1.8 Network Protocols and Layers: 30-minute Pack

OCR J277 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State the purpose of the IMAP and POP3 protocols.

(Total for Question 1 is 3 marks)

2 Explain the purpose of DNS (the Domain Name System), and why it is needed.

(Total for Question 2 is 3 marks)

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3 Describe, step by step, what happens at each layer of the TCP/IP model when a user's laptop sends an email to a friend on a different network, from the moment the user clicks 'Send' to the moment the data leaves the laptop.

(Total for Question 3 is 6 marks)

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4 Different network protocols are used for different purposes.

(a) Which protocol is used to request and receive web pages from a web server? **(1)**

- ☐ A) SMTP
- ☐ B) HTTP
- ☐ C) FTP
- ☐ D) IMAP

(b) Which protocol is a secure, encrypted version of the protocol used to transfer web pages? **(1)**

- ☐ A) HTTPS
- ☐ B) FTP
- ☐ C) TCP
- ☐ D) POP3

(c) Which protocol is used to send email from a client to a mail server? **(1)**

- ☐ A) SMTP
- ☐ B) HTTP
- ☐ C) FTP
- ☐ D) DNS

(d) Which protocol is used to transfer files between computers on a network? **(1)**

- ☐ A) FTP
- ☐ B) SMTP
- ☐ C) IMAP
- ☐ D) HTTPS

(Total for Question 4 is 4 marks)

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5 Different protocols operate at different layers of the TCP/IP model.

(a) State one protocol that operates at the application layer, and state its purpose. **(2)**

(b) State the protocol that operates at the transport layer to break data into segments, add sequence numbers, and check that all segments arrive correctly. **(1)**

(c) State the protocol that operates at the internet layer to address and route packets between networks. **(1)**

(Total for Question 5 is 4 marks)

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6 A school is choosing a protocol to stream a live assembly to parents watching at home in real time. State which protocol should be used and give two reasons for your choice.

(Total for Question 6 is 3 marks)

7 A file of 2400 bytes is split into equal-sized packets for transmission across a network. Each packet has a fixed overhead of 40 bytes of header data, in addition to its share of the file's payload data.

(a) The file is split into 6 equal packets of payload data. Calculate the number of payload bytes carried in each packet. **(2)**

(b) Calculate the total size of one packet, including its header, and hence calculate the percentage of one packet's total size that is header data. Give your answer to 1 decimal place. **(3)**

(Total for Question 7 is 5 marks)

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Mark scheme · 1.8 Network Protocols and Layers: 30-minute Pack

Question 1

IMAP and POP3 are both protocols used to retrieve/receive email from a mail server, oe **B1**

IMAP keeps a synchronised copy of email on the server, so the same mailbox can be viewed from multiple devices, oe **B1**

POP3 typically downloads email from the server onto one device (and may then remove it from the server), oe **B1**

Answer: Both retrieve email from a mail server; IMAP keeps mail synchronised on the server for viewing on multiple devices, while POP3 downloads mail onto a single device.

Question 2

DNS translates/converts a human-readable domain name (e.g. www.example.co.uk) into the numeric IP address of the web server hosting that site, oe **B1**

it works like a directory/look-up service that the browser queries before it can connect to the correct server, oe **B1**

it is needed because domain names are much easier for humans to remember and type than long numeric IP addresses, while computers still route data using IP addresses, oe **B1**

Answer: DNS translates a human-readable domain name into the numeric IP address of the correct server, acting as a directory service, because domain names are easier for humans to remember than IP addresses.

Question 3

Level 1 One or two layers, or one relevant protocol, are named with little explanation of what happens at each stage. Little relevant technical terminology is used. **1-2**

Level 2 Several layers are named in a broadly sensible order, with some explanation of what happens at each one, but the description may be incomplete or lack detail in places. Relevant technical terminology is generally used correctly. **3-4**

Level 3 A clear, well-ordered description covers all four layers, correctly names at least one relevant protocol at each of the application, transport and internet layers, and explains what each layer adds/does to the data. Relevant technical terminology is used correctly throughout. **5-6**

Indicative content:

- Application layer: the email software uses a protocol such as SMTP to format the email message ready to be sent
- Transport layer: TCP breaks the message into smaller segments, adds sequence numbers, and will later request that any lost segments are resent
- Internet layer: IP adds the source and destination IP addresses to each segment (now called a packet), so it can be routed across networks
- Link layer: the packets are converted into a form (e.g. as frames with a MAC address) that can be transmitted over the laptop's physical connection, such as Wi-Fi or Ethernet
- The data then leaves the laptop and is passed on, hop by hop, across intermediate devices until it reaches the friend's network
- A strong answer explains that each layer adds its own information/header to the data before passing it down to the next layer

Question 4

(a) B cao **B1**

(a) Answer: B) HTTP

(b) A cao **B1**

(b) Answer: A) HTTPS

(c) A cao **B1**

(c) Answer: A) SMTP

(d) A cao **B1**

(d) Answer: A) FTP

Question 5

(a) a valid application-layer protocol, e.g. HTTP, HTTPS, FTP, SMTP, IMAP, POP3 **B1**

(a) a correct purpose for the protocol named, matching its standard use **B1**

(a) Answer: For example, HTTP - used to request and transfer web pages between a browser and a web server.

(b) TCP, cao **B1**

(b) Answer: TCP

(c) IP, cao **B1**

(c) Answer: IP

Question 6

UDP, cao **B1**

because it has less overhead/does not wait for acknowledgements or resend lost data, so it transmits data faster, oe **B1**

for a live stream, keeping the video/audio smooth and close to real time matters more than every single packet arriving perfectly (a brief glitch is preferable to a delay), oe **B1**

Answer: UDP, because it transmits with less delay than TCP, and for a live stream staying close to real time matters more than every packet arriving perfectly.

Question 7

(a) 2400 / 6 shown as the method, oe **M1**

(a) 400, cao **A1**

(a) Answer: 400 bytes

(b) total packet size = 400 + 40 = 440 bytes, oe **M1**

(b) (40 / 440) x 100 shown as the method, oe **M1**

(b) 9.1%, awrt **A1**

(b) Answer: 440 bytes total; 9.1% is header data

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