0 1 . 1 A company is setting up a computer network to help manage its business.

The company sets up a computer that will act as a server. The server's primary role will be to act as an email server. It will also allow technicians to remotely login so that the server can be managed from other computers.

State the names of **two application layer** protocols that the server must implement and explain what each will be used for.

[4 marks]

Protocol 1: _____

Use: _____

_____

_____

Protocol 2: _____

Use: _____

_____

_____

0 1 . 2 Explain how the **transport layer** of the TCP/IP stack determines which application layer software on the server should deal with a received request.

[1 mark]

_____

_____

_____

_____

0 1 . 3 Describe **one** function of the **network layer** of the TCP/IP stack.

[1 mark]

_____

_____

_____

_____

0 2 An estate agency makes details of the properties that it has for sale available to potential customers through a website. The details of the properties and other data that are useful to the agency are stored in a relational database.

The individual web pages about specific properties that a customer can view are generated dynamically by a program from the data in the database.

A client-server system, which uses CRUD and REST, is used to provide details of properties in a web page that is being viewed in a web browser on a client computer.

Figure 3 shows the structure of the relations in the database.

Figure 3

Property(PropertyID, HouseNum, Street, Area, Postcode, Bedrooms, Bathrooms, AskingPrice, SellerID)

Seller(SellerID, Title, Forename, Surname, Telephone)

Buyer(BuyerID, Title, Forename, Surname, Telephone, DesiredArea, MinBedrooms, MaxPrice)

Viewing(BuyerID, PropertyID, ViewingDate, ViewingTime)

Sale(SaleID, PropertyID, BuyerID, SalePrice)

- The Property relation stores details of the properties that are for sale. This includes the number of bedrooms and the number of bathrooms that a property has.
- The Seller relation stores details of people who are selling the properties.
- The Buyer relation stores details of the people who are looking to buy a property and information about the type of property they want, including the area that they want to live in, the minimum number of bedrooms that they need in a property and the maximum price that they are prepared to pay.
- An entry is made in the Viewing relation whenever a buyer arranges to look at a property.
- An entry is made in the Sale relation whenever a property is sold to a buyer. The SalePrice may be different to the AskingPrice for the property.

0 2 . 1 The list below contains four statements about the principles of CRUD and REST. One of these statements is false.

Shade **one** lozenge to indicate which statement is **false**.

[1 mark]

A CRUD is an acronym for Create, Retrieve, Update, Delete. ⬭

B REST allows JavaScript to communicate with the server using the HTTP protocol. ⬭

C The database is connected to the web browser using REST. ⬭

D The REST API will be created and run on the client computer. ⬭

An SQL query is executed to retrieve some details about properties with at least four bedrooms in a particular area. The following two records are found:

PropertyID	HouseNum	Street	Bedrooms
8026	12	Chester Drive	4
9034	23a	Castle Street	5

These records could be sent from the server to the client using XML or JSON.

Figure 4 shows the query results encoded using each of these methods.

Figure 4

Representation 1

```
{"Properties":[
  { "PropertyID": 8026,
    "HouseNum": "12",
    "Street": "Chester Drive",
    "Bedrooms": 4 },
  { "PropertyID": 9034,
    "HouseNum": "23a",
    "Street": "Castle Street",
    "Bedrooms": 5 }
]}
```

Representation 2

```
<Properties>
  <Property>
    <PropertyID>8026</PropertyID>
    <HouseNum>12</HouseNum>
    <Street>Chester Drive</Street>
    <Bedrooms>4</Bedrooms>
  </Property>
  <Property>
    <PropertyID>9034</PropertyID>
    <HouseNum>23a</HouseNum>
    <Street>Castle Street</Street>
    <Bedrooms>5</Bedrooms>
  </Property>
</Properties>
```

0 2 . 2 Shade **one** lozenge to identify the method of encoding used by **Representation 2**.

[1 mark]

A JSON ⬭

B XML ⬭

0 2 . 3 State **two** reasons why it could be argued that JSON is better than XML.

[2 marks]

Reason 1 _____

_____

_____

Reason 2 _____

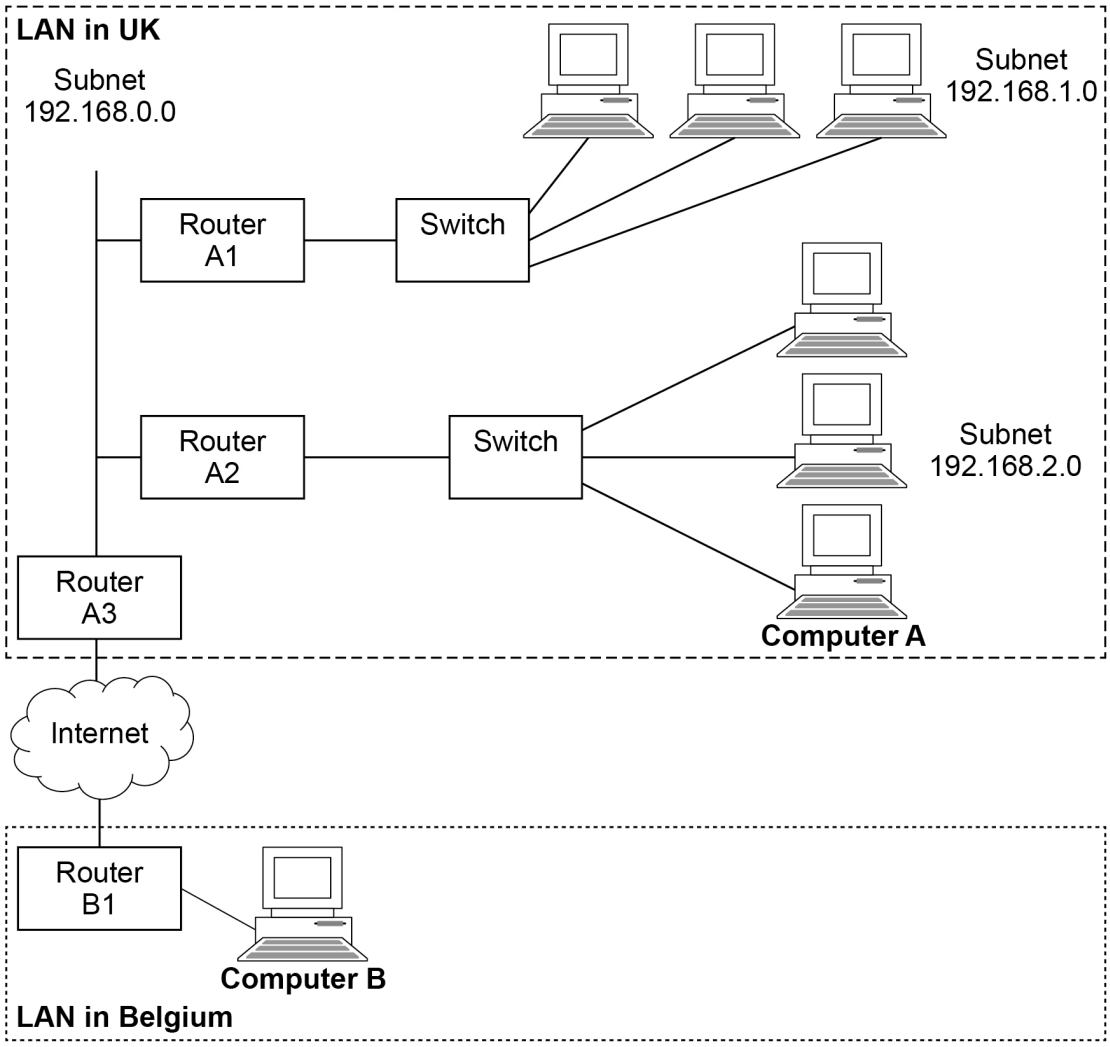
_____

_____

0 3 **Figure 5** shows a computer (**Computer A**) which is located on a LAN in the UK. It is connected, via the Internet, to an email server (**Computer B**) which is located on a LAN in Belgium.

Computer A has IP address 192.168.2.3 and **Computer B** has the public IP address 141.134.27.8

Figure 5



0 3 . 1 The computers on subnet 192.168.2.0 have been configured using the DHCP system.

State **one** advantage of using the DHCP system.

[1 mark]

0 3 . 2 **Computer A** has the IP address 192.168.2.3

Many other computers connected to the Internet have the same IP address.

Explain how two or more computers connected to the Internet can have the same IP address and still communicate with each other.

[2 marks]

0 3 . 3 A packet of data is to be transmitted across the Internet from **Computer A** in the UK to **Computer B** in Belgium. A checksum will be used to attempt to detect if any errors have occurred during the transmission.

Explain how:

- **Computer A** will use a subnet mask to determine whether or not it can send the packet directly to **Computer B** across the LAN or if the packet must be sent via the Internet
- the packet will be routed across the Internet
- the checksum can be used to determine if the received packet has been changed during the transmission.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response.

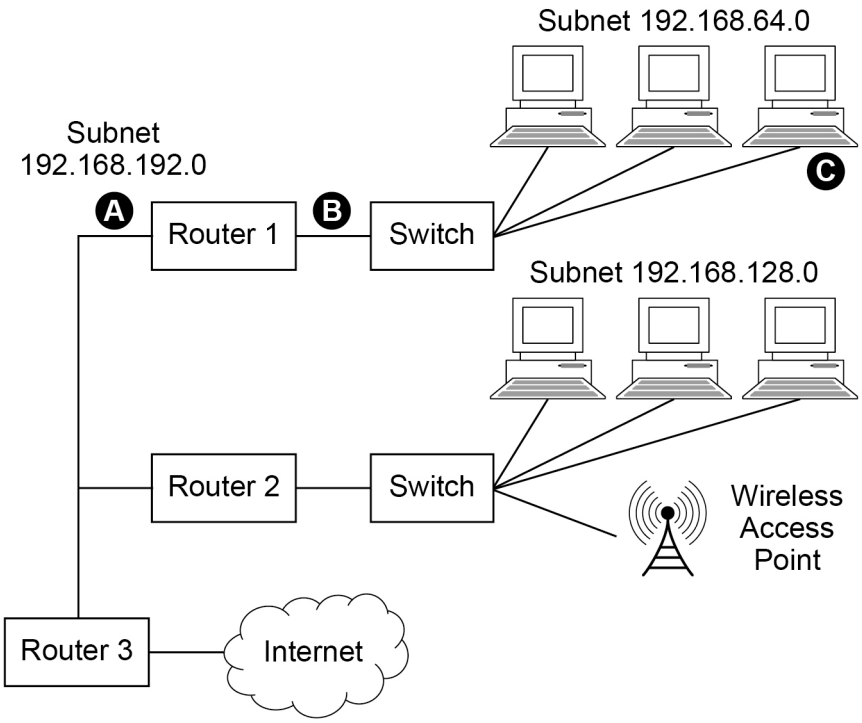
[12 marks]

0 4 Describe what thin-client computing is **and** explain **two** reasons why a thin-client system might be chosen in preference to a thick-client system.

[3 marks]

0 5 **Figure 8** shows a computer network. The devices connected to the network are identified using IPv4 addresses. When assigning IP addresses, 20 bits have been allocated to the Network IDs (also known as Subnet IDs or subnet addresses) and 12 bits have been allocated to the Host IDs.

Figure 8



0 5 . 1 State suitable IP addresses for:

[3 marks]

The Router 1 port labelled A _____

The Router 1 port labelled B _____

The computer labelled C _____

0 5 . 2 Shade **one** lozenge to indicate which of the following four subnet masks is the one that has been assigned to the devices connected to the network in **Figure 8**.

[1 mark]

A 255.255.0.0 ⬭

B 255.255.15.0 ⬭

C 255.255.240.0 ⬭

D 255.255.255.0 ⬭

0 5 . 3 The devices on the network in **Figure 8** use IPv4.

State **one** reason why IPv6 has been introduced to replace IPv4.

[1 mark]

0 5 . 4 State the name of the physical topology used in subnet 192.168.64.0 in **Figure 8**.

[1 mark]

0 5 . 5 Laptop computers and other devices can connect to the network via the wireless access point. The wireless connection uses the CSMA/CA protocol with Request to Send/Clear to Send (RTS/CTS).

A laptop connected to the wireless access point has data to send to another computer.

Explain how the CSMA/CA protocol with RTS/CTS will be used during this transmission.

[6 marks]

0 6 Compare the hardware requirements of thin-client and thick-client computing systems.
[3 marks]

0 7 . 1 Shade **one** lozenge on the row that correctly shows how REST enables CRUD to be mapped to database functions using SQL.

[1 mark]

A GET→FETCH, POST→CREATE, DELETE→DELETE, PUT→UPDATE ⬭

B GET→SELECT, POST→INSERT, DELETE→DELETE, PUT→UPDATE ⬭

C GET→SELECT, POST→INSERT, DELETE→DELETE, PUT→CREATE ⬭

D GET→SELECT, POST→UPDATE, DELETE→DELETE, PUT→INSERT ⬭

E GET→UPDATE, POST→SELECT, DELETE→DELETE, PUT→CREATE ⬭

0 7 . 2 JSON is used to encode datasets when they are passed between the server and the booking application. **Figure 6** shows an example of how data about some films can be encoded using JSON.

Figure 6

```
{"Films":[
  { "FilmID": 4301,
    "FilmName": "Alien Doomsday",
    "Duration": 106,
    "Certificate": "12A" },
  { "FilmID": 2098,
    "FilmName": "Tom's Amazing Adventure",
    "Duration": 84,
    "Certificate": "U" }
]}
```

State **two** reasons why JSON might have been chosen to encode the data instead of XML, assuming that the software supports both methods.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

0 8 An email is being sent from User A on Computer A to User B on Computer B.

0 8 . 1 Describe the role that will be played by the transport layer of the TCP/IP stack in the transmission of the email from Computer A to an email server.

[3 marks]

0 8 . 2 State the name and purpose of **two** application layer protocols that will be used to transfer the email from Computer A to Computer B.

Each protocol must have a different purpose.

[4 marks]

Protocol 1 name _____

Protocol 1 purpose _____

_____

_____

Protocol 2 name _____

Protocol 2 purpose _____

_____

_____

0 8 . 3 The email servers involved in the transmission of the email use well-known ports.

Explain what a well-known port is **and** why an email server must use one.

[2 marks]

What a well-known port is _____

_____

_____

_____

Why an email server uses a well-known port _____

_____

_____

_____

0 9 . 1 A company uses a file server that stores files on magnetic hard disk drives. These files can be accessed by other computers through a network.

Describe:

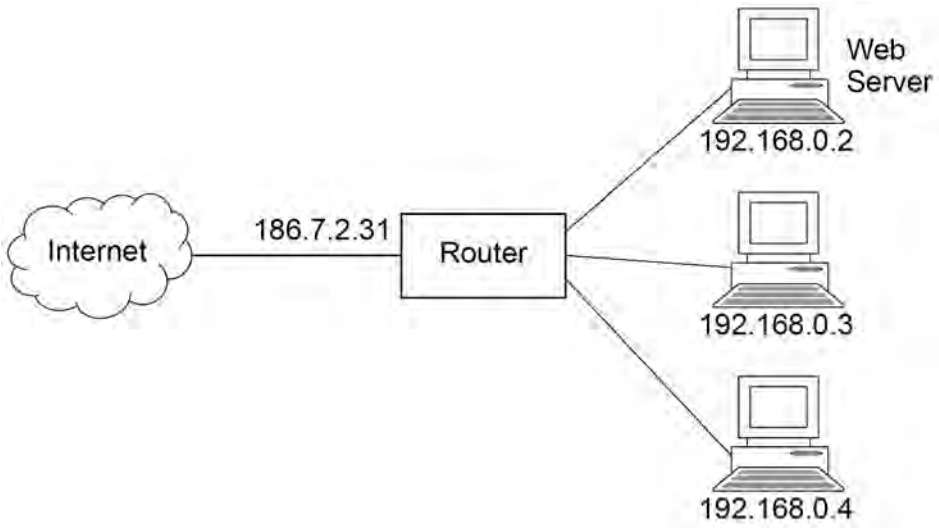
- how the data for a file would be stored on a magnetic hard disk **and** read from it by the file server
- how the individual layers of the TCP/IP stack in the file server would be used to transmit the file onto the network.

In your response, you do **not** need to describe how the file would be transmitted across the network or how the TCP/IP stack would be used in the computer that has requested the file. You only need to write about how the data would be put onto the network by the file server.

[12 marks]

Figure 5 shows a diagram of the LAN in the student's house. The LAN connects three computers, including the web server, to the Internet via a router.

Figure 5



The router's public IP address is 186.7.2.31. The non-routable IP addresses of each of the computers on the LAN is shown in **Figure 5**.

The router uses Network Address Translation (NAT) because the computers on the LAN, including the web server, have non-routable IP addresses.

The router also incorporates a switch and a DHCP server.

1 0 . 1 Explain how a computer located outside the LAN can access the web server, despite the fact that the web server is identified by a non-routable IP address.

[3 marks]

1 0 . 2 Explain why it might be undesirable to allow the network settings of the web server to be configured by a DHCP server.

[1 mark]

1 0 . 3 The student uses the computer with IP address 192.168.0.4 to download a file from an FTP server on the Internet using the File Transfer Protocol (FTP).

Describe how NAT will be used in this process, to handle both the outgoing request and the returned data.

[4 marks]

1 0 . 4 The replacement of IPv4 with IPv6 would mean that NAT is no longer necessary.

Explain why this is the case.

[1 mark]

1 0 . 5 The web server and the web browser on a client computer use the Websocket protocol when they communicate with each other.

Shade **one** lozenge to indicate which of these statements about the Websocket protocol is true.

[1 mark]

A All messages sent using the protocol encode data using XML. ⬭

B All messages sent using the protocol have a digital signature. ⬭

C Messages sent using the protocol can only originate from the web server. ⬭

D The protocol establishes a full-duplex communication channel. ⬭

E The protocol operates at the network layer of the TCP/IP stack. ⬭