

QUESTION 1.

Cambridge International AS/A Level – October/November 2016



- 2 (a) The number of images/frames recorded per second/unit time.
//The frequency with which the images/frames are recorded.

- (b) **ONE** mark per bullet point below. **MAX THREE** marks per type of encoding.

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).
- Originally used in television broadcasting and adapted for video recordings.
- 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 and displays all the frame data at the same time.
- The rate of picture display is the same as the frame rate.
- Used by traditional film/video digitised from a film camera/computer displays progressive encoding.
- High bandwidth requirements.

[4]

- (c) (i) **ONE** mark per term.

Description	Term
Pixels in two video frames have the same value in the same location. There is duplication of data between frames.	Temporal <u>redundancy</u>
A sequence of pixels in a single video frame have the same value.	Spatial <u>redundancy</u>

[2]

- (ii) (File) compression

[1]

QUESTION 2.



Question	Answer	
1(a)	1 mark per bullet point to max 3 - The microphone has a diaphragm - The incoming sound waves cause vibrations ... causing a coil to move past a magnet (dynamic microphone) // changing the capacitance (condenser microphone) - An electric current is generated / changed	
1(b)	1 mark per bullet point - The sampling resolution number of bits used to store each <u>sample</u> - Increasing the (sampling) resolution means a larger file size // Decreasing the (sampling) resolution means a smaller file size - Increasing the (sampling) resolution gives a more accurate representation of the analogue sound // Decreasing the (sampling) resolution gives a less accurate representation of the analogue sound - Increasing the (sampling) resolution means a greater range of values can be stored // Decreasing the (sampling) resolution gives a smaller range of values that can be stored - Increasing the (sampling) resolution reduces the quantization errors // Decreasing the (sampling) resolution causes greater quantization errors	3
1(c)	For 2 features 1 mark for identifying feature, 1 mark for describing what it does. For example: - Cut/delete ... Remove part of the sound file - Copy and paste ... Replicate part of the sound - Amplify ... Increase the volume of a section of sound	4
1(d)(i)	60 images are recorded per second	1
1(d)(ii)	1 mark per bullet point to max 2 - Each frame contains (all the lines for) the <u>complete image</u> - All the frame data is recorded at the same time - Each frame contains all the scan lines - The number of images stored is the same as the frame rate	2
1(e)	1 mark per bullet point to max 1 - A meta file / wrapper - Contains various different types of data	1

QUESTION 3.



Question	Answer	
6(a)	1 mark per bullet point to max 3 - The data from a single frame is split into two separate fields - One field has data for the odd numbered <u>rows/lines</u> and the other field has data for the even numbered <u>rows/lines</u> - Odd numbered line fields alternate with even numbered line fields - The viewer sees data from two frames simultaneously	
6(b)	1 mark per bullet point to max 1 - Produces what appears to be a higher refresh rate - Lower bandwidth needed // Halves the bandwidth requirements	1
6(c)	1 mark per bullet point to max 2 - Identifies pixels that do not change between frames - Records only the differences between the frames	2
6(d)(i)	1 mark per bullet point to max 3 - The amplitude of the wave is measured /sound wave is sampled - At <u>set/regular</u> time intervals - Each sample is stored as a binary number - Samples are stored in order in a file	3
6(d)(ii)	1 mark per bullet point to max 1 for each Sample rate: - Increasing the sample rate means more samples per second hence more bits per second <u>and</u> larger file size - Decreasing the sample rate means fewer samples per second hence fewer bits per second <u>and</u> smaller file size Sample resolution: - A higher sampling resolution means more bits per sample <u>and</u> a larger file size - A lower sampling resolution means fewer bits per sample. a smaller file size	2

QUESTION 4.



Question	Answer	Marks
4(a)(i)	1 mark per bullet point to max 3 • The microphone has a diaphragm / ribbon (accept equivalent) • The incoming sound <u>waves</u> cause vibrations (of the diaphragm) • ...causing a coil to move past a magnet (dynamic microphone) // changing the capacitance (condenser microphone) // deforms the crystal (crystal microphone) etc. • An electrical signal is produced	3
4(a)(ii)	1 mark per bullet to max 3 • The revolving drum is initially given an electrical charge • A laser beam (bounces off moving mirrors) <u>scans back and forth</u> across the drum • ...discharging certain points (i.e. 'drawing' the letters and images to be printed as a pattern of electrical charges) • The drum is coated with oppositely charged toner (which only sticks to charged areas) • The drum rolls over electro-statically <u>charged</u> paper // Electro-statically <u>charged</u> paper is fed (towards the drum) • The 'pattern' on the drum is transferred to the paper • The paper is passed through the fuser to seal the image • The electrical charge is removed from the drum // the excess toner is collected	3
4(b)	1 mark per bullet to max 2 • Stores all the scan lines for an entire frame // displays / records all the frame data at the same time // not split into fields • Complete frames are displayed <u>in sequence</u> • The rate of picture display is the same as the frame rate.	2



Question	Answer	
4(c)	1 mark per bullet to max 4 • DRAM has to be refreshed / charged and SRAM does not require a refresh • DRAM uses a single transistor and capacitor and SRAM uses more than one transistor • DRAM stores each bit as a charge and in SRAM each bit is stored using a flip-flop/latch • DRAM requires higher power consumption under low levels of access, (which is significant when used in battery-powered devices because it requires more circuitry for refreshing) // SRAM uses less power (no need to refresh) • DRAM less expensive to purchase (requires fewer transistors) // SRAM is more expensive to buy (as it requires more transistors) • DRAM has slower <u>access</u> time/speed (because it needs to be refreshed) // SRAM has faster <u>access</u> times • DRAM can have higher storage/bit/data <u>density</u> // SRAM has lower storage/bit/data <u>density</u> • DRAM used in main memory and SRAM used in cache memory	
4(d)(i)	1 mark for correct answer Formal or legal recognition of ownership of the program // Formal or legal restriction / permissions on use of the program // The intellectual property rights to the program	1
4(d)(ii)	1 mark per bullet point • She does not wish to release the source <u>code</u> • She does not want anyone to be able to edit / modify / share the source code/program • She wants to make money from the program	2



Question	Answer
4(d)(iii)	1 mark for a <u>name and a description</u> of each licence to max 2 Commercial Software • The program is purchased for a fee • It restricts the number of users/possible time period for use // Limited number of installations allowed // Software key needed to install • Source code not provided // source code protected / cannot be edited • Anyone can purchase/download if agree to the terms Shareware • The program is free for a trial period // The (free) program may have limited functionality // Need to purchase / enter details after trial • Users do not have access to the source code // source code may not be edited • Users may re-distribute the software. Freeware • There is no charge for the software • The software could still be copyrighted • She can set her own restrictions on what a user can do with the program

QUESTION 5.



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	✓	✓															
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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