1.5 Networks and Topologies: Test Pack

OCR J277 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A local college has one building in the centre of Sheffield. All of its computers are connected together using cabling installed inside that building.

(a) Define the term Local Area Network (LAN). **(1)**

(b) Define the term Wide Area Network (WAN). **(1)**

(c) The college later joins its Sheffield building's network with a second campus in Rotherham, 10 km away, so staff at both sites can share the same files. State, giving a reason, whether the combined network is now a LAN or a WAN. **(2)**

(Total for Question 1 is 4 marks)

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2 A cafe offers free WiFi to its customers using a single wireless access point (WAP).

(a) State one factor, other than bandwidth, that can affect the performance of this wireless network. **(1)**

(b) Explain how having many customers' devices connected to the same wireless access point at the same time can affect network performance. **(2)**

(c) Modern WAPs can broadcast on the 2.4 GHz or the 5 GHz frequency band. Give one advantage of using the 5 GHz band rather than the 2.4 GHz band. **(2)**

(Total for Question 2 is 5 marks)

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3 The TCP/IP model organises network communication into four layers.

(a) Starting with the layer closest to the user's application, list the four layers of the TCP/IP model in order. **(2)**

(b) State the function of the Transport layer. **(2)**

(c) State the function of the Link layer (also called the Network Access layer). **(2)**

(Total for Question 3 is 6 marks)

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4 A network technician wants to demonstrate a very simple encryption method before explaining why modern networks do not rely on it.

(a) Encrypt the plaintext ROUTER using a Caesar cipher with a shift of +4 (each letter is replaced by the letter 4 places later in the alphabet). **(2)**

(b) Explain one weakness of the Caesar cipher as a method of encrypting data sent across a network. **(2)**

(c) State one advantage of using a modern symmetric encryption algorithm rather than a Caesar cipher to protect data sent over a network. **(1)**

(Total for Question 4 is 5 marks)

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5 An IP address is stored as an array of four integers, each representing one octet, for example octet[0] = 192, octet[1] = 168, octet[2] = 1 and octet[3] = 15.

Write an algorithm, using OCR Exam Reference Language, that:
- uses a loop to check every one of the four octets
- determines whether all four octets are within the valid range 0 to 255 inclusive
- outputs the message "Valid IP" if every octet is within range, or "Invalid IP" if at least one octet is not within range.

Any correct logic will be awarded; ignore minor syntax errors.

(Total for Question 5 is 5 marks)

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Mark scheme · 1.5 Networks and Topologies: Test Pack

Question 1

(a) network of devices connected together within a small/single geographical area (e.g. one building or site), usually owned and controlled by one organisation **B1**

(a) Answer: A network of devices connected together in one building or a small site, usually owned/managed by a single organisation.

(b) network connecting devices/LANs across a large geographical area, often using infrastructure (e.g. telecoms lines) owned by a third party **B1**

(b) Answer: A network that connects devices or LANs over a large geographical area, often using third-party infrastructure.

(c) identifies WAN **B1**

(c) valid reason, e.g. it now spans a large geographical area / connects two separate sites using external telecoms infrastructure rather than internal cabling (oe) **B1**

(c) Answer: WAN, because it now connects two separate sites over a large geographical area using external infrastructure rather than in-building cabling.

Question 2

(a) any one of: interference from other wireless devices/appliances; number of devices connected at once; distance from the access point; physical obstructions such as walls (any one, oe) **B1**

(a) Answer: Interference from other devices (or: distance from the WAP, or: number of connected devices, or: physical obstructions).

(b) the available bandwidth is shared between all connected devices **B1**

(b) so each device receives a smaller share of the bandwidth, causing slower data transfer/increased latency for every user **B1**

(b) Answer: Bandwidth is shared among all connected devices, so as more devices connect, each gets a smaller share, slowing data transfer for everyone.

(c) fewer devices/networks/appliances use the 5 GHz band, so there is less interference/congestion **B1**

(c) so a faster and more reliable connection can usually be achieved (though typically over a shorter range than 2.4 GHz) **B1**

(c) Answer: Less congestion/interference on 5 GHz, giving a faster, more reliable connection (though with a shorter range).

Question 3

(a) all four correct layer names given: Application, Transport, Network (Internet), Link **B1**

(a) listed in the correct order (Application first, Link last) **B1**

(a) Answer: Application, Transport, Network (Internet), Link

(b) splits data into packets/segments and adds a port number so data reaches the correct application (and reassembles data at the destination) **B1**

(b) manages reliable delivery, e.g. checking for errors and re-sending lost packets (TCP), or provides faster unacknowledged delivery (UDP) **B1**

(b) Answer: Uses port numbers to direct data to the correct application. TCP provides reliable, ordered delivery and reassembly; UDP does not guarantee delivery or ordering.

(c) handles the physical/hardware connection to the network, i.e. how data is actually transmitted over the transmission medium (cable or radio waves) **B1**

(c) adds the MAC address so data can be delivered to the correct device on the local network **B1**

(c) Answer: Handles the physical transmission of data over the network medium and adds MAC addresses to deliver data to the correct local device.

Question 4

(a) correct method applied, shifting each letter by 4 places, with at least 4 of the 6 letters correct **M1**

(a) VSYXIV cao **A1**

(a) Answer: VSYXIV

(b) identifies a weakness, e.g. there are only 25 possible shifts **B1**

(b) develops the point, e.g. so an attacker could try every shift very quickly (brute force), or use frequency analysis of letters, to break the cipher without needing the key **B1**

(b) Answer: There are only 25 possible shift values, so the cipher can be broken almost instantly by trying every shift (brute force) or by frequency analysis.

(c) uses a much larger key space/more complex key and mathematical process, making it far harder/impractical to break by brute force **B1**

(c) Answer: It uses a much larger, more complex key, making brute-force attacks impractical.

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Question 5

correctly initialises a flag/boolean variable to True before the loop (e.g. valid = True); any correct logic, ignore minor syntax **P1**

uses a for loop that iterates through all four octets (e.g. for i = 0 to 3); any correct logic, ignore minor syntax **P1**

uses a correct if condition to test whether an octet is out of range, e.g. if octet[i] < 0 OR octet[i] > 255 then; any correct logic, ignore minor syntax **P1**

sets the flag to False inside the if when an octet is out of range, with correctly closed endif/next; any correct logic, ignore minor syntax **P1**

uses if/else/endif after the loop to output "Valid IP" when the flag is still True, else outputs "Invalid IP"; any correct logic, ignore minor syntax **P1**

Answer:valid = True
for i = 0 to 3
if octet[i] < 0 OR octet[i] > 255 then
valid = False
endif
next i
if valid == True then

```
    print("Valid IP")
```

else

```
    print("Invalid IP")
```

endif

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