Level 3 Design and maintain ICT networks software components (7540-356)

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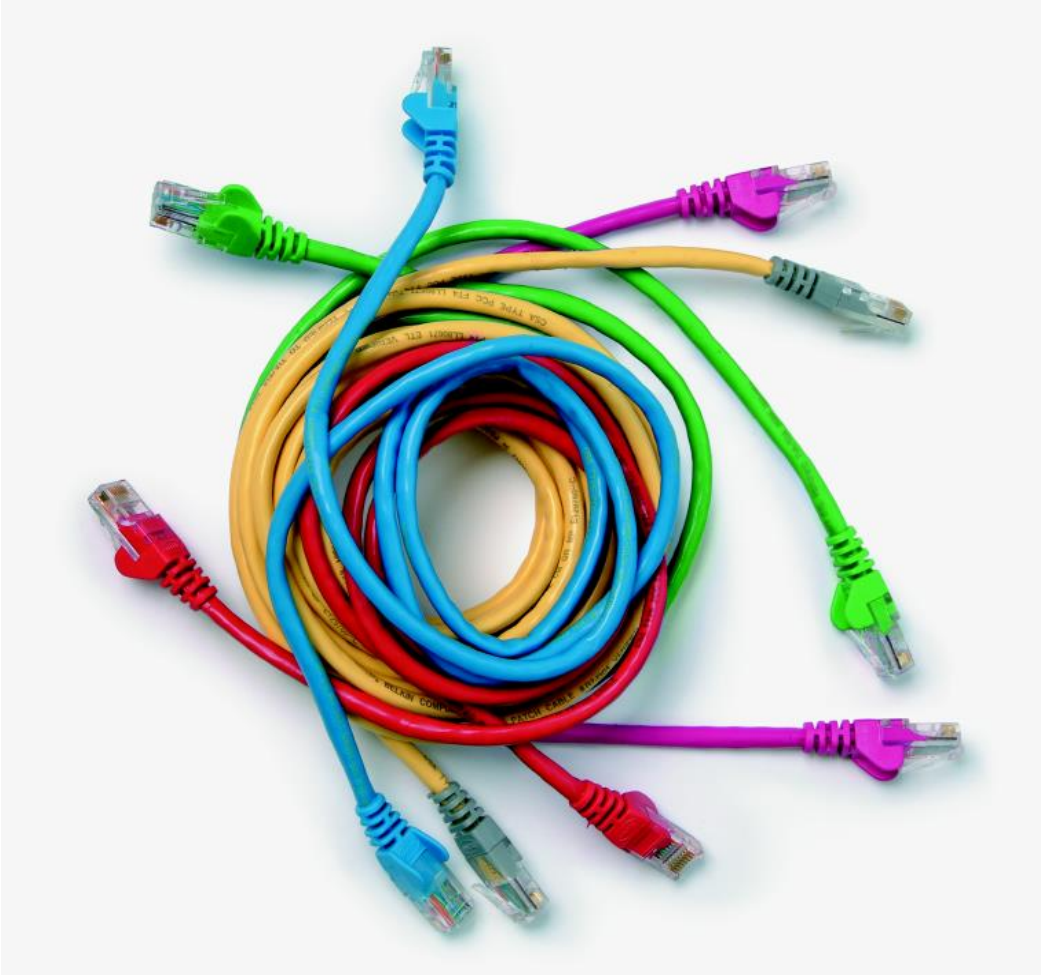
e-Quals
Assignment guide for Candidates
Assignment D



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Introduction – Information for Candidates

About this document

This assignment comprises all of the assessment for Level 3 Design and maintain ICT networks software components (7540-356).

Health and safety

You are asked to consider the importance of safe working practices at all times.

You are responsible for maintaining the safety of others as well as your own. Anyone behaving in an unsafe fashion will be stopped and a suitable warning given. You will **not** be allowed to continue with an assignment if you compromise any of the Health and Safety requirements. This may seem rather strict but, apart from the potentially unpleasant consequences, you must acquire the habits required for the workplace.

Time allowance

The recommended time allowance for this assignment is **4 hours**.

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Candidate Instructions

Time allowance: 4 hours

Assignment set up:

This assignment is made up of **four** tasks:

- Task A – Produce an amended WAN diagram, routing tables and encryption of data
- Task B – Explore packet assembling and disassembling for transmission of data across a network
- Task C – Explore data communications using a star topology
- Task D – Explore data communications using an Xmodem protocol

Scenario

FAST TeleComms specialise in networking and data communications software development. They have been hired to provide solutions for a client's communications problems. As an employee of FAST TeleComms, your team leader has assigned you the task of providing solutions.

Note

Some tasks require candidates to write algorithms. Where this is the case you should always identify:

- variable names and data types
- argument names and data types
- return values and data types.

Task A – Produce an amended WAN diagram, routing tables and encryption of data

Diagram 1 represents a WAN used by Data Comms Experts where A, B, C, D and E are switching nodes. Host 1 can communicate with Host 2 via any available node. Each link between the switching nodes has been given a number.

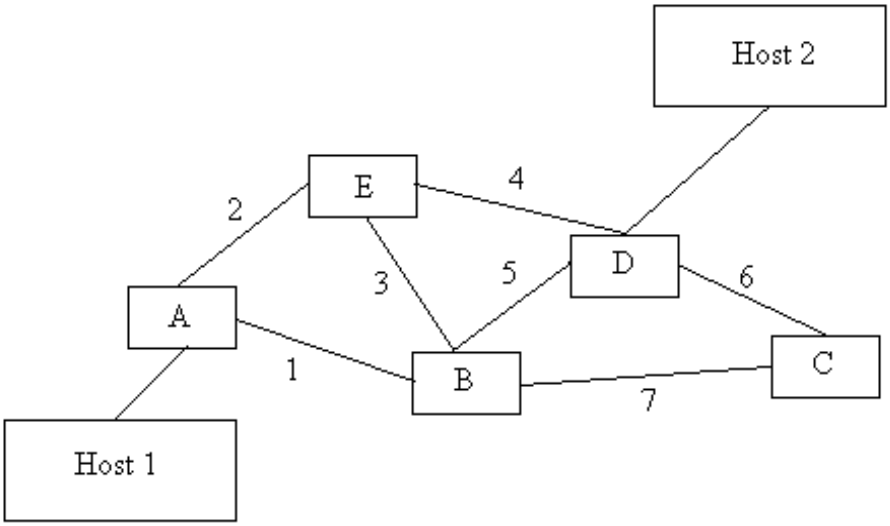

Diagram 1

Table 1 is a fixed routing table stored on node B. On receipt of a transmitted message, node B will look up the destination node in Table 1 to find which link to use to retransmit the message on. If a 0 entry is found, this indicates that the transmission is intended for itself and is not for retransmission.

Destination node	Link to transmit on	Alternative 1	Alternative 2
A	1	3	5
B	0	0	0
C	7	5	3
D	5	7	3
E	3	5	1

Table 1

1 Add a new node F to the WAN to link directly to nodes C and E. The link between nodes C and F is to be numbered 8 and the link between nodes E and F is to be numbered 9. Provide an amended diagram to show the WAN with the new node added. This will be labelled **WAN diagram 1**.

Continued over…

2 Provide an amended routing table for node C so that node F is included. This will be labelled **Routing Table 1**.

3 Provide a routing table for node D. This will be labelled **Routing Table 2**.

4 A bit manipulation method is to be used to encrypt the character data transmitted across the network. The logical operator NOT will be applied to each byte.

- Use the NOT operator on the following 4 bytes to show the encrypted data that will be transmitted.

Byte 1	01101111
Byte 2	01101001
Byte 3	01100110
Byte 4	01101110

- Use the NOT operator on the result of the encryption of the 4 bytes to show the result of decrypting the data at the receiver.

Task B – Explore packet assembling and disassembling for transmission of data across a network

1 Your team leader has asked you to design a software component that will split a large message to be sent across the network into smaller messages. Packets sent across the network have a maximum size of 500 bytes (excluding protocol header). Messages larger than 500 bytes are split into as many packets as are required.

- If a message of 2200 data bytes is to be sent how many packets will be required to transmit the message across the network?
- Provide an algorithm for a routine called TRANS that will be passed the following parameters
  - packet ID number
  - destination address
  - source address
  - the data to be transmitted
  - the length of the data to be transmitted.

Protocol header						
Packet ID number	Message sequence number	Total messages for this packet ID number	Destination Address	Source Address	Length of data	Data
2 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes	

Table 2.

Continued over…

If the length of the data to be transmitted is less than or equal to 500 bytes, the protocol header as shown in Table 2, with a message sequence number of 0 and total messages of 1 must be constructed and added and the packet transmitted.

If the length of the data to be transmitted is greater than 500 bytes then the message must be split into as many packets as are required. The protocol header as shown in Table 2, with a message sequence number of 1 for the first packet, 2 for the second, etc and the correct total messages value must be constructed and added and each packet transmitted.

Each packet is a fixed length so that if the data is less than 500 bytes the rest of the data bytes are padded with spaces.

- Check that the algorithm works correctly by passing it a message of 200 bytes and another of 1750 bytes.

Provide the results from checking the algorithm: ie the packets to be transmitted.

2 Your team leader has asked you to design a software component that will process packets received from the network and write them to a sequential file.

- Provide an algorithm for a routine called REC that will be passed a packet received across the network. The value 999 is passed as a Packet ID number to terminate the routine.

  If the packet has a message sequence number of 0, the message sequence number and total number of messages must be removed and the packet written to the sequential file.

  If the packet has a message sequence number greater than 0, the packet must be stored until all the packets with the same packet ID number have been received. The data in the packets must then be assembled into one message in the correct order of message sequence number and written to the sequential file as shown in Table 3.

Packet ID number	Destination Address	Source Address	Length of data	Data
2 bytes	2 bytes	2 bytes	2 bytes	500 bytes

Table 3

An error message must be displayed to include the packet ID number if all the packets for a message are not received.

Continued over…

- Check that the algorithm works correctly by passing it the packets shown in Table 4.

120	0	1	Destination Address	Source Address	400	Data
155	3	3	Destination Address	Source Address	350	Data
163	0	1	Destination Address	Source Address	450	Data
134	2	2	Destination Address	Source Address	100	Data
155	1	3	Destination Address	Source Address	500	Data
155	2	3	Destination Address	Source Address	500	Data
999						

Table 4.

Provide the results from checking the algorithm: ie the records written to the sequential file.

Task C – Explore data communications using a star topology

A client has a multi-user WAN, in a star topology, with a large database on the central computer. The attached computers are used to make enquiries and updates to the database. The client is concerned about recovery procedures.

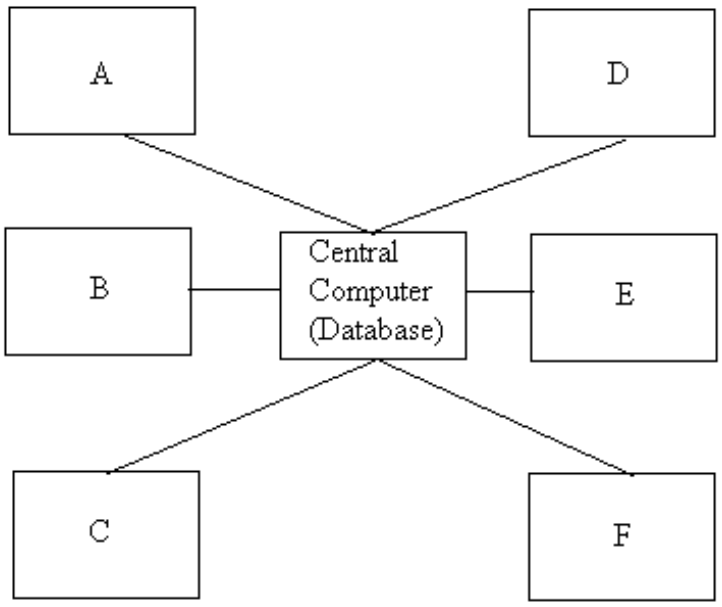

Diagram 2

Your team leader has asked you to write a report about the system shown in Diagram 2. This will be called **Star Report 1**.

Continued over…

1 Which computers in this network are client(s) and which are server(s)?

2 Write **one** advantage of a star network topology.

3 Write **one** disadvantage of a star network topology.

4 List **three** message accountability actions to be performed on incoming data transmissions to help prevent errors occurring and also enable tracing of errors.

5 List **three** message accountability actions to be performed on outgoing data transmissions to help prevent errors occurring and also enable tracing of errors.

6 Describe **one** method of backup that can later be used for recovery after a system failure.

Task D – Explore data communications using an Xmodem protocol

Your team leader has asked you to help design a software component that will link two computers using a serial cable, in a half-duplex mode and an Xmodem protocol.

Your team leader has asked you to write a report about the system. This will be called **Xmodem Report 2**.

1 Describe the difference between serial and parallel data transmission.

2 Explain why half-duplex mode is suitable for an Xmodem protocol.

3 Describe how flow control is achieved using an Xmodem protocol.

Table 5 is the Event-state table for the transmitter.

Event / Present State	Timer Expires	Message ready to send	ACK received	NAK received	
Idle (0)	NA	Tx	Error	Error	**Action**
	0	1	0	0	**New State**
Waiting Acknowledgment (1)	Tx	Delay	Process ACK	Tx	**Action**
	1	1	0	1	**New State**

Table 5

Tx: Transmit message
NA: No action
Delay: Wait for a defined time eg 10 seconds

Continued over…

4 Provide a State Transition Diagram for the transmitter. This will be called **State Transition Diagram 1**.

5 Provide the State Transition Diagram for the receiver. This will be called **State Transition Diagram 2**.

6 Provide the Event-state table for the receiver. This will be called **Event-state Table 1**.

When you have finished working:

- Sign each document above your name and label all removable storage media with your name.
- Hand all paperwork and removable storage media to your assessor.

If the assignment is taken over more than one period, all paperwork and removable media must be returned to the test supervisor at the end of each sitting.

End of assignment

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