
0 1 1 0 1 0 0 1	✓	

[3]

(b) **(i)** byte number: **7**

column number: **6**

[2]

(ii) Any **two** from:

- letter "A"(byte 7) transmitted as odd parity (three 1s)
- column 6 has odd parity (seven 1s)
- intersection of byte 7 and column 6 indicates incorrect bit value

[2]

(c) **190**

[1]

(d) Any **one** from:

- 2 bits interchanged (e.g. 1 → 0 and 0 → 1) that won't change parity value
- even number of bits/digits are transposed
- If there are multiple errors in the same byte/column, that still produce the same parity bit, the error will not be detected

[1]

Q 3) Winter 2015 P12

6 **(a)** Any **three** from:
- hypertext mark-up language
- used to create/develop/author webpages
- translated by a browser to display webpages
- uses (opening and closing) tags to display/format content

(b) Structure:
- instructs how the layout of the content is displayed

Presentation:
- instructs how the content will be formatted e.g. colour/style/CSS

(c) Any **three** from:
- displays web page
- interprets/translates the HTML document
- interprets/translates embedded scripting, for example JavaScript
- provides functions, such as bookmarks and history
- identifies protocols, such as https, SSL

7 **(a) (i)** 1 mark for correct check digit and 1 mark for showing the calculation

$(4 \times 1) + (2 \times 2) + (4 \times 3) + (1 \times 4) + (5 \times 5) + (0 \times 6) + (8 \times 7)$

= 4 + 4 + 12 + 4 + 25 + 0 + 56 = 105

105/11 = 9 remainder 6

check digit is: **6**

(ii) 1 mark
- No/incorrect check digit

2 marks
- Total is 78
- 78/11 …
- … gives 7 remainder 1
- check digit should be 1

(b) (i) 1 mark for each correct parity bit

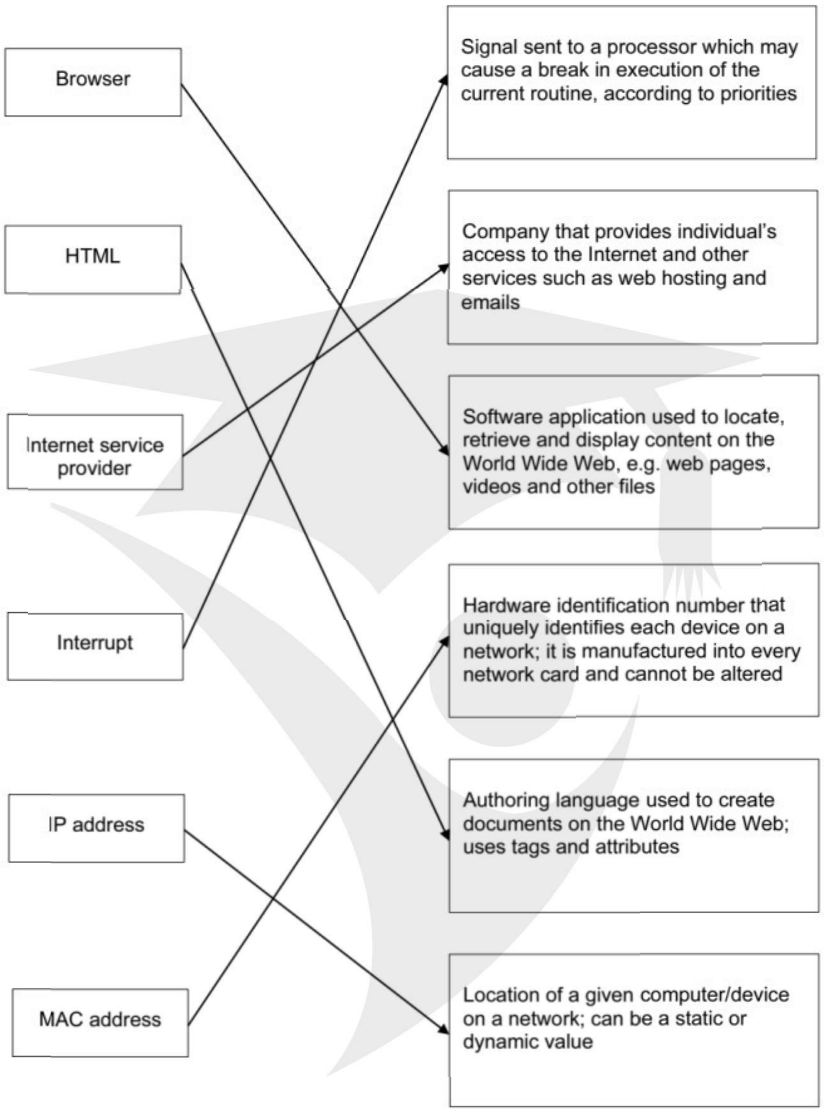
parity bit							
0	**1**	**1**	**0**	**0**	**1**	**1**	**0**

parity bit							
1	**0**	**0**	**0**	**0**	**0**	**0**	**1**

(ii) Any **one** from:
- an even number of digits are changed
- a transposition error(s) has occurred

Q 5) Winter 2015 P11

4



12 (a)

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

(b) 1 mark for error detection method and 1 mark for description

- Check sum
- … sum of bits is transmitted and checked against the sum of the received bits

- Check digit
- … a digit that is calculated (e.g. using modulo-11) and transmitted with the data

- ARQ
- … when an error is detected in a packet of data a request is automatically sent for the data to be resent

Q 6) Summer 2016 P11 & P13

4 (a) (i) serial [1]

(ii) Any **three** from:
- automatically detects the hardware/installs drivers
- plug only goes in one way/can't connect incorrectly
- supports different data transmission speeds/a range of data transmission speeds
- has become the industry standard/universally used
- backwards compatible (with earlier versions of USB ports) [3]

9 (a) **1** mark for correct check digit and **1** mark for showing the calculation

$(4 \times 1) + (2 \times 2) + (4 \times 3) + (1 \times 4) + (5 \times 5) + (0 \times 6) + (8 \times 7)$

$= 4 + 4 + 12 + 4 + 25 + 0 + 56 = 105$

105/11 = 9 remainder 6

check digit is: **6**

} 1 mark for any correct line of working

(b) **incorrect** check digit

- check digit should be 1
- (3*1) + (2*2) + (4*3) + (0*4) + (0*5) + (4*6) + (5*7) // 3 + 4 + 12 + 0 + 0 + 24 + 35 // Total = 78
- 78/11 gives 7 remainder 1

Q 7) Summer 2016 P12

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0478	12

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]

11 **1** mark for each correct point
- Presentation is used to format colour/style
- Structure is used to create layout
- In a HTML document structure and presentation are often kept separate
- By keeping the presentation separate it is easier to update colour/font
- Presentation is often stored in a file called a CSS …
- … the CSS in then linked to the HTML document to implement the presentation requirements
- (Mark-up) tags are used to define the structure of the document …
- … presentation and formatting can also be included within the tags [4]

Q 8) Winter 2016 P12

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

serial

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

[2]

(ii) Any **two** from:

parallel

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

[2]

(b) – serial

Any **two** from:

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

[3]

4 (a) Intersection of Row 7 and column 4 circled [1]

(b) – Row (byte number) 7 has an odd number of 1s (five 1s)
– Column (bit number) 4 has an odd number of 1s (five 1s)

[2]

10 (a) Any **three** from:

- hyper text mark-up language
- uses both structure and presentation
- web-authoring language/software // used to create websites/webpages
- uses tags to define e.g. colour / font / graphics / layout

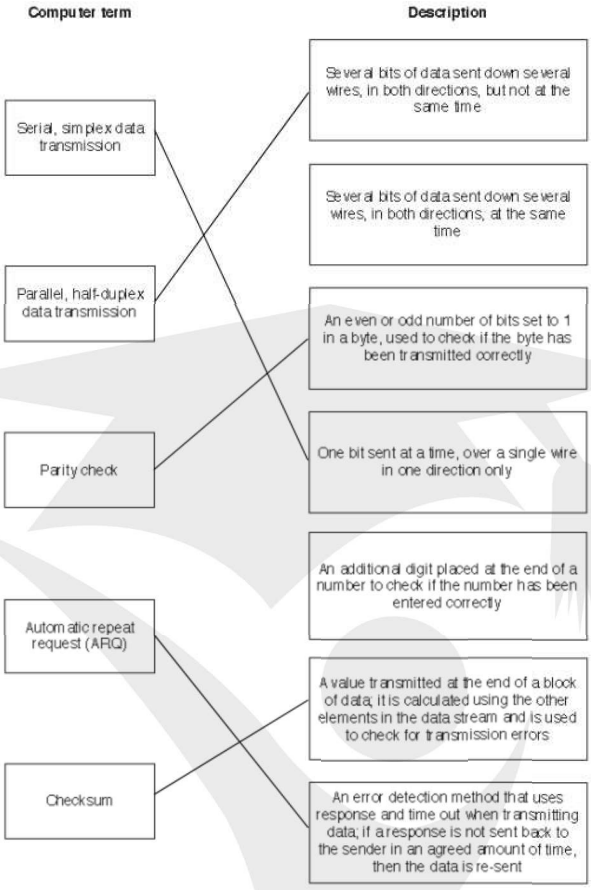
[3]

(b)

File name:	ComputerSciencePapers
Protocol:	http(://)
Web server name:	www.cie.org.uk

[3]

Q 9) Winter 2016 P11& 13



[5]

(c) Register Z [1]

(d) (i) (byte) 5 [1]

(ii) (column) 4 [1]

(iii) corrected byte is: **1 0 0 1 1 1 1 1** [1]

(iv) that gives the value: **1 5 9**
(follow through applies) [1]

(v) Any **two** from:

- The byte would be transmitted without having 5 consecutive 1's
- The fault condition would not be recognised [2]

Q 10) March 2017 India

Question	Answer	Marks
3(a)	1 mark for: ∞ serial Any **two** from: ∞ serial data transmission more reliable over distance ∞ less likely for the data to be skewed/out of synchronisation ∞ less interference as only a single wire ∞ it is a cheaper connection as only single wire needed // cheaper to set up	3
3(b)	∞ Register 1 – odd ∞ Register 2 – even	2
3(c)	Any **one** from: ∞ checksum ∞ ARQ (Automatic Repeat request)	1

Question	Answer	Marks
5	HTML – HyperText Markup Language / language used to create web pages http – hypertext transfer protocol / protocol used by web browsers https – hypertext transfer protocol secure / secure protocol used by web browsers	3

Q 11) Summer 2017 P11

Question	Answer	Marks
4	1 mark per correct tick	5

Statement	True	False
Data is transmitted in one direction only, one bit at a time.		✓
Data is transmitted in both directions, multiple bits at a time.		✓
Data is transmitted in one direction only, multiple bits at a time.		✓
Data is transmitted in both directions, but only one direction at a time. Data is transmitted one bit at a time.	✓	
Data is transmitted in both directions, but only one direction at a time. Data is transmitted multiple bits at a time.		✓

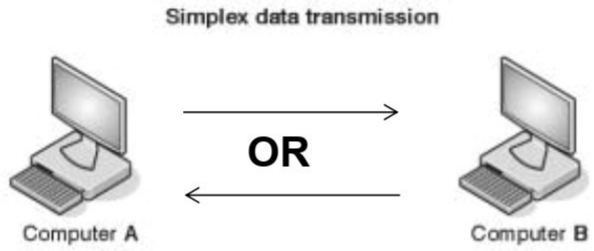
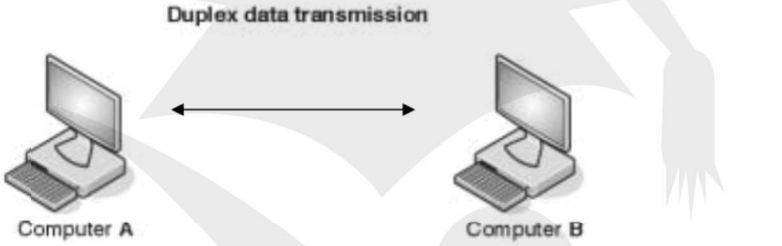
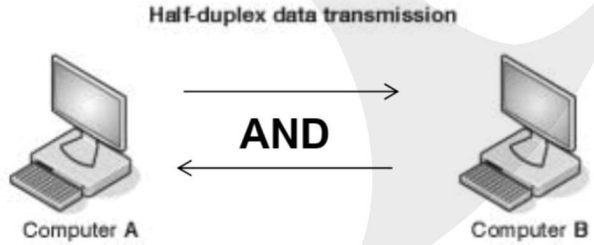
Question	Answer	Marks
5(a)	1 mark per correct tick	3

Received byte	corrupted during transmission (✓)	not corrupted during transmission (✓)
10110100	✓	
01101101		✓
10000001	✓	

5(b)	**Four** from: ∞ Uses acknowledgement and time out ∞ Check performed on received data // error is detected by e.g. parity check, check sum ∞ If error detected, request sent to resend data // negative acknowledgment is used ∞ If no acknowledgement is sent that data is received // positive acknowledgement is used ∞ Data is resent / Resend request repeated, till data is resent correctly … ∞ … or request times out // limit is reached	4

Q 12) Summer 2017 P12

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 even or odd ∞ 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  (Direction of data is) one way only // unidirectional  (Direction of data is both ways) at same time / simultaneously / concurrently  (Direction of data is both ways) but at different times / not at the same time / not simultaneously / not concurrently	6

Question	Answer	Marks
7(b)	1 mark each use, must be different. **Simplex** e.g.: Microphone to computer Sensor to computer Computer to printer Computer to speaker Computer to monitor Webcam to computer Sending data to a device // sending data from a device **Duplex** e.g.: Telephone call Voice over IP Computer to printer (only award once) Instant messaging Broadband connections Video conferencing Sending data to and from devices e.g wireless technology Computer to modem	**2**
7(c)	2 marks for IC, 2 marks for USB **IC** ∞ parallel transmission // description of parallel ∞ for sending data internally **USB** ∞ serial transmission // description of serial ∞ for sending data externally (to and from peripherals / between devices)	**4**

Question	Answer	Marks
11	**Seven** from: **Requested** ∞ a web browser is used ∞ user enters the URL / web address (into the address bar) // clicks a link containing the web address // clicks an element of the webpage ∞ the URL / web address specifies the protocol ∞ protocols used are Hyper Text Transfer Protocol (HTTP) / Hyper Text Transfer Protocol Secure (HTTPS) **Sent** ∞ the URL / web address contains the domain name ∞ the Internet Service Provider (ISP) looks up the IP address of the company ∞ the domain name is used to look up the IP address of the company ∞ the domain name server (DNS) stores an index of domain names and IP addresses ∞ web browser sends a request to the web server / IP address **Received** ∞ Data for the website is stored on the company's web server ∞ webserver sends the data for the website back to the web browser ∞ web server uses the customer's IP address to return the data ∞ the data is transferred into Hyper Text Mark-up Language (HTML) ∞ HTML is interpreted by the web browser (to display the website)	**7**

Q 13) Winter 2017 P12

4(a)(i) — **2**

Method 1	Tick (✓)	Method 2	Tick (✓)
Serial	✓	Simplex	
Parallel		Half-duplex	
		Duplex	✓

4(a)(ii) — **4**

Any **four** from (**Max 3** for serial):
- Serial has less/lower interference
- Serial is (more) reliable/accurate over distances
- In serial the bits won't be skewed
- In serial it is easier to collate the bits together again after transmission

- Duplex transmits data in both directions at the same time
- simplex/half-duplex/remaining methods won't allow read and write at same time

4(b) — **6**

1 mark for error checking method, 2 marks for description:

Checksum
- A value is calculated from the data // Description of calculation
- Value is transmitted with data
- Value is recalculated after transmission
- If the values match the data is (more likely to be) accurate

Parity check
- A parity bit is transmitted with each byte of data
- Odd or even (parity can be used)
- Counts / checks number of 1's // counts / checks to see if 1's are even // counts / checks to see if 1's are odd
- (Each byte is) checked after transmission to see if it matches the odd/even parity used

Automatic Repeat Request (ARQ)
- Uses acknowledgement and timeout
- When a device detects an error in data transmission it asks for the packet to be resent / no error detected, positive acknowledgment sent
- The sending device resends the packet after the request to resend/ timeout received
- This process is continuous until the packet received is correct/until the ARQ limit is reached

Echo (check)
- Copy of data is sent back to sender
- Data is compared to see if it matches
- If it does not match error detected

5(a) — **4**

Any **four** from:
- Data / files
- Stored in a text file
- Downloaded to a user's computer when a website is visited // webserver sends to web browser
- Stored on a user's computer
- Stored by a browser
- Detected by the website when it is visited again

5(b) — **2**

Any **two** from: e.g.
- To store personal information/data
- To store login details
- To save items in an online shopping basket
- To track/save internet surfing habits // to track website traffic
- To carry out targeted advertising
- To store payment details
- To customise a webpage // to store user preferences
- Store progress in online games/quizzes

Q 14) Winter 2017 P13

Question	Answer	Marks
3(a)	– Part 1 (access) protocol – Part 2 domain (name) – Part 3 filename	3
3(b)	**Four** from: – IP address is used to identify a device (on the Internet / network) – IP address is allocated by the network/ ISP – Can be used in place of URL – IP addresses can be IPv4 or IPv6 – IP address can be static … – … meaning it doesn't change each time it is connected to the Internet – IP address can be dynamic …. – … meaning that it can change each time a device is connected to the Internet – Any valid example (e.g. xxx.xxx.xxx.xxx or xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx)	4

Q 15) March 2018 P12 (India)

Question	Answer	Marks
3(a)	Byte 3 / 10110100	1
3(b)	Odd parity used Counted / added the number 1's // Most Bytes have an odd number of 1's Byte 3 has an even number of 1's // Byte 3 didn't follow odd parity	3

Question	Answer	Marks
8(a)	**Descriptions** / **Method**: Serial / Parallel Multiple bits are sent and received at the same time. — ✓ Parallel [1] Bits are sent one at a time in a single direction. — ✓ Serial [1] Bits are *sent using a single* wire. Data can be sent or received, but not at the same time. — ✓ Serial [1]	3

Question	Answer	Marks
8(b)	**Descriptions** / **Type**: Simplex / Half-duplex / Duplex Multiple bits are sent and received at the same time. — ✓ Duplex [1] Bits are sent one at a time in a single direction. — ✓ Simplex [1] Bits are sent using a single wire. Data can be sent or received, but not at the same time. — ✓ Half-duplex [1]	3

Q 16) Summer 2018 P11

Question	Answer	Marks
3	1 mark for correct register, 3 marks for reason: – Register C Any **three** from: – Count the number of 1/0 bits (in each byte/register) – Two bytes/registers have an odd number of 1/0 bits // Two use odd parity – Odd parity must be the parity used – One byte/register has an even number of 1/0 bits // One uses even parity – One with an even number of one bits/even parity is incorrect // Register C should have odd parity	4

Question	Answer	Marks
10(a)	Any **four** from: – Structure **and** presentation are defined using (mark-up) tags – Structure **and** presentation dictate the appearance of the website – Structure is used for layout – Example of structure – Presentation is used for formatting / style – Example of formatting – Separate file / CSS can be used for presentation content	4
10(b)(i)	1 mark for each correct part – domain (name) – file name/webpage name	2
10(b)(ii)	Any **two** from: – Hypertext Transfer Protocol Secure // it is the access protocol // It is a protocol – It means the website uses SSL/TLS – It means data sent (to and from the webserver) is encrypted	2
10(c)	Any **two** from e.g. : – To store items that a customer has added to an online shopping basket – To store a customer's credit card details – To store log-in details – To track what product a customer browses // Track music preferences – Targeted advertising // making recommendations – Personalises/customises the experience – Shows who are new and returning customers – To speed up log-in times – To speed up/allow single click purchases – Improves the experience	2

Q 17) Summer 2018 P12

4	1 mark for each correct section:  	3
12(a)(ii)	Any **five** from: – Her personal details before encryption is the plain text – The plain text/her personal details is encrypted using an encryption algorithm – The plain text/her personal details is encrypted using a key – The encrypted text is cypher/cipher text – The key is transmitted **separately** (from the text) – The key is used to decrypt the cypher text (after transmission)	5
12(b)	Any **three** from a single error method: – Checksum – Calculation carried out on data – (checksum/calculated) value sent with data – recalculated after transmission **and** compared to original – If they do not match an error is present – ARQ – uses acknowledgment **and** timeout – A request is sent with data to acknowledge all data is received – Acknowledgement sent back to say all data is received – If no acknowledgement is received in a time frame an error in transmission detected / data automatically resent.	3

Q 18) Winter 2018 P12

Question	Answer	Marks
7	1 mark for each correct line (to a maximum of 5) Browser → A program that allows a user to view webpages Internet Service Provider (ISP) → A company that provides a connection to access the Internet Hypertext Transfer Protocol (HTTP) → The main protocol that governs the transmission of data using the Internet Uniform Resource Locator (URL) → The website address that is typed into the address bar MAC address → An address given to each device on a network. It is provided by the network IP address → A unique address given to a device on a network. It is provided by the manufacturer	5

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

Question	Answer	Marks
9(b)	Maximum of three marks per error detection method. 1 mark for naming the method, 2 marks for describing it. **Parity (check)** ∞ Odd or even parity can be used ∞ Bits are added together // 1 bits are counted ∞ Parity bit added (depending on parity set) ∞ Parity checked on receipt ∞ If parity bit is incorrect an error is detected **Checksum** ∞ Calculation performed on data (to get the checksum) ∞ Checksum sent with data ∞ Checksum recalculated after transmission ∞ Comparison made between checksum before and checksum after transmission ∞ Error detected if checksums are different **Automatic repeat request (ARQ)** ∞ Uses acknowledgement and timeout ∞ Request is sent (with data) requiring acknowledgement ∞ If no response/acknowledgment within certain time frame data package is resent ∞ When data received contains an error a request is sent (automatically) to resend the data ∞ The resend request is repeatedly sent until packet is received error free/limit is reached/acknowledgement received	9

Q 19) Winter 2018 P13

Question	Answer	Marks
2(a)	2 marks for 3 correct bits, 1 mark for 2 correct bits Parity Bit: _ _ _ _ _ _ _ **0**: 1 0 1 0 0 1 1 **0**: 1 0 1 1 1 1 1 **1**: 1 0 1 0 0 0 1	2
2(b)	**Two** from: ∞ Set of rules for controlling error checking/detection // it's an error detection method // used to detect errors ∞ Uses acknowledgement and timeout ∞ Request is sent (with data) requiring acknowledgement ∞ If no response/acknowledgment within certain time frame data package is resent ∞ When data received contains an error a request is sent (automatically) to resend the data ∞ The resend request is repeatedly sent until packet is received error free/limit is reached/acknowledgement received	2
2(c)	Checksum	1

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

Question	Answer	Marks
8(a)	Uniform Resource Locator	1
8(b)	**Four** from: ∞ The web browser sends URL to DNS ∞ DNS stores an index of URL and matching IP address ∞ DNS searches for URL to obtain the IP address ∞ IP address sent to web browser, (if found) ∞ Web browser sends request to IP of webserver ∞ Webserver sends web page to web browser ∞ Web browser interprets HTML to display web page ∞ If URL not found DNS returns error	4

Q 20) March 2019 P12

4(d)(i)	– Sending device creates value from calculation on **data** // By example – Value is transmitted with the data – Receiving device performs same calculation – Values are compared **after transmission** // If values do not match ... – ... an error is detected	5
4d(ii)	– Parity check – Check digit – Automatic repeat request	3
6(a)	**Three** from: – Universal Serial Bus – Data transmission method – Uses serial transmission // bits of data are sent one at a time – Universal standard // common interface	3
6(b)(i)	– Laser printer	1

Q 21) Summer 2019 P11

1(b)	**Four** from: • Media Access Control (address) • Used to identify a device • It is a **unique** (address) • It is a static address // It does not change • It is set by the manufacturer • The first part is the manufacturer ID/number/identifies the manufacturer • The second part is the serial number/ID	4

Q 22) Summer 2019 P12

6(a) — 4

Structure
- This is the **layout** of the web page
- e.g. placing an image alongside some text // example of tag, such as

Presentation
- This is the **formatting/style** of the web page
- e.g. the colour that is applied to some text // example of tag, such as <font-color>

6(b) — 5

1 mark per each correct row.

Statement	True (✓)	False (✓)
Cookies can be used to store a customer's credit card details	✓	
Cookies can be used to track the items a customer has viewed on a website	✓	
Cookies will corrupt the data on a customer's computer		✓
Cookies are downloaded onto a customer's computer	✓	
Cookies can be deleted from a customer's computer	✓	

6(c) — 4
- Several/multiple **bits** are transmitted **at a time/simultaneously**
- Several/multiple wires are used
- Data is transmitted in both directions …
- … at the **same time/simultaneously**

6(d) — 1

One from:
- Uniform resource locator
- The website's address
- User friendly version of the IP address

6(e)(i) — 4

Four from:
- Designed to deny people access to a website
- A large number/numerous requests are sent (to a server) …
- … all at the same time
- The server is unable to respond/struggles to respond to all the requests
- The server fails/times out as a result

6(e)(ii) — 1

One from:
- Proxy server
- Firewall

9 — 3

1 mark per each correct parity bit:

	Parity bit							
Register A	**1**	0	1	0	0	1	0	1
Register B	**1**	1	0	0	0	0	0	1
Register C	**1**	1	0	0	0	0	1	1

Q 23) Winter 2019 P13

Question	Answer	Marks
1(b)(iii)	**Six** from: ∞ The system could use odd or even parity ∞ A parity bit is added ∞ The data is checked to see if it has incorrect/correct parity // by example ∞ If parity is correct no error is found ∞ An acknowledgement is sent that data is received correctly ∞ The next packet of data is transmitted ∞ If incorrect parity is found an error has occurred ∞ A signal is sent back to request the data is resent ∞ The data is resent until data is received correctly/timeout occurs	6
1(c)(i)		6

Question	Answer	Marks
1(c)(ii)	**One** mark for identification: ∞ Compression **Three** from e.g.: ∞ Best compression would be lossy ∞ Use compression algorithm ∞ This would remove all the unnecessary data from the file // removes detail/sound that the human eye/ear may not see/hear ∞ Reduce colour palette … ∞ … so each pixel requires fewer bits ∞ Reduce resolution ∞ Only store what changes between frames // temporal redundancy	4
1(d)	**Five** from: ∞ The display is made up of pixels … ∞ … that are arranged together as a matrix ∞ Each pixel has three filters, red, blue and green ∞ Shades of colour are achieved by mixing red, blue and green ∞ The screen is backlit ∞ Light is shone through the liquid crystals ∞ The liquid crystals can be made to turn solid or transparent/on or off … ∞ … by changing the shape of the crystal	5

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

Question	Answer	Marks
5	**One** mark for each correct parity bit	3

	Parity bit							
Register A	0	0	1	0	0	0	1	1
Register B	0	0	0	0	0	1	1	1
Register C	0	0	0	0	0	0	1	1

Q 24) Winter 2019 P12

Question	Answer	Marks
7(a)	**Four** from: ∞ Membrane / matrix / circuit board present at base of keys ∞ A key is pressed that presses a switch ∞ When a key is pressed it completes a circuit // changes the current in a circuit ∞ The location of the keypress is calculated ∞ An index of characters is searched to find the corresponding keypress ∞ Each character has an ASCII / Unicode value ∞ The ASCII / Unicode value has a binary value ∞ Keypress generates an interrupt ∞ Each character / keypress is added to a buffer to wait to be processed ∞ The binary can then be processed by the CPU to action the key press	4
7(b)	**Three** from: ∞ Display a web page ∞ Sends a request to the web server ∞ Receives data from web server ∞ Translates HTML files ∞ Processes client-side script, e.g. JavaScript ∞ Store favourites ∞ Store history ∞ Navigation forward and backward ∞ Check security ∞ Store / access cookies ∞ Find specific text within a web page ∞ Downloading file from the web ∞ Allows a homepage ∞ Allows multiple tabs / web pages to be opened ∞ Stores data in its cache	3

Question	Answer	Marks
7(c)	**Three** from: ∞ Hypertext Transfer Protocol Secure // It is a protocol … ∞ … that is a set of rules/standards ∞ Secure version of HTTP ∞ Secure website // secures data ∞ Uses TLS / SSL ∞ Uses encryption	3

Question	Answer	Marks
9(a)	**One** mark per each correct tick	5

Statement	True (✓)	False (✓)
Duplex data transmission can be either serial or parallel	✓	
Duplex data transmission is when data is transmitted both ways, but only one way at a time		✓
Duplex data transmission is always used to connect a device to a computer		✓
Duplex data transmission is when data is transmitted both ways at the same time	✓	
Duplex data transmission automatically detects any errors in data		✓

9(b)	∞ Parallel data transmission	1

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Question	Answer	Marks
9(c)	**Four** from (maximum two marks per benefit): ∞ It is a universal standard … ∞ … so it is likely to be compatible with the computer ∞ It can only be inserted one way … ∞ … so there is less chance of connecting a device incorrectly ∞ It is a high-speed connection … ∞ … so data will be transmitted quicker ∞ It uses serial transmission … ∞ … so it is cheaper to manufacture/buy ∞ … less chance of skewing / errors ∞ It doesn't require a (wireless) network … ∞ … therefore, can be used if a network is down ∞ It is backwards compatible … ∞ … so no additional technology is needed ∞ It can power the device … ∞ … therefore no separate source of power is needed ∞ Drivers are automatically downloaded // device is automatically identified … ∞ … so no need to find them online / install them manually	4
10(a)	**Four** from: ∞ Validation method ∞ Used to check data entry ∞ Digit is calculated from data // by example ∞ Digit is appended / added to data ∞ Digit is recalculated when data has been input ∞ Digits are compared ∞ If digits are different, error is detected // If digits match, no error is detected	4

Q 25) March 20 P12

Question	Answer	Mark
2(a)	1 mark per each correct row:	3

Description	Method		Type		
	Serial (✓)	Parallel (✓)	Simplex (✓)	Half-duplex (✓)	Duplex (✓)
Data is sent down a single wire in a single direction only.	✓		✓		
Data is sent down multiple wires in both directions, at the same time.		✓			✓
Data is sent down a single wire in both directions, but never at the same time.	✓			✓	

Question	Answer	Mark
2(b)(i)	1 mark for each correct parity bit:	3

Binary Value							Parity Bit
1	1	0	0	1	1	1	**1**
1	0	1	0	1	0	1	**0**
0	1	1	0	1	0	0	**1**

Question	Answer	Mark
2(b)(ii)	Any **one** from: • Transposition error // bits are interchanged • Bits still add up to **even** number • **Even** number of errors has occurred	1

Question	Answer	Mark
8(a)	Any **five** from: • **Sends** the URL of the website • … to a DNS to find the IP address • Connects to the webserver (using the IP address) … • … using HTTP / HTTPS • Renders/Translates the HTML • Runs active/client-side scripts built into webpages • **Manages** SSL/TLS certificate process • Stores/retrieves cookies	5

Q 26) Summer 20 P12

Question	Answer	Marks
5(a)	Any **three** from: – Convert HTML code – Display web pages – Check if a website is secure – Request web pages from a web server – Send URL/domain name – Runs active script – Store history/favourites/bookmarks – Create tabs	3

Question	Answer	Marks
8(a)	Any **three** from: – It is a universal standard – It can't be inserted the wrong way around – Supports different transmission speeds – Automatically detects if correct driver installed	3
8(b)	**Two** marks for benefits, **one** mark for drawback Benefits: – Faster speed of printing – Can print duplex / on both sides – Many letters can be printed from one toner cartridge – Can print in high volumes Drawback – Toner cartridge more expensive to buy – More time to warm-up – Larger footprint	3

Question	Answer	Marks
8(c)(i)	Any **two** from: – Paper jam – Out of paper – Out of toner/ink – Buffer full – Awaiting input – Print complete – Printer ready Award any other valid example	2

Q 27) 15a Summer 20 P11

3(a)	Any **three** from: – It is a universal standard – It can't be inserted the wrong way around – Supports different transmission speeds – Automatically detects if correct driver installed – It will charge the mobile device at the same time	3
3(b)	– Serial	1
3(c)	– A compression algorithm is used – No data is removed in the compression process – An index/dictionary of pixels is created – The number of times a pixel is repeated in a row is stored	4
4(a)	Any **two** from: – They both calculate a value from the data – They both append the calculated value to the data – They both recalculate the value – … They both report an error if they don't match	2
4(b)	**One** mark for method, **three** marks for description: **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 timeout / limit is reached – Send acknowledgement that data is received // positive acknowledgement is used – If acknowledgement not received in set time data is resent **Parity Check** – A parity bit is added (to the parity byte) – Counts / checks number of 1's – Can be even or odd – If parity is incorrect, error is detected	4

Q 28) Winter 20 P12

1(a)	Any **one** from: – Hypertext Mark-up Language – Web authoring language // **language** used to write/create websites/web pages	**1**
1(b)(i)	– Presentation	**1**
1(b)(ii)	**One** mark per each nibble: 43 0 1 0 0 0 0 1 1 B7 1 0 1 1 0 1 1 1 F0 1 1 1 1 0 0 0 0	**6**
1(c)(i)	– Input	**1**

2(a)	**One** mark for each correct row: **8-bit binary value** / **Even (✓)** / **Odd (✓)** 11111111 / ✓ / 01100110 / ✓ / 01111011 / ✓ / 10000000 / / ✓	**4**
2(b)	Any **five** from: – A value is calculated **from the data** – The value is calculated **using an algorithm** // by example – The value is appended to the data to be transmitted – Value is recalculated after transmission – Values are compared – If the values match the data is correct // if the values do not match the data is incorrect	**5**

Q 29) Winter 20 P13

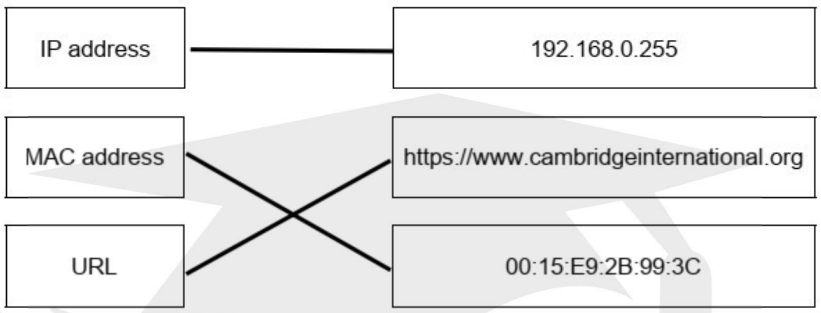
4(a)	Any **four** from: – Browsers sends URL to DNS – … using HTTP – DNS finds matching IP addresses for URL – … and sends IP address to web browser – Web browser sends request to IP address/web server for web pages – Web pages are sent from web server to browser – Browser renders HTML to display web pages – Any security certificates are exchanged/authenticated // SSL/HTTPS is used to secure the data – … encrypting any data sent	**4**
4(b)	Any **three** from: – Hacking – Denial of service (DoS) – Malware – Virus NOTE: three suitable types of malware can be awarded	**3**

5(a)	**One** mark for correct tick, **two** marks for description – Serial – Bits sent one at a time – Single wire If parallel given, no mark for parallel, but follow through for correct description of parallel: – Multiple bits sent at a time – Multiple wires	3
5(b)	Any **three** from: – Universal connection // industry standard – Can only be inserted one way – Backward compatible – Auto configures // automatically recognised devices – Can power devices – Fast data transfer speed – Inexpensive to purchase/manufacture	3
7(a)	**One** mark for each correct row: **8-bit binary value** / **Even (✓)** / **Odd (✓)** 10000001 / ✓ / 10000010 / ✓ / 00101001 / / ✓ 00101000 / ✓ /	4
7(b)	Any **one** from: – Transposition error – When bits still add up to odd/even number – **Even** number of incorrect bits	1
7(c)	Any **one** from: – ARQ – Checksum	1

Q 30) March 20 P12

1(d)(i)	Any **three** from: – More **accurate/reliable/efficient** over long distances – Less chance of interference / cross talk – …that will skew / distort the data // less likely to get errors – Data will arrive in order – Serial is cheaper to **purchase/install/maintain**	**3**
1(d)(ii)	– Transmission in both directions … – …not at the same time // asynchronous	**2**
1(d)(iii)	Any **three** from: – Calculates a value from the bits/data (to be transferred) // by example/description – Value is appended to the bits/data – Value is transferred with the bits/data – Receiver recalculates the checksum – If both values are different error is detected // if both values are the same the transmission is successful	**3**

2(a)	Any **three** from: – A compression algorithm is used – Data will be lost/deleted **permanently** // original file cannot be recreated – Reduce the range of colours used / colour depth / bits per pixel – Reduce the number of pixels / image resolution removes data that will not be noticed by the user // removes unnecessary data	**3**

2(b)	1 mark for 1 line, 2 marks for 3 lines 	**2**