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

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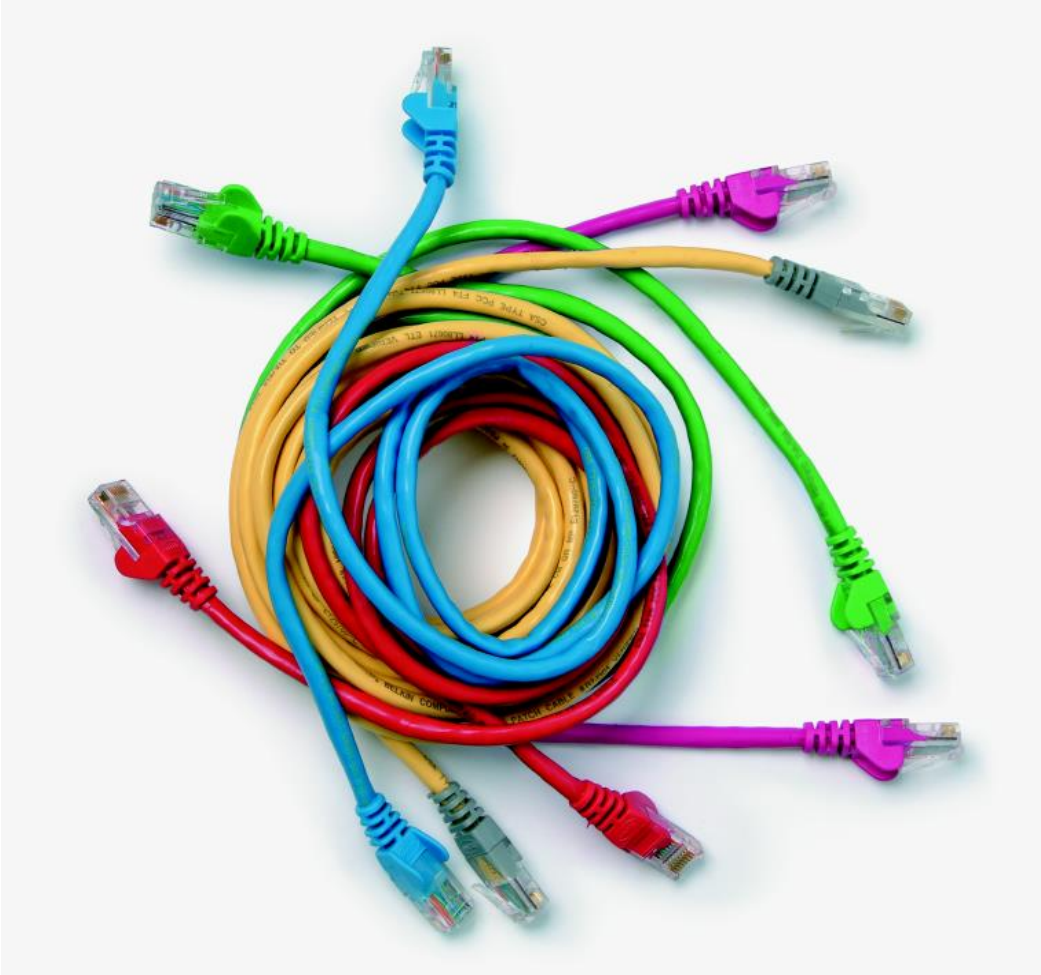
Systems and Principles
Assignment guide for Candidates
Assignment B



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Level 3 Design and maintain ICT Network software components (7540-356) Assignment B

Introduction – Information for Candidates

About this document

This assignment comprises all of the assessment for Level 3 Design and maintain ICT Network 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**.

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

Candidate Instructions

Time allowance: 4 hours

Assignment set up:

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

- Task A – Produce an updated WAN routing diagram, a routing table and an encryption algorithm
- Task B – Produce a report for the specified broadcast LAN
- Task C – Design a software component linking two computers on a WAN

Scenario

Data Comms Experts 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 Data Comms Experts, 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 updated WAN routing diagram, a routing table and an encryption algorithm

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

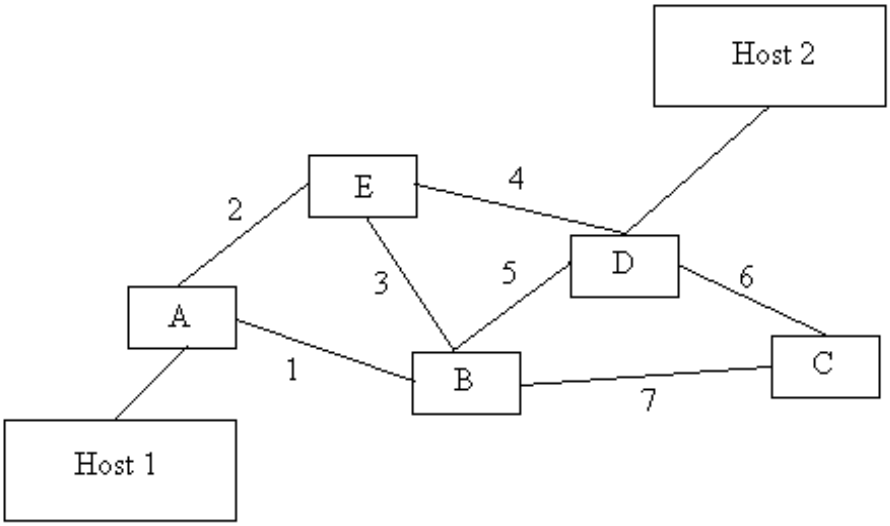

Diagram 1

Table 1 below 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 B and C. The link between nodes B and F is to be numbered 8 and the link between nodes C 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**).

2 Provide an amended routing table for node B so that node F is included (this will be labelled **Routing Table 1**).

3 Provide a routing table for node E (this will be labelled **Routing Table 2**).

4 A simple transposition method is to be used to encrypt the character data transmitted across the network. The transposition method used will enter the characters into a table by row and transmit the characters by reading them by column. See Table 2 below.

	1	2	3	4	5
1	T	h	e		n
2	a	m	e		o
3	f		t	h	e
4		a	c	c	o
5	u	n	t		i
6	s		S	m	i
7	t	h	.	-1	-1
8	-1	-1	-1	-1	-1

Table 2

The message to be transmitted is:

The name of the account is Smith.

This is entered into the table by row and the characters transmitted are then read by column so that the message is actually transmitted as:

Taf usthm an h eetctS. hc mnoeoii

The value –1 in the table represents the end of the column of characters.

a) Provide an algorithm for a function named Transpose, which is passed the message to be transmitted and returns the encrypted message. The message should be stored in a table of 10 columns by 10 rows.

b) Check the results from your algorithm by encrypting the following message:

A request has been received for the latest brochure.

Provide the results of the encryption.

Task B – Produce a report for the specified broadcast LAN

Diagram 2 below shows a broadcast Local Area Network (LAN) with a bus topology set up and built by your team leader to test new software.

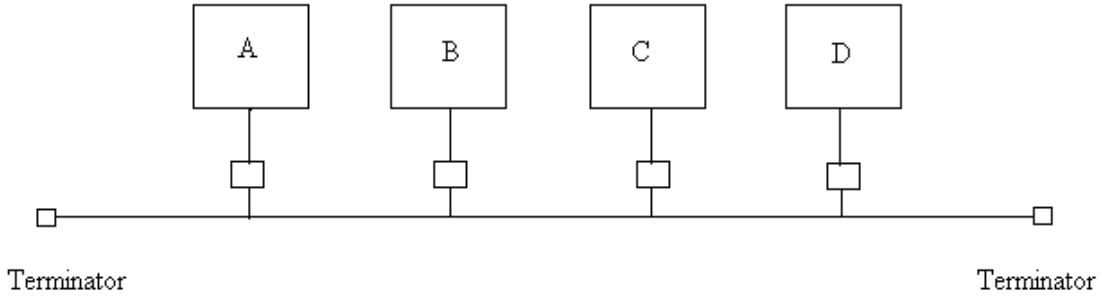

Diagram 2

Table 3 shows the message protocol:

DA	SA	CF	Data	CS

Table 3

Each field except the data field is 8 bits. Table 4 below describes the fields used in the message protocol.

Field	Contains
DA	Destination address
SA	Source address
CF	Identification number for the message
CS	Checksum byte used for error checking

Table 4

Table 5 below gives the addresses for each of the computers on the LAN.

Computer	Address
A	00000001 (01 hex)
B	00000010 (02 hex)
C	00000011 (03 hex)
D	00000100 (04 hex)

Table 5

You have been asked by your team leader to write a report based on the information contained in Tables 3, 4 and 5 (this will be called **LAN Report 1**) for a message transmission from computer A to computer D.

1 Provide a diagram (**Protocol bytes diagram 1**) that shows the contents of the protocol bytes: DA, SA and CF for the transmission of the message. The message identification number is 00000111 (07 hex).

2 Explain why handshaking is not required.

3 Explain how the contents of the checksum will be calculated for the CS field.

4 Explain how flow control is achieved.

5 Explain what happens when the message is broadcast and how computer D recognises that it is the intended recipient.

6 Explain how the situation is resolved if computer B broadcasts a message at the same time as computer A sends its message.

7 Explain the action taken and the content of the protocol of any message transmitted by computer D on receipt of the message under the following conditions:

a) Calculation of the checksum indicates an error.
b) Calculation of the checksum indicates the message is OK and accepted.

8 Explain the action taken and the content of the protocol of any message transmitted by computer A when the response from computer D indicates:

a) An error occurred during transmission between computer A and computer D.
b) Computer D accepted the message.

9 The LAN is to be connected to an external network. Explain the purpose of Firewall software.

10 Explain the function of the Network Interface Card (NIC) installed in each computer on the LAN.

11 The LAN needs a server installed. Identify and explain **three** differences between a file server and a client server.

Task C – Design a software component linking two computers on a WAN

Your team leader has asked you to design a software component, which will link two computers on a WAN using a standard protocol and a half-duplex connection. Diagram 3 below is the State Transition Diagram for the transmitter software.

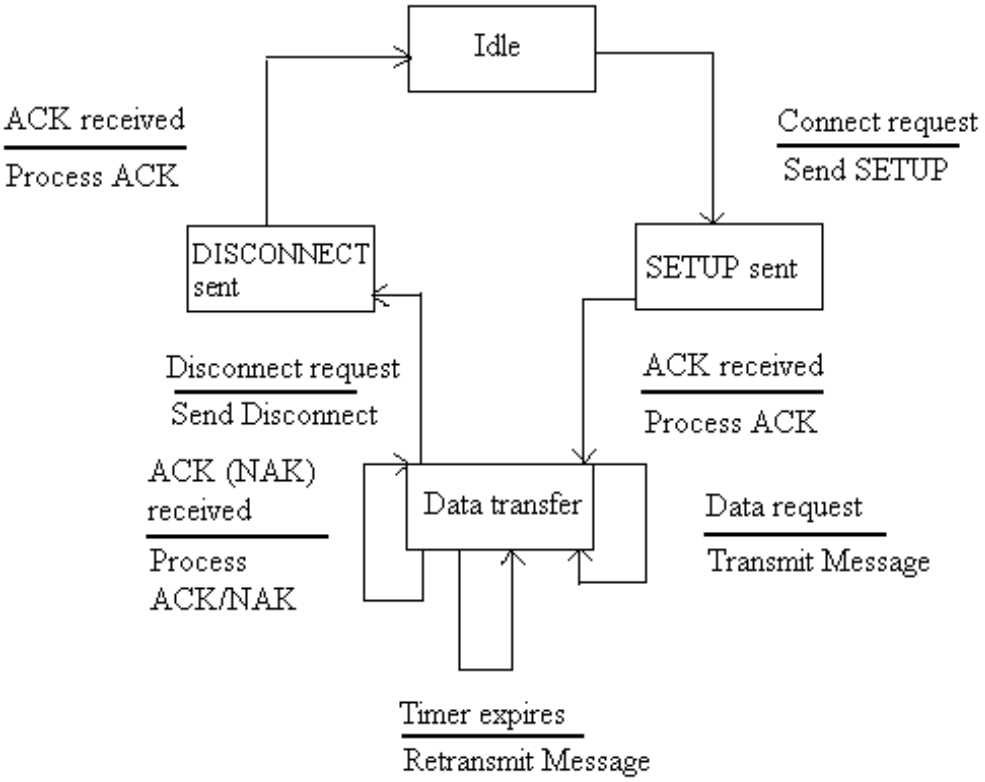

Diagram 3

Table 6 below is the Event-state table for the transmitter.

Event / Present State	Connect request	Data request	Disconnect request	ACK received	NAK received	Timer expires	
Idle (0)	Send Setup						**Action**
	1						**New state**
SETUP sent (1)				Process ACK	Retransmit Setup	Retransmit Message	**Action**
				2	1	1	**New State**
Data transfer (2)		Transmit Message	Disconnect	Process ACK	Retransmit Message	Retransmit Message	**Action**
		2	3	2	2	2	**New State**
DISCONNECT sent (3)				Process ACK	Retransmit DISCONNECT	Retransmit Message	**Action**
				0	3	3	**New State**

Table 6

1 Provide an algorithm for the transmitter software component using the information in the State Transition Diagram shown in Diagram 3 and the Event-state table shown in Table 6. An outgoing message should contain an id-number, which is incremented for each message sent. An ErrorLog is to be created to hold a count of the number of errors that have occurred. The data to be transmitted will be provided by another software component in a file.

Diagram 4 below is the State Transition Diagram for the receiver software.

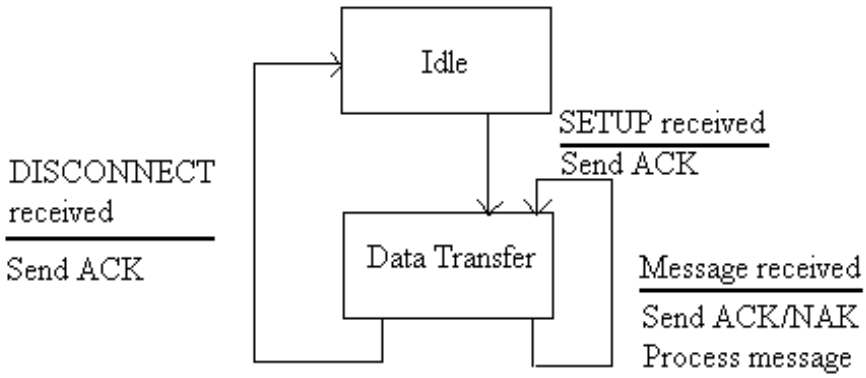

Diagram 4

2 Provide the Event-state table (this will be called **Event-state Table 1**) for the receiver using the information provided in the STD (Diagram 4).

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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