2 The TCP/IP protocol suite can be viewed as a stack with **four** layers.

(a) Complete the stack by inserting the names of the **three** missing layers.

Application layer

[3]

(b) BitTorrent is a protocol used at the Application layer for the exchange of data.

(i) State the network model used with this protocol.

..... [1]

(ii) State the use of BitTorrent.

..... [1]

(iii) Explain how applications use BitTorrent to exchange data.

.....

.....

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..... [4]

(c) State **two** other protocols that are used at the Application layer for the exchange of data.

For each protocol, give a different example of an appropriate exchange of data.

Protocol 1 .....

Example .....

.....

Protocol 2 .....

Example .....

.....

[4]

6 **(a)** Explain how packet switching is used to transfer messages across the internet.

.....

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.....

..... [5]

(b) Outline the function of a router in packet switching.

.....

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..... [3]

8 **(a)** Describe the purpose of the Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols.

.....

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.....

.....

..... [2]

(b) Explain how SSL/TLS protocols are used when a client-server communication is initiated.

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..... [4]

2 **(a)** Complete the diagram to show how the layers of the TCP/IP protocol are related.

Choose from the terms: Internet Layer, Presentation Layer, Data Link Layer, Application Layer, Transport Layer.

Network Access Layer

[3]

(b) Give the names of **two** LAN network technologies that the Network Access Layer has to interface with.

Network technology 1: .....

Network technology 2: ..... [2]

One layer of the protocol makes use of IP addresses. An IP address is a 32-bit number; for example, 205.123.4.192 is an IP address.

Part of the IP address is used for the network ID, and part of the address is used for the host ID.

(c) **(i)** Explain the terms:

network ID: .....

.....

host ID: .....

..... [2]

Most IP addresses fall into one of three classes:

- If the 32-bit address starts with a 0 bit, the address is a Class A address.
- If the 32-bit address starts with the bits 10, the address is a Class B address.
- If the 32-bit address starts with bits 110, the address is a Class C address.

(ii) Show how to determine whether 205.123.4.192 is a Class A, Class B or Class C address.

.....

.....

.....

..... [2]

(iii)
- In a Class A address, the first byte represents the network ID and the remaining three bytes represent the host ID.
- In a Class B address, the first two bytes represent the network ID and the remaining two bytes represent the host ID.
- In a Class C address, the first three bytes represent the network ID and the remaining byte represents the host ID.

For the address 205.123.4.192 state the:

network ID: .....

host ID: ..... [2]

2 The TCP/IP protocol suite can be viewed as a stack with **four** layers.

(a) Write the correct descriptions for the **two** layers **and** the correct layers for the **two** descriptions given in the following table.

Layer	Description
Application	
	Handles forwarding of packets
Internet / Network	
	Handles how data is physically sent

[4]

(b) (i) Explain why communication protocols are necessary.

.....

.....

.....

..... [2]

(ii) Identify **and** describe **one other** communication protocol. State its purpose.

Protocol .....

Description .....

.....

Purpose .....

.....

[3]

3 Describe, with the aid of a diagram for each one, the bus and star network topologies.

Bus

Description .....

.....

.....

.....

.....

.....

Star

Description .....

.....

.....

.....

.....

.....

[6]

3 **(a)** Describe, with the aid of a diagram, a bus topology network.

Description .....

.....

.....

.....

.....

..... [3]

(b) Describe the way in which a bus network uses Ethernet technology for communication.

.....

.....

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..... [4]

3 The use of the TCP/IP protocol suite is essential for successful communication over the Internet.

(a) (i) Describe the TCP/IP protocol suite.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) A group of over 100 students has produced a movie. The size of the movie file is very large.

The students would like to use peer-to-peer file sharing to share this file with friends and family.

Identify the **most appropriate** TCP/IP protocol for sharing this file over the Internet **and** describe the way this protocol works.

Protocol .....

Description .....

.....

.....

.....

.....

.....

.....

.....

[5]

(b) (i) Files shared over the Internet are sent using packet switching or circuit switching methods.

Identify **and** describe the **most suitable** method for the large movie file from **part (a)(ii)**.

Method .....

Description .....

.....

.....

.....

.....

.....

.....

[4]

(ii) State **one** benefit and **one** drawback of the method you identified in **part (b)(i)**.

Benefit .....

.....

Drawback .....

.....

[2]

3 The use of protocols is essential for successful communication between computers.

(a) Define the term **communication protocol**.

.....

.....

..... [2]

(b) Identify **two** protocols that are used in the transfer of emails **and** state the purpose of each protocol.

Protocol 1 .....

Purpose .....

.....

Protocol 2 .....

Purpose .....

.....

[4]

(c) Manav and Miora want to have a video conversation over the Internet using a dedicated connection.

(i) Identify **and** describe the switching method used to implement this connection.

Method .....

Description .....

.....

.....

.....

.....

[3]

(ii) State **one** benefit and **one** drawback of the method you identified in **part (c)(i)**.

Benefit .....

.....

Drawback .....

.....

[2]

3 A mobile phone company uses circuit switching for voice calls and packet switching to send and receive other data.

(a) (i) Describe circuit switching.

.....

.....

.....

.....

.....

..... [3]

(ii) Explain why the company uses circuit switching for voice calls.

.....

.....

.....

..... [2]

(b) (i) Describe packet switching.

.....

.....

.....

.....

.....

..... [3]

(ii) Explain why the company uses packet switching to send and receive other data.

.....

.....

.....

..... [2]

3 Protocols are essential for communication between computers.

(a) Explain why protocols are essential for communication between computers.

.....

.....

.....

.....

..... [2]

(b) A protocol used in bus networks is CSMA/CD.

Explain what is meant by **CSMA/CD**.

.....

.....

.....

.....

.....

.....

.....

..... [4]

5 **(a)** Explain why user-defined data types are necessary.

.....

.....

.....

..... [2]

(b) An organisation stores data about its employees.

- Employee ID is a five-digit number, for example, 01234.
- Employee name is a string, for example, 'Kiri Moana'.
- Department is one of three values: Sales, Technical, Customer services.
- Salary is an integer value in the range 25 000 to 150 000.

(i) Complete the following **pseudocode** definition of a user-defined data type to store the employee data.

```
TYPE Employee

  DECLARE EmployeeID   :  .....
  DECLARE EmployeeName :  STRING
  DECLARE Department   :  ( .....
                             .....)
  DECLARE Salary       :  25000..150000
```

.....

[4]

(ii) Write a **pseudocode** statement to declare a variable, `NewEmployee` of data type `Employee`.

.....

..... [1]

(iii) Write a **pseudocode** statement that assigns `02244` to the `EmployeeID` of `NewEmployee`.

.....

..... [1]

(iv) `Employee` is an example of a record that is a composite data type.

State **two** other composite data types.

1 .....

2 .....

[2]

7 **(a)** Identify the **four** layers of the TCP/IP protocol suite.

1 .....

2 .....

3 .....

4 .....

[4]

(b) The TCP/IP protocol suite is responsible for transmitting data across the Internet using packet switching.

(i) Explain why packet switching is used when sending data across the Internet.

.....

.....

.....

..... [2]

(ii) Each packet requires a header.

Describe the purpose of a packet header.

.....

.....

.....

..... [2]

(iii) Identify **three** items that should be contained in a packet header.

Item 1 .....

.....

Item 2 .....

.....

Item 3 .....

.....

[3]

[Turn over

3 A computing department in a school has a Local Area Network (LAN) with a bus topology.

(a) A description of sending a message on a bus network is given.

Complete the following description by inserting an appropriate term in each space.

Computer 1 and Computer 2 are on the same bus network. Computer 1 sends a message to Computer 2. Before the message is sent, it is split into ..... .

Computer 1 needs to check that the ..... is free, before sending the message, otherwise a ..... will occur that will be managed by the ..... protocol.

[4]

(b) The computing department's LAN needs to connect to the Internet.

Explain how each device is used in the operation of the bus network.

Router .....

.....

.....

.....

Network Interface Card (NIC) .....

.....

.....

.....

[4]

(c) The computing department's network is being adapted to allow students to connect wireless devices.

(i) Identify **two** types of hardware components the computing department will need to allow wireless connection.

1 .....

2 .....
[2]

(ii) Describe how the wireless connection sends and receives data.

.....

.....

.....

.....

.....

.....

.....

..... [4]

2 Cables connect the computers in a university admissions department in a star topology. The server room contains the server and printer for the employees to use. The department has three employees. Each employee has a computer connected to the star network.

(a) (i) Draw a diagram to show this topology.

[3]

(ii) Explain the benefits to the admissions department of using a star topology.

.....

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.....

..... [4]

(b) Each department of the university has its own network. All the department networks connect to the university's main Local Area Network (LAN). The LAN has a bus topology and uses the CSMA/CD protocol.

Describe the CSMA/CD protocol.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Explain how the following devices are used to support the university LAN.

(i) Router .....

.....

.....

..... [2]

(ii) Network Interface Card (NIC) .....

.....

.....

..... [2]

(iii) Wireless Access Point .....

.....

.....

..... [2]

3 A local college has CSMA/CD in operation on its Local Area Network (LAN).

(a) One function of CSMA/CD is to monitor traffic on the network.

State **two** other tasks performed by CSMA/CD.

1 .....

2 .....

[2]

(b) The network uses the TCP/IP protocol to transfer files across the network.

(i) State **three** functions of the **TCP** part of this protocol.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) State **two** functions of the **IP** part of this protocol.

1 .....

2 .....

[2]

(iii) Identify **one** other common protocol that could be used to transfer files across the college network.

.....[1]

(c) Protocols are essential for successful transmission of data over a network. The TCP/IP protocol suite operates on many layers.

Give an appropriate protocol for each layer in the table.

Layer	Protocol
Application	
Transport	
Internet	

[3]

(d) The TCP/IP protocol is used to send an email message from one node on a LAN to a node on a different LAN.

State the steps that take place when the email message is sent and received.

.....

.....

.....

.....

.....

.....

.....

.....[4]

2 **(a)** A network can be set up using a star topology.

Give **three** features of a star topology.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) **(i)** Describe what is meant by **circuit switching**.

.....

.....

.....

.....[2]

(ii) The table shows statements that relate to circuit switching, packet switching or both.

Tick (✓) **one or more** boxes in each row to show whether the statement applies to circuit switching, packet switching or both.

Statements	Circuit switching	Packet switching
Shares bandwidth		
Data may arrive out of order		
Data can be corrupted		
Data are less likely to get lost		

[4]

(d) Describe **two** different composite data types.

Data type 1 .....

Description .....

.....

.....

Data type 2 .....

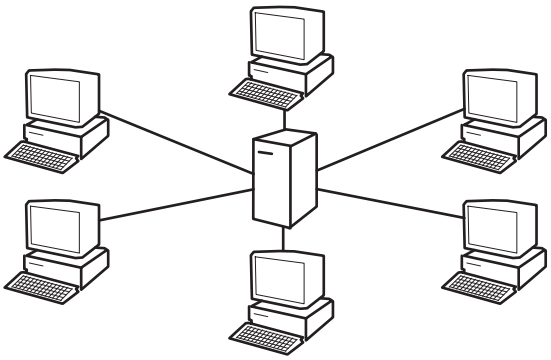
Description .....

.....

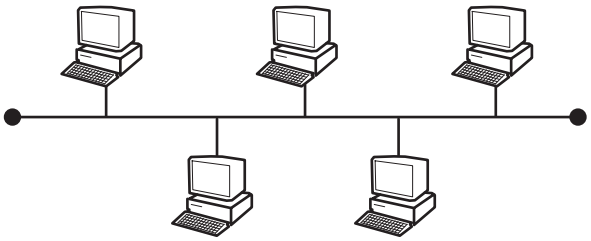
.....

[4]

3 Star and bus are two types of topology that can be used in a Local Area Network (LAN).



Star topology



Bus topology

(a) (i) State **one** benefit and **one** drawback of the star topology.

Benefit .....

.....

Drawback .....

.....

[2]

(ii) State **one** benefit and **one** drawback of the bus topology.

Benefit .....

.....

Drawback .....

.....

[2]

(b) The sequence of steps 1 to 7 describes what happens when the LAN transmits data from Computer X to Computer Y using circuit switching. Four statements (4 to 7) are missing from the sequence.

A	Computer X sends the data.
B	The sender signals node to deallocate resources.
C	Computer Y sends a receipt signal.
D	If available, Computer X sets up path between nodes.

Write **one** letter (**A** to **D**) in the appropriate space to complete the sequence.

1 Computer X sends a connection request to Computer Y.

2 Computer Y sends ready or busy signal.

3 If busy, Computer X waits and then resends the connection request to Computer Y.

4 ……

5 ……

6 ……

7 ……

[3]

(c) **(i)** Protocols are essential for successful transmission of data over a network. The TCP/IP protocol suite operates on many layers.

State the appropriate layer for each protocol in the following table.

Protocol	Layer
TCP	
IP	
SMTP	

[3]

(ii) Peer-to-peer (P2P) file sharing uses the BitTorrent protocol.

Explain how the BitTorrent protocol allows files to be shared.

.....

.....

.....

.....

.....

.....[3]

(b) Find the denary value for the following binary floating-point number.

Mantissa							
1	0	1	1	0	0	0	0

Exponent			
1	1	1	0

Show your working.

Working .....

.....

.....

.....

.....

Answer .....

[3]

4 The TCP/IP protocol suite is used on the Internet.

(a) The table has statements about transmitting data across the Internet.

Put a tick (✓) in each row to identify whether the responsibility belongs to TCP or IP.

Responsibility	TCP	IP
Correct routing		
Host to host communication		
Communication between networks		
Retransmitting missing packets		
Reassembling packets into the correct order		

[5]

(b) Identify **two** other internet protocols. State a use for each protocol.

Protocol 1 .....

.....

Use .....

.....

Protocol 2 .....

.....

Use .....

.....
[4]

(c) State the name of the TCP/IP layer that uses IP addresses.

.....[1]

(d) Emails are transmitted across the Internet using packet switching and routing tables.

(i) Give **four** items of data in an IP data packet.

1 .....

2 .....

3 .....

4 .....
[4]

(ii) Describe **two** benefits of using packet switching.

Benefit 1 .....

.....

.....

.....

Benefit 2 .....

.....

.....

.....
[4]

(iii) Give **two** items of data stored in a routing table.

1 .....

2 .....
[2]

1 A Local Area Network (LAN) consists of three computers, one server and a switch. The LAN uses a star topology.

(a) Complete the following diagram to show how the computers, the server and the switch could be connected.

[1]

(b) There are four statements in the following table. For each statement, place a tick (✓) in the appropriate column to indicate whether it is true or false.

Statement	True	False
The server can send packets to Computer B and Computer C at the same time.		
The network software on each computer needs to include collision detection and avoidance.		
Computer B can read a packet sent from the server to Computer C.		
Computer A can send a packet to Computer B and at the same time the server can be sending a packet to Computer C.		

[4]

(c) The LAN shown in **part (a)** will be connected to the Internet.

(i) A router will be attached to one of the devices on the LAN.

State the device used. Give a reason for your choice.

Device .....

Reason .....

.....

..... [2]

(ii) Explain why a router is required.

.....

.....

.....

..... [2]

(iii) After the router has been connected, Computer A sends several packets to an internet web server.

Explain how the packets are transmitted from the router to the web server.

.....

.....

.....

.....

.....

..... [3]

2 **(a)** The following diagram shows four descriptions and four types of computer architecture.

Draw lines to connect each description to the appropriate computer architecture.

Description	Computer architecture
Most parallel computer systems use this architecture.	SIMD
Widely used to process 3D graphics in video games.	MIMD
A microprocessor is used to control a washing machine.	MISD
There are a number of processing units. Each processing unit executes the same instruction but on different data.	SISD

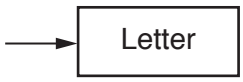
[4]

(c) The definition of <variable> is changed to allow:

- one or two letters and
- zero, one or two digits.

Draw an updated version of the syntax diagram for <variable>.

Variable



[2]

(d) The definition of <assignment_statement> is altered so that its syntax has <unsigned_integer> replaced by <real>.

A real is defined to be:

- at least one digit before a decimal point
- a decimal point
- at least one digit after a decimal point.

Give the BNF for the revised <assignment_statement> and <real>.

<assignment_statement> ::= .....

.....

<real> ::= .....

.....

[2]

4 The Secure Socket Layer (SSL) protocol and its successor, the Transport Layer Security (TLS) protocol, are used in Internet communications between clients and servers.

(a) (i) Define the term **protocol**.

.....

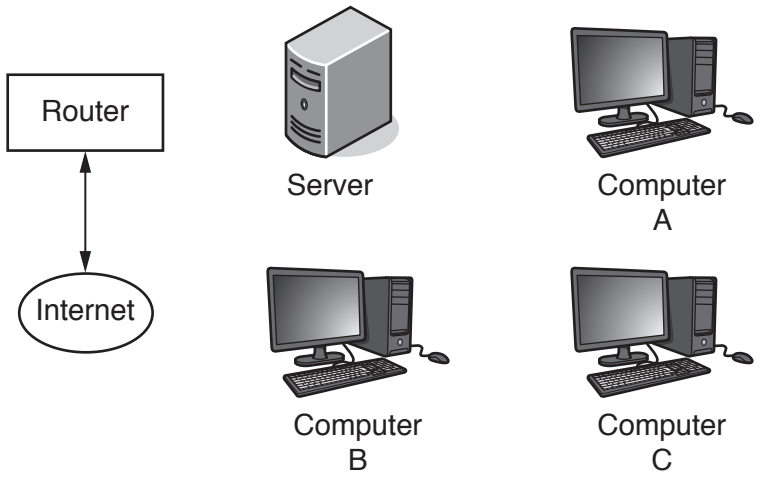
.....

.....

..... [2]

1 A Local Area Network (LAN) consists of three computers, one server and a router connected to the Internet. The LAN uses a bus topology.

(a) Complete the following diagram to show how the computers, the server and the router could be connected.



[2]

(b) There are four statements in the following table. For each statement, place a tick (✓) in the appropriate column to indicate whether it is true or false.

Statement	True	False
The server can send packets to Computer B and the router at the same time.		
Computer C uses the IP address of a web server to send a request for a web page on the web server.		
Computer B can read a packet sent from Computer A to Computer C.		
The server can read all incoming packets from the Internet.		

[4]

(c) The user on Computer A and the user on Computer B are both using the Internet at the same time. On a few occasions, Computer A and Computer B start transmitting packets to the router at exactly the same time. This causes a problem called a collision.

(i) Explain what is meant by a **collision** in this context.

.....

.....

.....

.....[2]

(ii) As a result of the collision, both Computer A and Computer B stop transmitting.

Computer A must carry out a number of steps to ensure the successful transmission of its packet.

Give **two** of the steps.

Step 1 .....

Step 2 .....
[2]

(d) The LAN topology is redesigned.

(i) Describe the changes that could be made to the LAN topology to overcome the problem identified in **part (c)**.

.....

.....

.....

.....[2]

(ii) Explain how the redesign has overcome the problem.

.....

.....

.....

.....[2]

5 **(a)** A web browser is used to request and display a page stored on an internet web server.

Explain how each of the following items is used in this event.

(i) Packet: .....

.....

.....

.....[2]

(ii) Router: .....

.....

.....

.....[2]

(iii) TCP/IP: .....

.....

.....

.....[2]

(b) The Internet can be used for video conferencing. Data can be transmitted over the Internet using either packet switching or circuit switching.

(i) State **two** problems that could arise if video conferencing were to use packet switching.

Problem 1 .....

.....

Problem 2 .....

.....

[2]

(ii) Explain what is meant by **circuit switching**.

.....

.....

.....

.....[2]

(iii) Explain how the use of circuit switching overcomes the problems you have identified in **part (i)**.

.....

.....

.....

.....

.....

.....[3]

6 A computer system is used to manage some of the functions in a vehicle. The vehicle has a number of sensors and actuators. One sensor is used to monitor the moisture on the screen. If the moisture exceeds a pre-set value, the windscreen wiper motor turns on automatically.

The software used in the computer system is dedicated to the sensor management functions. When the system starts, the software runs some initial tasks. It then loops continuously until the system is switched off.

(a) (i) State the name given to the type of system described.

.....[1]

(ii) Explain your answer to **part (i)**.

.....

.....[1]

(b) Within the software loop, the value of each sensor is read in turn. The value read from the sensor is then processed.

State **two** drawbacks with this method of reading and processing sensor data.

Drawback 1 .....

.....

Drawback 2 .....

.....

[2]

5 The TCP/IP protocol suite can be viewed as a stack with four layers.

(a) Complete the stack by inserting the names of the three missing layers.

Application layer

[3]

(b) BitTorrent is a protocol used at the Application layer for the exchange of data.

(i) State the network model used with this protocol.

.....[1]

(ii) State the use of BitTorrent.

.....[1]

(iii) Explain how the exchange of data is achieved using BitTorrent.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(c) State **two** additional protocols that are also used at the Application layer for the exchange of data.

For each protocol, give an example of an appropriate exchange of data.

Protocol 1 .....

Example .....

.....

Protocol 2 .....

Example .....

.....

[4]

5 The TCP/IP protocol suite can be viewed as a stack with four layers.

(a) (i) Complete the stack by inserting the names of the three missing layers.

[3]

(ii) State how each layer of the stack is implemented.

..... [1]

(b) A computer is currently running two processes:

- Process 1 is downloading a web page.
- Process 2 is downloading an email.

(i) Describe **two** tasks that the Transport layer performs to ensure that the incoming data is downloaded correctly.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [4]

(ii) Name a protocol that will be used by Process 1.

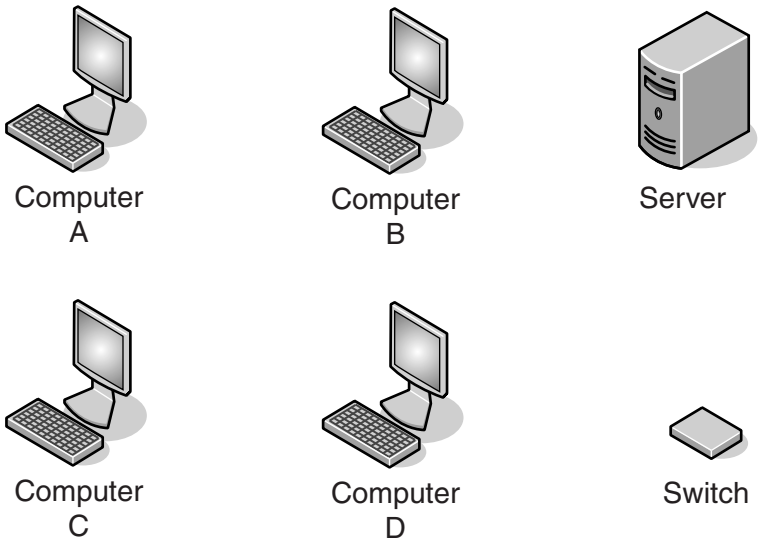
..... [1]

(iii) Name a protocol that will be used by Process 2.

..... [1]

6 A Local Area Network (LAN) consists of four computers, one server and a switch. The LAN uses a star topology.

(a) Complete the diagram below to show how to connect the devices.



[2]

(b) The LAN uses packets to transfer data between devices.

Three statements are given below.

Tick (✓) to show whether each statement is true or false.

Statement	True	False
All packets must be routed via the server.		
Computer B can read a copy of the packet sent from the Server to Computer A.		
No collisions are possible.		

[3]

(c) In the same building as this star network, there is another star network.

(i) Name the device needed to connect the two networks together.

..... [1]

(ii) Explain how the device in **part (c)(i)** decides whether to transfer a packet from one network to the other.

.....

.....

.....

..... [2]

(c) Computer A starts transmitting a packet to Computer C. At exactly the same time, the File server starts transmitting a packet to Computer D. This causes a problem.

(i) State the name given to this problem.

.....

.....[1]

(ii) Give **three** steps taken by both Computer A and the File server to allow them to transmit their packets successfully.

Step 1 .....

.....

Step 2 .....

.....

Step 3 .....

.....[3]

(d) Adding a switch to the LAN changes its topology. Explain how the use of a switch removes the problem identified in **part (c)(i)**.

.....

.....

.....

.....

.....

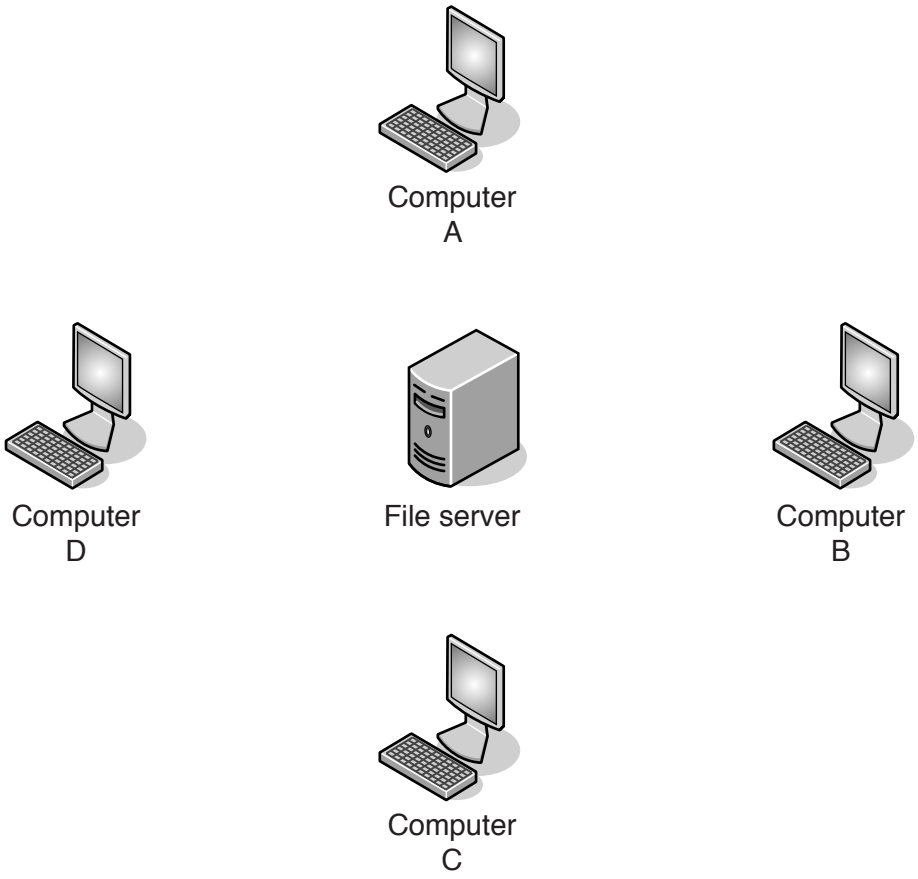
.....

.....

.....[4]

1 A Local Area Network (LAN) consists of four computers and one server. The LAN uses a bus topology.

(a) Complete the diagram below to show how the computers and the File server could be connected.



[2]

(b) Computer C sends a data packet to Computer A.

Three statements are given below.

Tick (✓) to show whether each statement is true or false.

Statement	True	False
Computer C uses the IP address of Computer A to indicate that the packet is for Computer A.		
Computer B can read the packet sent from Computer C to Computer A.		
The File server routes the packet to Computer A.		

[3]

(c) Computer A starts transmitting a packet to Computer C. At exactly the same time, the File server starts transmitting a packet to Computer D. This causes a problem.

(i) State the name given to this problem.

.....

.....[1]

(ii) Give **three** steps taken by both Computer A and the File server to allow them to transmit their packets successfully.

Step 1 .....

.....

Step 2 .....

.....

Step 3 .....

.....[3]

(d) Adding a switch to the LAN changes its topology. Explain how the use of a switch removes the problem identified in **part (c)(i)**.

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.....[4]

3 An email is sent from one email server to another using packet switching.

(a) State **two items** that are contained in an email packet apart from the data.

1 .....

2 .....[2]

(b) Explain the role of routers in sending an email from one email server to another.

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.....[3]

(c) Sending an email message is an appropriate use of packet switching.

Explain why this is the case.

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.....[2]

(d) Packet switching is not always an appropriate solution.

Name an alternative communication method of transferring data in a digital network.

.....[1]

(e) Name an application for which the method identified in **part (d)** is an appropriate solution. Justify your choice.

Application .....

Justification .....

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.....[3]

3 **(a)** Explain what is meant by circuit switching.

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.....[2]

(b) There are many applications in which digital data are transferred across a network. Video conferencing is one of these.

For this application, circuit switching is preferable to the use of packet switching.

Explain why this is so.

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.....[6]

(c) A web page is transferred from a web server to a home computer using the Internet.

Explain how the web page is transferred using packet switching.

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.....[3]

2 **(a)** Four descriptions and three types of local area network (LAN) are shown below.

Draw a line to connect each description to the type of LAN it applies to.

Description	Type of LAN
Any packet the listening computer receives may be part of a message for itself	Bus with terminators at each end
Connection provided through an access point	Star
A process for handling collisions has to be implemented	Wireless
Listening computer only receives packets that are addressed to itself	

[4]

(b) A user downloads a file using the FTP protocol.

Explain the function played by each of the following:

(i) Server .....

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.....[2]

(ii) Command .....

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.....[2]

(iii) Anonymous .....

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.....[2]

6 **(a)** Four descriptions and three protocols are shown below.

Draw a line to connect each description to the appropriate protocol.

Description	Protocol used
email client downloads an email from an email server	HTTP
email is transferred from one email server to another email server	POP3
email client sends email to email server	SMTP
browser sends a request for a web page to a web server	

[4]

(b) Downloading a file can use the client-server model. Alternatively, a file can be downloaded using the BitTorrent protocol.

Name the model used.

.....[1]

(c) For the BitTorrent protocol, explain the function of each of the following:

(i) Tracker .....

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.....[2]

(ii) Seed .....

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.....[2]

(iii) Swarm .....

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