5.6 Representing images, sound and more part 2
Mark Scheme

Q1.

(a) (i) (Analogue sound) is converted into digital // discrete values;
(Height of analogue wave) sampled;
At regular intervals;
Height/value represented by a number/binary code/binary pattern;
R MIDI

3

(ii) Digital-to-Analogue converter;
A sound card;
R MIDI
A D-
A Converter; DAC n.e.
R A-D converter

1

(b) Endpoints /a pair of / two (x,y) co-ordinates // start point, direction and length;
Type of object /shape;
Thickness of shape/line;
Colour of shape/line;

2

[6]

Q2.

(a) *Any two ways at one each*
Barcode;
OCR;
MICR;
Magnetic stripe;
Smart card/Microchip/Memory chip;
R Computer chip
R Chip
R OMR

2

(b) **Either**
Biometric method used locally:
1 mark for what is stored on ID card – one of fingerprint, retina pattern, iris pattern, ear pattern, palm print (NB not DNA), vein pattern, (electronic) stored facial image (but not visible photograph of person) ;
1 mark for capturing the biometric information and comparing with what is on card.
Expectation is of a system that stores this information on card in a way that is hard to tamper with
Or
Biometric method involving checking remote central database:
1 mark for capturing specified biometric information - one of fingerprint, retina pattern, iris pattern, ear pattern, palm print (NB not DNA), vein pattern, facial image;
1 mark for comparing with stored biometric information held in central database;
Or

1 mark for entering pin number;
1 mark for comparing entered pin number with stored pin number on remote database or stored on card;
Or
Photograph on card scanned//Camera captures image of person// PersonID scanned in//PersonID typed in;
Image compared with image stored on remote database;
R Remote database stores whether card has been lost/stolen – card will have tobe re-issued with same name, address, PersonID
A Remote database stores whether card lost/stolen; – card will have to be re-issued with new PersonID;

2 or nothing

2

[4]

Q3.

(a) Medium: Magnetic hard disk
A Hard Disk (1)
Justification: Random access device;
Sufficiently high data transfer rate;
Sufficiently high storage capacity;
R Magnetic disk is fast enough (1)

2

(b) (i) Processing is faster; **A** System runs faster
Loading on main processor can be reduced;
CODEC has its own processor;
R Faster on its own;
A Faster with justification

1

(ii) Movie needs to be compressed to fit storage capacity of DVD-R;

1

(c) Backing up (data stored on magnetic disk drive);
Archiving (data);
R Storing video once editing complete

1

[5]

Q4.

(a) Picture is broken into a grid of pixels;
A diagram;**R** dots **R** parts **R** screen for each pixel a number/value is stored; in memory; number/value represents a colour; **R** *black/white answers*

Max 2

(b) The graphic can be enlarged/reduced/zoomed in/out without distortion;
Can take up much less (memory) space / smaller file size;
Image is more accurate; smooth edges/lines; can produce 3D images;

Max 1

[3]

Q5.

(a) The number of times the amplitude is measured per second/unit of

time/sampling rate;
The number of bits available to store the amplitude measurement/ sampling resolution;
R amount of memory
R bits per second
R all other factors
R references to playback only

2

(b) Editing out noise/wrong notes post processing; sounds/data can be changed/edited;
Stored/transmitted digitally;
I compression

1

(c) Producing/creating/generating audio signals/sound(s) by computer/digitally; (which sound like an instrument/voice)
R editing/changing

1

[4]

Q6.

(a) E-mail may pass through many computers/servers if it travels over a network, each computer can make a copy/can be accessed;
When a message arrives at its destination, it waits until the intended recipient picks it up. During this time the message is vulnerable to being read or copied by the computer's operator;
Electronic eavesdropping of telephone wires and local area networks is possible;
With e-mail alterations leave no trace(no physical damage) whereas with paper alterations leave a physical mark;

Max 1

(b) (i) E-mail encrypted using public key;
Recipient's private key used to decrypt e-mail;

2

(ii) E-mail encrypted by sender using private key;
Recipient decrypts e-mail using sender's public key;

2

[5]

Q7.

(a) (i) 54;

1

(b) (i) '4' / 4 ; ;

1 mark for ASCII value 52; 2 marks for correct character 4 ; ;

Max 2

(ii) UNICODE / EBCDIC / EBCD /extended binary coded decimal ;
A minor misspelling of EBCDIC

1

(c) (i) Bit-mapped graphic;

R as pixels
R jpeg *etc*

1

(ii) Image broken down into separate pixels;
Each pixel is either black or white / on or off;
Use 2 different values for black and white / 1 for black and 0 for white (or vice versa);
Store in one bit / bits / byte of computer memory;
A diagram which maps onto above points
A follow through from (i) a .gif or .jpeg image:

Max 2

[7]

Q8.

(a) 1024 × 1024 / 1,048,576 / 2^{20};

1

(b) A picture element/the smallest illuminable element of a display/smallest addressable part of an image;
A screen/image divided into a grid, a pixel is one square of that grid;
R dot/square on a screen *(not enough)*

1

(c) (i) Display is made up of 1024 pixels wide/across/horizontally and 1024 pixels high/down/up/vertically;

1

(ii) 1 (byte);

1

(iii) 256;

1

[5]

Q9.

(a) Analogue;

1

(b) Converts analogue signals into digital (signals); digitises signal;
Transforms the analogue input into digital form;
A data instead of signal

1

[2]

Q10.

(a) *Any two reasons × 1 each*
To monitor criminal activity; (accept two different types of each category)
(**A** Anything that maps onto criminal activity, e.g. pornography)
To monitor terrorist activity; (accept two different types of each category)
To monitor political groups; (accept two different types of each category)
A To monitor for viruses which threaten economic wellbeing of country or have a criminal intent;

2

(b) One way: encrypt content;
A encode/send in code

1

[3]

Q11.

(a) (Analogue sound) is converted into digital;
(Height of analogue wave) sampled;
At regular intervals;
Height/value represented by a number/binary code/binary pattern;

Max 2

(b) (i) Picture broken down into pixels;
R dots / **R** parts
Each pixel represented by 1 bit;
0 for black and 1 for white; (*or vice versa*);
R bit map made up of pixels

Max 2

(ii) Need more than one bit to represent each pixel;
Need more bits to represent colours
R pixels coded hexadecimally
R need to store red, green, blue values

1

[5]

Q12.

(a) Analogue – continuously varying signal (wavey line signal)/vary between two Values Digital – discrete signal (stepped signal)/two states/on or off/ O's & I's
(Good labelled diagrams will suffice)

2

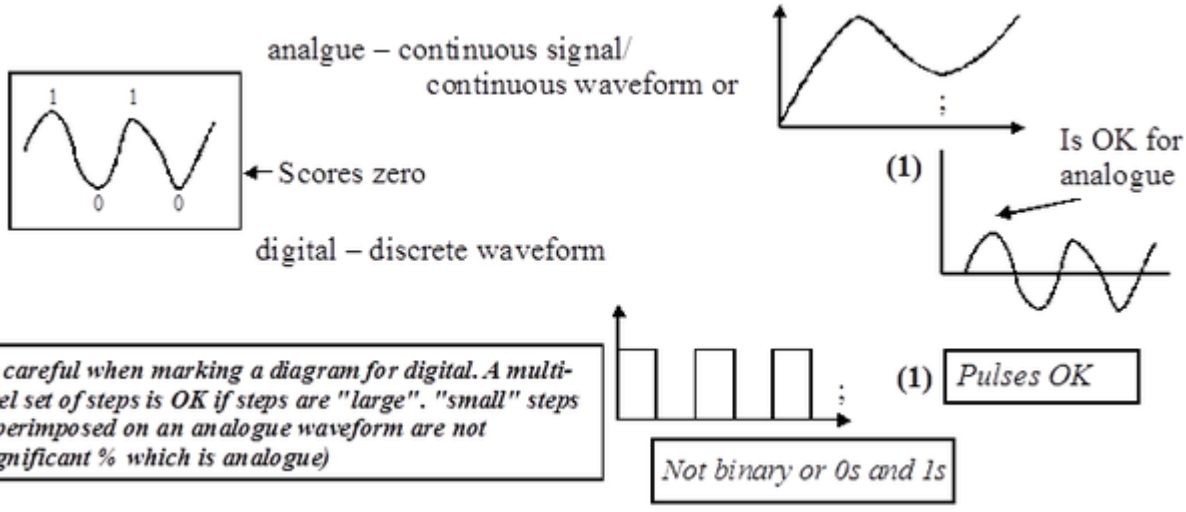
(b) Any two sensible instances where input is analogue Description should clearly state the variable (e.g. temperature) & the situation (e.g. furnace).

2

[4]

Q13.

(a)



2

(b) (i) A class is a set of objects that share a common structure and a common behaviour;
A class is a set/collection of objects with same attributes/properties/characteristics/fields & methods (accept procedures or functions for methods) /behaviours/operations/code;

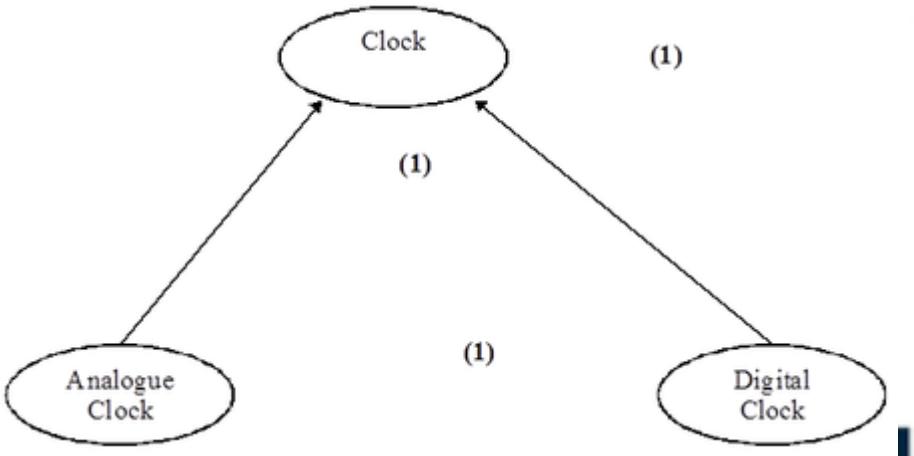
NOT set of objects with same data

1

(ii) Inheritance is a relationship/link among classes wherein one class shares the structure and behaviour of another class;
It is where one class is derived from another class.
It is where one class uses attributes/properties/etc/ from another class;
It is where one class uses methods/procedures/etc from another class;
It is where one class inherits from a parent class(hierarchy must be clear

1

(c)



1 mark for clock in root position. 1 mark for both Analogue and Digital clocks in leaf positions.
1 mark for correct arrow-headed lines.
Must be correctly vertically aligned for these two marks

3

[7]

Q14.

(a) Part of a program
Numeric
Graphics data
Sound data
Address of memory location
Textual data
Logical data
Characters
Binary integers
Floating point numbers
BCD numbers

1 mark per clearly <u>distinct</u> interpretation to max 3

3

(b) The program instructs it to take the contents of that location and use it accordingly

1

[4]

Q1.

Some candidates provided excellent answers while others seemed to not have the most fundamental understanding, suggesting that sounds are turned into either a 0 or a 1. Analogue sound is converted into digital by sampling the height of the analogue wave at regular intervals and representing the measured value by a binary code. Some candidates wrongly suggest that a modem can be used for this. To convert the digitally recorded sound so it can be played back through speakers, most candidates suggested a 'sound card' which was accepted, though what was required was the essential component of the sound card, which is the Digital to Analogue Converter. MIDI was a frequent wrong answer.

Vector graphics have featured in pervious examination questions in this unit but few candidates could give a full answer. The (x,y) co-ordinates of the two endpoints of the line are stored, together with information about its thickness, colour and what type of shape it is. Many candidates could not express clearly enough the idea of start and end points and others referred to pixels, clearly not understanding the different methods of representing images.

Q2.

Part (a) was well answered on the whole with barcode and magnetic stripe being the most popular answers. A smart card was another acceptable answer. Some candidates substituted microchip for smart card which was accepted, but chip was not.

Few candidates obtained both marks for part (b) because either they failed to state that biometric information was stored on the card or that a comparison was made with biometric information stored in a central database.

This question and several other questions demonstrated a tendency amongst the weaker candidates to supply answers that left much unsaid. Part (a) asked for a description but several candidates simply wrote one-word answers or acronyms such as MICR. Apart from demonstrating poor examination technique, this could be construed as evidence that the candidate's thinking and communication skills were underdeveloped.

Q3.

Candidates performed well on most of this question. Part (b)(i) was less well answered across the candidature. If the CODEC has its own hardware then the loading on the main processor can be reduced. Consequently, compression and decompression of videos will be faster.

Q4.

(a) Answers showed some confusion with many candidates describing how the bit-mapped image is displayed on the screen rather than how the image itself is held in memory. There is some overlap so that some candidates obtained credit almost by accident! Many candidates insisted that a pixel of a coloured image could be stored in one bit. Candidates need to understand that an image is broken down into a grid of pixels and for each pixel a number is stored which represents a colour.

(b) Most candidates obtained the mark by stating that it either 'takes up less space' or that it could be 'zoomed in without distortion'. Those who gave the vague 'better

quality' lost out.

Q5.

This was very poorly answered with few correct answers.

(a) The question stem gave enough information about how sound is converted to digital data. Most candidates did not pick up on the significant points but concentrated on the quality of the microphone and speakers, or even the sound source. Many candidates referred to bits per second, which did not gain credit. Correct responses referred to the sampling rate (how many samples taken per second) and sampling resolution (how many bits available to store the amplitude measurement).

(b) Many candidates stated that the sound could be 'cleaned up' or 'hiss removed' to gain the mark.

(c) This was poorly answered, with the commonest incorrect answers either returning the question, e.g. 'where sound is synthesised…' or by describing the recording industry's technique of 'sampling' where pieces of already recorded music are used to create a new piece of music. Answers involving the creation of sound by computer gained credit.

Q6.

The majority of the candidature succeeded in making a creditable attempt at this question. The most popular answer for part (a) was the lack of any physical trace with electronic mail alterations, which is not true of alterations to paper mail. Fewer candidates answered that opportunities exist to alter emails because e-mails travel through several computers/servers to which access is possible.

Many candidates successfully deduced that a publicly distributed public key would be used to encrypt e-mail and the corresponding private key would be used to decrypt it. Some candidates failed to make it clear that the recipient's private key, not any private key, must be used. To verify that e-mail has originated from the sender and has not been altered the sender's private key can be used to encrypt the e-mail. The corresponding public key can be used to decrypt this e-mail. Many candidates understood the sequence in which the keys had to be used but fewer spelt out that decryption takes place using the sender's public key, not just any public key.

Q7.

Nearly all candidates scored some marks on this question.

(a) (i) Nearly all gave 54.

(b) (i) The majority correctly identified 4 as the encoded character.

(ii) Depending on the centre, Unicode or EBCDIC were the correct answers given (with some highly original spellings of EBCDIC), while 'encryption' and 'hexadecimal' were very popular incorrect answers.

(c) (i) Most gained credit with 'bitmap' as their answer.

(ii) Nearly all candidates gained at least one mark but many ignored the fact in the question stem that a black-and-white image was to be stored and went into details about storing coloured images. Resolution was also often described which was not asked for here. The description that the image is

broken down into pixels, and these are either black or white, that a one could be stored for each white pixel and a nought for each black pixel or vice versa would have gained full marks.

Q8.

(a) Correct responses were 1024 x 1024 or 1,048,576 or 220. However, a substantial number of candidates gave 1,000,000 or even 1024.

(b) Surprisingly, a pixel was rarely described correctly – 'a tiny dot on the screen' is not an adequate description. Acceptable responses included Picture Element or the smallest addressable part of an image. The description of an image divided into a grid and each square of that grid being a pixel was also worthy of credit.

(c) (i) Many candidates requoted the question, some stated this means high resolution, a response which did not gain credit. Candidates who elaborated to explain that this meant there were 1024 rows and 1024 columns of pixels gained the mark.

(ii) Very few candidates managed to calculate this correctly, even when they had correctly stated that 1Mb was 1024 x 1024 bytes. The answer '1 byte' ought to have been reasonably straightforward.

(iii) Again simple arithmetic evaded many candidates. Instead of 256, the numbers quoted ranged from 2 to millions.

Q9.

(a) Most candidates correctly stated that sound is analogue in form, although some were under the impression that it is inherently digital.

(b) Again most candidates could describe that an A-to-D converter converts analogue signals to digital signals. However, some described instead the action of a modem and did not gain the mark for suggesting that the signal was also converted back to analogue.

Q10.

Many candidates correctly identified to monitor criminal activity and to monitor terrorist activity. Some candidates answered quoting a specific example, "to catch paedophiles at work exchanging child pornography", which also gained credit.

Several candidates answered that the reason was "to look out for viruses" which was not quite enough to gain credit. Those candidates that answered more fully "to detect and prevent viruses from causing economic harm to the country" did gain credit. Often a candidate's response to a "give reasons" type question falls short of the expected answer because the detail is missing. "To look for criminals" would not be enough whereas "to look for criminal activity" would be.

The majority of the candidates gave the creditworthy answer 'encryption' as their response to part (b). A few wrongly suggested using a password.

Q11.

(a) Some candidates clearly understood this topic and gained full credit for explanations which showed that the sound was converted into digital by sampling the height of the analogue wave at regular intervals and representing the value by a

number. Many candidates were under the misconception that this was done by the microphone.

(b) Most candidates mentioned pixels in part (i) but did not explain that an image was made up of pixels. Many good answers stated that each pixel could be represented by one bit, 1 for black and 0 for white (or vice versa). Superficial answers such as stating that the image needs to be placed into suitable software and saved as a monochrome bitmap do not gain credit.

There was a common misconception in part (b)(ii) that one bit could be used to code any colour, or that increasing the resolution would provide colour. Responses which gained credit mentioned that more than one bit would be needed to represent each pixel.

Q12.

Part (a) was adequately answered by nearly all of the candidates, including most of those who offered diagrams to show the difference. In part (b), however, poor quality of English or lack of examination experience cost many candidates one or both marks: the question asked for brief descriptions of two *situations* where the input would be analogue, so examples of analogue signals without reference to the application or context was not sufficient.

Q13.

(a) Several candidates confused a digital signal with digital data and gave inappropriate answers. Digital data are discrete values. Examples are text and integers, e.g. sequences of binary 0s and 1s or denary numbers such as 1, 2, 3, 4, et cetera... In a communications system, data are propagated from one point to another by means of electric signals. An *analogue signal* is a continuously varying electromagnetic wave. A *digital signal* is a sequence of voltage pulses that may be transmitted over a wire medium; for example, a constant positive voltage level may represent binary 1 and a constant negative voltage may represent binary 0 as illustrated below.

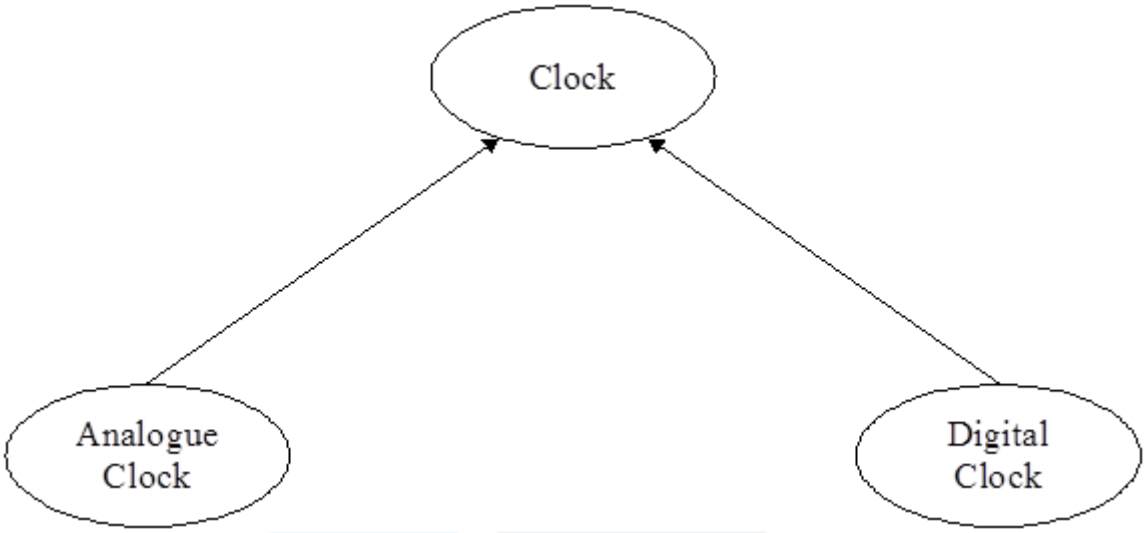
Some candidates drew diagrams that depicted a digital signal with more than two discrete levels. This is fine. However, a few candidates drew diagrams of a digital signal that essentially depicted an analogue signal modulated by a very small digital component. It was not sufficiently clear that the diagram represented a digital signal and hence no credit was given. Candidates are advised, for clarity's sake, to stick to a two state representation when drawing diagrams.

Some candidates drew a diagram of two computers linked by a telecommunications link with a modem at the interface of each with the link. This gained no credit.

(b) Many candidates were unable to define the terms class and inheritance precisely and so failed to gain credit. Many candidates defined a class as an object where in fact it is an object type describing a set of objects that share a common structure and common behaviour. Answers from several candidates focussed on data being stored and gave a definition that described a record not an object type, e.g. " a set of objects with the same data". The idea of encapsulation - combining a record with the

functions and procedures that manipulate it - was not well expressed.

(c) The inheritance diagram was drawn vertically by most candidates but with many failing to show the correct direction for the arrows. The correct direction is illustrated below.



Q14.

Candidates gained no marks for offering 'binary' as an interpretation, as all data in the location would be in binary. Hexadecimal and Octal were incorrect alternatives that were seen too often. 'A binary number' or 'integer' followed by 'twos complement' were not considered distinct answers. Few candidates were then able to give a sensible answer to part (b).