

QUESTION 1.



6 (a)	Description Protocol used email client downloads an email from an email server email is transferred from one email server to another email server email client sends email to email server browser sends a request for a web page to a web server HTTP POP3 SMTP	1 mark for correct arrow from each description
(b)	peer-to-peer	1
(c) (i)	Tracker: central server that: stores details of other computers that have all / part of file to be downloaded // has data on those peers downloading and uploading file // shares IP addresses with other clients in swarm allowing them to connect	1 1
(ii)	Seed: peer computer that has 100% of file // is uploading downloaded content	1 1
(iii)	Swarm: all the connected peer computers that have all or part of the file to be downloaded / uploaded // share a torrent	1 1
		Total: 11

QUESTION 2.



2 (a)	Description Type of LAN	
	any packet the listening computer receives may be part of a message for that computer connection provided through an access point a process for handling collisions has to be implemented listening computer only receives packets that are addressed to this computer bus with terminators at each end star wireless 1 mark for correct arrow(s) from each description	1 1 1 1
(b) (i)	Server: central computer stores files that are to be downloaded	1 1

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(ii)	Command: user can send action/instruction (or by example, e.g. change directory) that are carried out on server	
(iii)	Anonymous: allows user to access files user does not need to identify themselves to connect	1

QUESTION 3.

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5 (a) (i)

Application
Transport
Internet
Network / Link

[1]

[1]

(ii) software / module / program / code

[1]

- (b) (i) For example:
check packet port ... [1]
 to identify the application type [1]
check packet destination socket ... [1]
 so that packet sent to correct application [1]
check incoming packet sequence number ... [1]
 to ensure data is reassembled in correct order [1]
recalculate checksum of packet ... [1]
 to ensure integrity of packet [1]
if packet checksum invalid ... [1]
 send message to have packet retransmitted [1]

[Max 2 tasks]

[Max 4]

(ii) HTTP / HTTPS

[1]

(iii) POP3

[1]

QUESTION 4.

Cambridge International A Level – October/November 2016



- 4 (a) (i) A set of rules ... governing communications/transmission of data /sending and receiving data [1]
- (ii) For example, (Web) browser / email client [1]
- (iii) For example, Web server / email server [1]
- (iv) Security //example: for example, alteration of transmitted messages [1]
Privacy // for example, only intended receiver can view data [1]
Authentication // for example, trust in other party [1]

[Max 2]

(b) For example:

- which protocol will be used... [1]
there are a number of different versions of the two protocols [1]
session ID ... [1]
uniquely identifies a related series of messages between server and client [1]
session type ... [1]
reusable or not [1]
encryption method ... [1]
public / private keys to be used // asymmetric/ symmetric [1]
authentication method ... [1]
use of digital certificates / use of digital signature [1]
compression ... [1]
method to be used [1]

[Max 2 parameters]

[Max 4]

(c) For example:

- banking [1]
private / secure email [1]
shopping [1]
financial transactions [1]
secure file transfer [1]

[Max 2]

QUESTION 5.



Question	Answer	
5(a)(i)	Packet: Both web page and web page request are split into packets Each packet is sent individually from device to device	1 1
5(a)(ii)	Router: Transmit packets Contain connections to many other routers When packets arrive at router, router decides where next to send packet 1 mark for any valid point	Max 2
5(a)(iii)	TCP/IP: Is the protocol Rules for communication between web server and browser	1 1 2
5(b)(i)	Two from: Picture and sound not synchronised Interruptions // video not continuous Can be degraded by other competing traffic	1 1 1 Max 2
5(b)(ii)	<u>Dedicated</u> communications channel between the two communicating devices Established prior to start of communication // removal of links at end of communication	1 1 2
5(b)(iii)	In packet switching, packets can take different routes and may not arrive in order Will arrive in order (only one route) As packets can take many different routes / share paths with others can be delayed Dedicated circuit has full bandwidth No loss of synch 1 mark for any valid point	Max 3

QUESTION 6.



Question	Answer		
5(a)	Option 1		Option 2
	Application Layer		
	Transport		
	Internet		
	Network Interface		
5(b)(i)	Peer-to-peer		1
5(b)(ii)	File sharing		1
5(b)(iii)	Any four points from the following: • Torrent descriptor file is made available • File to be shared is split into pieces • BitTorrent client software made available to other peers / users / computers Allowing them to work as seeds or leeches. A peer can act as a 'seed' – used to upload pieces of a file Peer downloading file can get pieces from different seeds simultaneously • Once a peer has a piece of the file it can become a seed for the parts downloaded • Leeches download much more than they upload • Central server called a tracker keeps records of all the peers ('swarm') and the parts of the file they have Can pause and restart at any time.		Max 4
5(c)	Any two protocols from: - HTTP/HTTPS ... - Used for transfer of web pages from server to client - FTP ... - Used for interactive file transfer - SMTP ... - Used for sending email messages - POP3 ... - Used for incoming email messages		Max 4

QUESTION 7.



Question	Answer		
5(a)(i)	Packet: Both web page and web page request are split into packets Each packet is sent individually from device to device	1 1	
5(a)(ii)	Router: Transmit packets Contain connections to many other routers When packets arrive at router, router decides where next to send packet 1 mark for any valid point		Max 2
5(a)(iii)	TCP/IP: Is the protocol Rules for communication between web server and browser	1 1	2
5(b)(i)	Two from: Picture and sound not synchronised Interruptions // video not continuous Can be degraded by other competing traffic	1 1 1	Max 2
5(b)(ii)	<u>Dedicated</u> communications channel between the two communicating devices Established prior to start of communication // removal of links at end of communication	1 1	2
5(b)(iii)	In packet switching, packets can take different routes and may not arrive in order Will arrive in order (only one route) As packets can take many different routes / share paths with others can be delayed Dedicated circuit has full bandwidth No loss of synch 1 mark for any valid point		Max 3

QUESTION 8.



Question	Answer	
4(a)(i)	A (known) set of rules Agreed/standard method for data transmission // governs how two devices communicate	1 1
4(a)(ii)	Max 2 marks for purpose: • Purpose of TLS is to provide for secure communication (over a network) • maintain data integrity • additional layer of security Max 2 marks for further explanation from: • TLS provides improved security over SSL • TLS is composed of two layers / record protocol and handshake protocol • TLS protects this information by using encryption • Also allows for authentication of servers and clients	Max 3
4(b)	• The client validates (the server's) TLS Certificate • The client sends its digital certificate (to the server if requested) • Client sends an encrypted message to the server using the server's public key • The server can use its private key to decrypt the message ... • ... and get data needed for generating symmetric key • Both server and client compute symmetric key (to be used for encrypting messages) // session key established • The client sends back a digitally signed acknowledgement to start an encrypted session • The server sends back a digitally signed acknowledgement to start an encrypted session 1 mark for each point, max 3 points	3
4(c)	Applications, for example: • online banking • private email • online shopping • online messaging etc. 1 mark for each point, Max 2	2

Question	Answer	Marks

QUESTION 9.



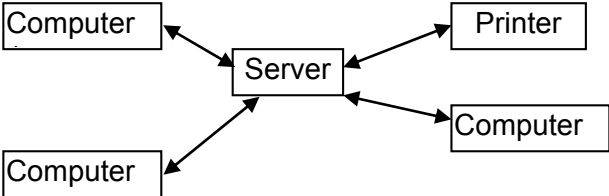
Question	Answer									
3(a)	1 mark per bullet point to max 2: - to only allow data to be sent when the line is idle - to detect a collision on the network - to halt transmissions when a collision occurs - calculates random wait time - allow retransmission after a random amount of time									
3(b)(i)	1 mark per bullet point to max 3: - allows applications to exchange data - establishes and maintains a connection until exchange of data is complete - determines how to break application data into packets - adds sequence / packet number to (TCP) header - sends packets to and accepts packets from the network / Internet layer - manages flow control // manages congestion avoidance - acknowledges all packets that arrive - detects when a packet has not arrived at destination - handles retransmission of dropped packets - reassembles packets into the correct order	3								
3(b)(ii)	1 mark per bullet point to max 2 - routes the packets around the network - adds to the IP header a source/destination address for each packet - encapsulates data into datagram - passes datagram to the network access layer (for transmission on the LAN)// passes datagram to the transport layer (on arrival at destination) - Defines the addressing method e.g. subnetting, NAT	2								
3(b)(iii)	HTTP(S) // FTP // POP3 // SMTP // UDP // etc...	1								
3(c)	1 mark for appropriate protocol in each layer <table><tr><th>Layer</th><th>Protocol</th></tr><tr><td>Application</td><td>HTTP(S) // FTP // POP3 // SMTP // UDP etc...</td></tr><tr><td>Transport</td><td>TCP</td></tr><tr><td>Internet</td><td>IP</td></tr></table>	Layer	Protocol	Application	HTTP(S) // FTP // POP3 // SMTP // UDP etc...	Transport	TCP	Internet	IP	3
Layer	Protocol									
Application	HTTP(S) // FTP // POP3 // SMTP // UDP etc...									
Transport	TCP									
Internet	IP									



Question	Answer
3(d)	1 mark per bullet point to max 4: • Message is split into packets • Each packet is a fixed size • Each packet is given a header.... • ...including destination IP address, sequence number etc. • Packets are forwarded from one LAN to the other LAN • Packets may take different routes • Missing packets are requested to be resent • Packets re-assembled into order at destination

QUESTION 10.



Question	Answer	
2(a)(i)	1 mark per bullet point Diagram shows: • All four devices labelled and connected directly to the server • And no other device • Two-way flow of data between each device and the server 	
2(a)(ii)	1 mark per benefit and 1 mark for a further explanation in context to max 2 (x2) For example: • Personal data (used by admissions department) is kept secure • ... transmissions only go between server and destination • A new device/employee can be easily added to the network • ...only one connection direct to server needs setting up • If one node or link fails • ... the other employees can continue working / the rest of network is unaffected • If the department has a range of different devices • ... they can all operate at different speeds or with different protocols	4
2(b)	1 mark per bullet point (max 3) • Carrier Sense Multiple Access (with) Collision Detection • Before transmitting a device checks if the channel is busy • If it is busy the device waits // if channel free data is sent • When transmission begins the device listens for other devices also beginning transmission • If there is a collision, transmission is aborted / transmitting a jam signal • Both devices wait a (different) random time, then try again	3
2(c)(i)	1 mark per bullet point (max 2) • Allows (internal) connections between the university LANs • Allows <u>external</u> connection from the main LAN	2
2(c)(ii)	1 mark per bullet point (max 2) • Provides device with a <u>MAC address</u> • ...to uniquely identify it on the network • Allows each individual device to connect to the network	2
2(c)(iii)	1 mark per bullet (max 2) • Allowing devices to connect to the LAN via radio communication • ... instead of using a cable • ... easy to move a device to as different location	2

QUESTION 11.



Question	Answer	Marks
7(a)	1 mark per bullet point • Application • Transport • Internet / Network • Data Link	4
7(b)(i)	1 mark per bullet point to max 2 • Packet switching makes best use of the available (channel) capacity • ... by using alternative routes • ... which is more secure / robust • ... as packets to / from different sources and destinations can share the same route	2
7(b)(ii)	1 mark per bullet point to max 2 • To store data about packet • ... and its routing // to ensure it reaches its destination • ... to ensure that message can be properly reconstructed	2



Question	Answer
7(b)(ii)	1 mark per item to max 3 For example: • IP address of sender • IP address of destination • IP version • Number of packets the message consists of • ID number of that packet • Protocol used • Packet length • Time to live // max number of hops • Synchronisation data • Source port • Destination Port • Checksum

QUESTION 12.



Question	Answer	
3(a)	1 mark per appropriate term: Computer 1 and Computer 2 are on the same bus network. Computer 1 sends a message to Computer 2. Before the message is sent, it is split into packets. Computer 1 needs to check that the line / path / bus / channel is free before sending the message, otherwise a collision will occur that will be managed by the CSMA/CD protocol.	
3(b)	1 mark per bullet point, max 2 marks per device: Router • Contains a routing table • ... holds the (private) IP / MAC addresses of the devices on the bus • provides the public IP address for the network • forwards packets to the correct IP / MAC address • may contain a firewall / proxy server NIC • Has a (unique) MAC address • ... to identify a device • Provides a hardware interface // physical connection between computer and network // connection to Ethernet cable	4
3(c)(i)	1 mark per bullet point to max 2 • <u>Wireless</u> Access Points // <u>WAP</u> • <u>Wireless</u> Network Interface Card // <u>WNIC</u> // <u>Wireless</u> adapter • <u>Wireless</u> Router • (Wireless) Repeater	2
3(c)(ii)	1 mark per bullet point to max 4 Send (max 3 marks) • Encrypts the data (using TKIP or AES) • ... encodes the data into radio / analogue signal • Listens for other radio signals • Transmits / broadcasts when quiet • ... using an antenna / WNIC / WAP / aerial Receive (max 3 marks) • (Constantly) checking / tuning into / detecting signals • Receives radio / analogue signal • ... using an antenna / WNIC / WAP / aerial • Checks if the signal is for that device • If so, decodes the signal • ... and decrypts the data	4