

QUESTION 1.



5 (a)

Description	Conventional telephone using PSTN	Internet-based system
connection only in use whilst sound is being transmitted		✓
dedicated channel used between two points for the duration of the call	✓	
connection maintained throughout the telephone call	✓	
encoding schemes and compression technology used		✓
lines remain active even during a power outage	✓	

[5]

(b) **maximum of two marks** for Internet references and **maximum of two marks** for world wide web references

Internet

- massive network of networks/interconnected network of computer devices
- Internet stands for Interconnected Networks
- uses TCP/IP protocol

World Wide Web (www)

- is a collection of (multimedia) web pages/documents
- ...stored on websites
- http/protocols used to transmit data
- web pages are written in HTML
- URLs specify the location of the web pages
- web documents are accessed using browsers

[3]

- (c)
- (i) router [1]
 - (ii) gateway [1]
 - (iii) server [1]

QUESTION 2.



- 7 (a) (i) – at least one computer used to “serve” ...
– ... other computers are referred to as “clients”
– server provides services / applications etc. ...
– ... which may be requested by clients
- (ii) any **two** from:
- files and resources are centralised
 - creation of security / manage security
 - user needs user name and password to access network
 - centralised back-up
 - intranet capability
 - Internet monitoring
 - clients can be less powerful machines, therefore less expensive to buy
 - saving resources on server reduces the burden on the client

[2]

(b) router

[1]

(c)

Statement	Sequence number
The requested web page is displayed on the client computer	5
The user clicks on the hyperlink and the web page is requested from the web server	1
The requested web page content is transmitted to the client computer	3
The client computer processes the JavaScript code using the web browser software	4
The web server locates the requested web page	2

[5]

QUESTION 3.



6 (a) **Two** from:

- WWW is a collection of interlinked, hypertext documents/webpages/multimedia resources (accessed via the Internet) // WWW is content from web servers organised as web pages
- Internet is the global connection of interconnected computer networks
- The Internet uses TCP/IP protocol / WWW uses http protocols to transmit data

(b)

[5]

Description	Fibre-Optic cables	Copper cables	Radio waves
'Wireless' media			✓
Twisted-pair is an example		✓	
Uses light waves	✓		
WiFi			✓
Fastest transmission media	✓		

(c) **One pair** from:

[2]

- Real-time - a live stream of an event that is currently taking place
- On-demand - streaming of an event/programme that has taken place in the past
- Real time – the event is captured live with a video camera connected to a computer
- On-demand – Existing media are encoded to bit streaming format and uploaded to a server
- Real-time – cannot be paused / rewind etc
- On-demand – can be paused / re-wound / fast forwarded etc

(d) **Two marks** for description, **one mark** for correct example.

[3]

- Four numbers separated with '.'
- Each number is between 0 and 255 / 00 and FF in Hex / stored in one byte.
- 32 bits long
- Correct example

Page 7	Mark Scheme	
	Cambridge International AS/A Level – May/June 2016	

(e) **Four** from:

- URL is a reference address to a resource on the Internet.
- The URL is passed to the nearest Domain Name Server (by browser software).
- DNS server stores a database / list of URLs and matching IP addresses.
- DNS (Name Resolver) looks for the URL in its database.
- Finds the matching IP address and returns it to the originator.
- Or if it cannot find it, it forwards to another Domain Name Server at a higher level.
- (Original) DNS server adds the returned IP address to its cache



QUESTION 4.

Cambridge International AS/A Level – October/November 2016



6 Any **four** from:

- User needs high-speed broadband (connection)
 - Data is streamed to a buffer (in the computer)
 - Buffering stops video pausing as bits streamed
 - As buffer is emptied, it fills up again so that viewing is continuous
 - Actual playback is (a few seconds) behind the time the data is received by computer
- [4]

Question	Answer	
6(a)	Two from: - The <u>file</u> is made available from a web/email/FTP server - The user's <u>browser</u> is the client software - The client (software browser) <u>requests</u> the <u>file</u> from the server - The desired <u>file</u> is returned to the client computer	1 1 1 1
6(b)	1. The user keys in the Uniform Resource Locator (URL) into the browser Software. 2. E // The Domain Name Service (DNS) uses the domain name from the browser to look up the IP address of the web server. 3. D // The web server retrieves the page 4. F // Sends the web page content to the browser 5. B // Browser software renders the page and displays	4 1 1 1 1
6(c)(i)	Output1, Output2 RunnerID // Runner ID	1 1
6(c)(ii)	6 – 21	1
6(c)(iii)	13	1
6(c)(iv)	Checks that the RunnerID entered starts with the characters CAM or VAR only	1
6(c)(v)	Two checks from: One mark for check and one mark for description - Format check RunnerID is three letter characters followed by two digit characters //Position is digit characters only - Length check RunnerID has exactly five characters - Range check The value for Position is between 1 and (say) 50 - Presence check The text box for RunnerID or Position is not empty - Existence check To ensure that RunnerID has been registered - Uniqueness check To ensure no two runners have the same number	Max 4 1 1 1 1 1 1 1 1

QUESTION 6.



Question	Answer																	
2(a)	Use the IP address instead of the URL																	
2(b)(i)	1 mark per correct answer <table><tr><th>IP Address</th><th colspan="2">Valid or invalid</th></tr><tr><td>21E5:69AA:FFFF:1:E100:B691:1285:F56E</td><td colspan="2">Valid</td></tr><tr><td>::255.255.255.255</td><td colspan="2">Valid</td></tr><tr><td>59FB::1005:CC57:6571</td><td colspan="2">Valid</td></tr><tr><td>56FE::2159:5BBC::6594</td><td colspan="2">Invalid</td></tr></table>			IP Address	Valid or invalid		21E5:69AA:FFFF:1:E100:B691:1285:F56E	Valid		::255.255.255.255	Valid		59FB::1005:CC57:6571	Valid		56FE::2159:5BBC::6594	Invalid	
IP Address	Valid or invalid																	
21E5:69AA:FFFF:1:E100:B691:1285:F56E	Valid																	
::255.255.255.255	Valid																	
59FB::1005:CC57:6571	Valid																	
56FE::2159:5BBC::6594	Invalid																	
2(b)(ii)	1 mark per correct row <table><tr><th>Statement</th><th>Public</th><th>Private</th></tr><tr><td>192.168.2.1 is an example of this type of address</td><td></td><td>✓</td></tr><tr><td>Assigned by the Internet Service Provider (ISP)</td><td>✓</td><td></td></tr><tr><td>IP address cannot be duplicated in different networks</td><td>✓</td><td></td></tr><tr><td>Network Address Translation (NAT) is necessary to access the Internet directly</td><td></td><td>✓</td></tr></table>			Statement	Public	Private	192.168.2.1 is an example of this type of address		✓	Assigned by the Internet Service Provider (ISP)	✓		IP address cannot be duplicated in different networks	✓		Network Address Translation (NAT) is necessary to access the Internet directly		✓
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2(c)	1 mark per example to max 2 - Fibre-optic - Wi-Fi / Radio waves - Microwave - Infrared																	

QUESTION 7.



Question	Answer	Marks
2(a)	1 mark for 1 correct answer, 2 marks for all 3 correct answers 1 Gopal types into the web browser 2 B (Web browser sends URL to Domain name Service (DNS)) 3 DNS looks up URL in a table 4 A (DNS finds corresponding IP address) 5 C (DNS returns IP address to web browser)	2



Question	Answer	
2(b)	1 mark per bullet point to max 2 • Gives each device on a network an identifier // IP address used to locate a device on a network • Each address is <u>unique</u> within the network • Allows a device/gateway/node to send data to the correct destination / a specific device/gateway/node	
2(c)(i)	1 mark per bullet point to max 3 • Less interference in signal • Signal does not degrade as fast // Needs less signal boosting • More difficult to hack // more secure • Greater bandwidth // <u>Faster</u> transmission speeds possible	3
2(c)(ii)	1 mark per bullet point to max 2 • (Initial) installation cost is higher // Cable / hardware is more expensive to buy (per metre) • Specialists / trained personnel needed to install / maintain • Difficult to terminate // Electronics at both ends are more complex • Fibre-optic cables can break <u>when bent</u> • Only transmits data in one direction • If a fibre-optic cable connection fails, many more services can be affected	2

QUESTION 8.



Question	Answer	
1(a)	1 mark for each correct indication and explanation 3A.21.2H.1 Invalid H is not a valid hexadecimal digit 299.53.2.2 Invalid 299 is not in the correct range 192.2.1.0 Valid Consists of four numbers in the range 0–255 separated by full stops	
1(b)	1 mark per bullet point to max 3 • URL is parsed to obtain the Domain name • Domain name is sent to the nearest Domain Name Server (DNS) • DNS holds a list of Domain names and matching IP addresses • DNS name resolver searches its database for the Domain name • If DNS does not find the Domain name, the request is forwarded to a higher level DNS • If the Domain name is found, the IP address is returned • If the Domain name is not found, the request is passed to a higher level server • If the Domain name is finally not found, an error message is generated	3
1(c)	1 mark for each correct term Real-time On-demand	2
1(d)(i)	1 mark per bullet point to max 1 • The data files are very large • It would take a long time to send the uncompressed file // Compressed files will download faster • A higher bandwidth would be needed to transmit the uncompressed file	1
1(d)(ii)	1 mark per bullet point to max 1 • Data is lost • The decompressed file is not the same as the original	1
1(d)(iii)	1 mark per bullet point to max 3 • Lossy creates a smaller file than lossless // lossy compresses further than lossless • The recording of the concert is a large file size and needs <u>significant</u> reduction in size • Lossy removes detail which can be lost without people noticing • By example e.g. reduction in sound quality <u>will not be noticed</u>	3

QUESTION 9.



Question	Answer	
1(a)(i)	1 mark for any valid example e.g. 192.168.0.1	
1(a)(ii)	1 mark for correct answer The number of IP addresses needed will exceed the number available using IPv4.	1
1(a)(iii)	1 mark per bullet point to max 2 • Too many digits per group • Too many groups of digits • The address is more than 32 bits / 4 bytes • Colons are used as separators	2
1(b)(i)	1 mark per bullet point to max 2 • The PSTN consists of many different types of communication lines • Data is transmitted in both directions <u>at the same time</u> // (full) <u>duplex</u> data transmission • The communication passes through different switching centres	2
1(b)(ii)	1 mark for benefit, 1 mark for drawback Benefit • (Probably) faster connection / communication / transmission of data • (Usually) more consistent transmission speed • Improved security Drawback • Expensive to <u>set-up / maintain</u> • Disruption to the dedicated line would leave no alternative	2



Question	Answer	
1(c)	1 mark per bullet point to max 4, max 3 for router, max 3 for gateway Only award the repeated bullet points (1 to 5 in each section) once Router: • Connects two (or more) networks • Can connect a network to a WAN // acts as the single access point for... • Receives packets and forwards towards the destination • ...using the IP address of the destination • Assigns private IP addresses • Operates between <u>similar</u> networks // networks using the <u>same protocol</u> • Can be used to segment a network Gateway: • Connect two (or more) networks • Can connect a network to a WAN // acts as the single access point for... • Receives packets and send packets towards the destination • ...using the IP address of the destination • Assigns private IP addresses • Connects two <u>dissimilar</u> networks // networks that use <u>different protocols</u>	
1(d)	1 mark per bullet point to max 3 for any valid answer For example: • File server • Print server • Proxy server • Web server • Application server	3

QUESTION 10.



Question	Answer	Marks
4(a)(i)	1 mark per bullet point to max 3 . If no application to the bank max 2 • The bank's server holds the customer account data / website • ... and performs the requested tasks / processes. The computers used by the customers are the clients ... • ... that send requests to the server • ... which returns the results of the request • ... E.g. a customer asks for a list of recent transactions on their account.	3
4(a)(ii)	1 mark per example to max 2 e.g. • Sending and receiving email • A company or school centrally storing files • Using a print server • Using a file server	2
4(b)	1 mark per bullet point to max 3 • All data is held on the server // All processing is performed on the server • The server only sends the results of the query to the client • The client does not have access to all the data • ... which keeps the data more secure / consistent • Customers can be identified when they log in • ...from a database of usernames and passwords	3



Question	Answer									
4(c)(i)	1 mark per bullet point to max 2 - Less interference in the signal - The signal does not degrade as quickly // Needs less signal boosting - More secure // more difficult to hack - Greater bandwidth // <u>Faster</u> transmission speeds possible									
4(c)(ii)	1 mark per bullet point to max 2 - Initial installation cost is higher // Cable / hardware is more expensive to buy per metre - Specialists / trained personnel are needed to install / maintain - Difficult to terminate // The electronics at both ends are more complex - Fibres can break <u>when bent</u> - Only transmits data in one direction // Cannot transmit power, only data	2								
4(d)(i)	1 mark per table - Table CUSTOMER with fields FirstName, LastName, DateOfBirth, CustomerID - Table ACCOUNT_TYPE with fields AccountID, Name, Bonus - Table CUSTOMER_ACCOUNT with fields ID, CustomerID, AccountID, Amount CUSTOMER (<u>CustomerID</u>, FirstName, LastName, DateOfBirth) ACCOUNT_TYPE (<u>AccountID</u>, Name, Bonus) CUSTOMER_ACCOUNT (<u>ID</u>, CustomerID, AccountID, Amount)	3								
4(d)(ii)	1 mark for 1 or 2 correct Primary Keys, 2 marks for 3 correct Primary Keys CUSTOMER: CustomerID ACCOUNT_TYPE: AccountID CUSTOMER_ACCOUNT: ID	2								
4(d)(iii)	1 mark for both table name and Foreign Key Table: CUSTOMER_ACCOUNT Foreign Key: CustomerID / AccountID	1								
4(d)(iv)	1 mark for each correct term <table><tr><th>Definition</th><th>Term</th></tr><tr><td>All the data about one entity</td><td>Table / Relation</td></tr><tr><td>The data in one row of a table</td><td>Tuple / Record</td></tr><tr><td>A column or field in a table</td><td>Attribute</td></tr></table>	Definition	Term	All the data about one entity	Table / Relation	The data in one row of a table	Tuple / Record	A column or field in a table	Attribute	3
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All the data about one entity	Table / Relation									
The data in one row of a table	Tuple / Record									
A column or field in a table	Attribute									

QUESTION 11.



Question	Answer																
6(a)(i)	1 mark for touchscreen being both 1 mark for remaining 3 devices <table border="1"> <thead> <tr> <th>Device</th><th>Input</th><th>Output</th></tr> </thead> <tbody> <tr> <td>Touchscreen</td><td>✓</td><td>✓</td></tr> <tr> <td>Webcam</td><td>✓</td><td></td></tr> <tr> <td>Microphone</td><td>✓</td><td></td></tr> <tr> <td>Fingerprint scanner</td><td>✓</td><td></td></tr> </tbody> </table>	Device	Input	Output	Touchscreen	✓	✓	Webcam	✓		Microphone	✓		Fingerprint scanner	✓		
Device	Input	Output															
Touchscreen	✓	✓															
Webcam	✓																
Microphone	✓																
Fingerprint scanner	✓																
6(a)(ii)	1 mark for any 1 correct letter in the correct position 2 marks for any 2 correct letters in the correct positions 3 marks for any 3 correct letters in the correct positions 4 marks for 5 correct letters in the correct positions C An electric current is sent to the speaker. E The electric current passes through the coil. <i>The current in the coil creates an electromagnetic field.</i> A Changes in the audio signal cause the direction of the electrical current to change. This determines the polarity of the electromagnet. D The electromagnet is repelled by, or attracted to the permanent magnet. <i>The movement of the coil causes the diaphragm to vibrate.</i> B The vibration creates sound waves.	4															
6(b)(i)	To store files / software long term	1															
6(b)(ii)	1 mark per bullet point to max 3 - No moving parts - Solid state memory is non-volatile - Makes use of blocks / arrays of ... Semiconductors // NAND gates // NOR gates // transistors // integrated circuits - SSD Controller manages the components - Uses a grid of columns and rows that has two transistors at each intersection - One transistor is called a floating gate - The second transistor is called the control gate - Memory cells store voltages which can represent either a 0 or a 1 - Essentially the movement of electrons is controlled to read/write - Not possible to overwrite existing data // it is necessary to first erase the old data then write the new data in the same location	3															



Question	Answer	
6(c)	1 mark per bullet point to max 2 - RAM stores currently running parts of files / programs / processes / OS - ROM stores boot up instructions / OS kernel // data permanently // store the firmware for the tablet	
6(d)(i)	1 mark per bullet point to max 4 Max 3 for image Max 3 for sound Images - The images are stored as bitmaps - Each image is made up of pixels ... each pixel is of a single colour - Each colour has a unique binary number Store the sequence of binary numbers for each image / frame // store the binary value of each pixel Sound - Measure the height/amplitude of the sound wave - A set number of times per second // at regular time intervals - Each amplitude has a unique binary number Store the sequence of binary numbers for each sample	4
6(d)(ii)	1 mark per bullet point max 2 for each coding term. Interlaced encoding - The data from a single frame are encoded as two separate fields - One containing the data for the even numbered rows / lines and the other has the data for the odd numbered rows / lines - The image is rendered by alternating between the even field and the odd field of each successive frame - The viewer sees data from two frames simultaneously - The rate of picture display (the field rate) is twice the rate of image frame display (the frame rate) - Produces what appears to the eye to be a high refresh rate - Halves the transmission bandwidth requirements Progressive encoding - Stores the data for an entire frame - Displays all the frame data at the same time - The rate of picture display is the same as the frame rate - High bandwidth requirements	4



Question	Answer	
6(e)(i)	1 mark per bullet to max 3 • The data is compressed before transmitting • The video is transmitted continuously as a series of bits • The video is hosted on a media server • On download, the server sends the data to a buffer on the client computers // The buffer stores the data from the server • The recipient / user's software receives bit stream from the buffer	
6(e)(ii)	1 mark for: On-demand 1 mark for justification from: • The video does not need to be broadcast live // the video is already recorded • Dominic's colleagues will watch the video at a later date // at their convenience	2
6(e)(iii)	1 mark per description Temporal Redundancy • Pixels in a sequence of consecutive video frames have the same value in the same location Spatial Redundancy • A sequence of consecutive pixels in a single video frame have the same value	2

QUESTION 12.



Question	Answer													
1(a)(i)	1 mark per input device to max 2 e.g. - Barcode scanner / Infra-red scanner - Pressure sensor - RFID / chip reader - Bank note scanner - Pin / key pad - Magnetic strip reader													
1(a)(ii)	1 mark per output device to max 2 e.g. - Speaker - Printer - LCD screen	2												
1(a)(iii)	1 mark for at least two statements in the correct position, 2 marks for all four statements in correct position. 1 B (The screen has a layer that stores an electrical charge) 2 <i>When the user touches the screen</i> 3 A (Charge is drawn to the point of contact) 4 C (There is a change in the electrostatic field) 5 <i>The coordinates of the point of contact can be calculated</i> 6 D (These coordinates are sent to the touchscreen driver)	2												
1(b)(i)	1 mark per bullet point to max 2 - To store the files needed to boot the system - To store parts of the self-checkout machine operating system - To store the self-checkout machine software - To store the intermediate data / running total for items purchased	2												
1(b)(ii)	1 mark for at least one correct row, 2 marks for all three correct rows <table border="1" data-bbox="317 1473 1139 1733"> <thead> <tr> <th>Statement</th><th>SRAM</th><th>DRAM</th></tr> </thead> <tbody> <tr> <td>More expensive to make</td><td>✓</td><td></td></tr> <tr> <td>Requires refreshing (recharging)</td><td></td><td>✓</td></tr> <tr> <td>Made from flip-flops</td><td>✓</td><td></td></tr> </tbody> </table>	Statement	SRAM	DRAM	More expensive to make	✓		Requires refreshing (recharging)		✓	Made from flip-flops	✓		2
Statement	SRAM	DRAM												
More expensive to make	✓													
Requires refreshing (recharging)		✓												
Made from flip-flops	✓													



Question	Answer	
1(c)(i)	1 mark per bullet point to max 3 plus 1 mark for suitable example • When a barcode on an item is scanned • ... the server performs any requested tasks // the server looks up the details of the product • The self-checkout machine is a client • ... that send requests to the server // the self-checkout machine asks for, e.g. the price of the item • The server returns the results of the request // the server returns e.g. the item price • Self-checkout machine displays e.g. price to the user	
1(c)(ii)	1 mark for each security method to max 2, 1 mark for integrity Security • encryption • access rights • username and password // biometrics // user accounts • backup // disk mirroring • firewall • Physical methods (e.g. CCTV, locked rooms etc.) Integrity • checksum • parity • validation on input	3