

GCE

ICT

Advanced GCE **2515**

Communications Technology and its Application

Mark Scheme for June 2010

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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The Awarding of Marks for Written Communication

Marks are awarded for the use of accurate spelling, punctuation and grammar according to the following criteria.

		Marks
Below Threshold Performance		0
Threshold performance	Candidates spell, punctuate and use the rules of grammar with reasonable accuracy; they use a limited range of specialist terms appropriately.	1
Intermediate performance	Candidates spell, punctuate and use the rules of grammar with considerable accuracy; they use a good range of specialist terms with facility.	2–3
High performance	Candidates spell, punctuate and use the rules of grammar with almost faultless accuracy, deploying a range of grammatical constructions; they use a wide range of specialist terms adeptly and with precision.	4

The marks will be awarded on an impression basis and will reflect the candidate's performance in the paper as a whole.

Rule of thumb



- 0** Award only in rare circumstances eg no written work or minimal, which is not in sentences and is spelt incorrectly, without use of appropriate technical terms.
- 1** Questions answered using statements or single words only.
- 2** Candidates use some sentences and some technical words. Some errors in grammar and spelling.
- 3** Candidates use sentences correctly, with few errors in grammar. Some technical words used appropriately and with limited spelling errors.
- 4** Almost perfect use of grammar, technical vocabulary and spelling.

The 'norm' will probably be 3 marks. However, do not be afraid to award 4 marks if appropriate.

1 (a) Bus**Benefits**

- no requirements for switches/hubs (1)
- easy to add extra nodes/terminals/stations/devices (1) (as the main cable can be extended) (1)
- easy to cable (1)
- low cost network because of (simple) cabling (1)

Drawbacks

- if the main cable fails then the whole network/segment will fail (1)
- likelihood of data collisions (as data travels in both directions)(1)
- restriction on length of cabling between terminators (1) without the use of repeaters (1)
- terminals are required at both ends of backbone cable (1)
- difficult to identify the problem if the entire network shuts down (1)

[Max 4]**(b) (i) NIC:**

- allows communication to network (1) by interpreting protocols (1) allows the computer to be uniquely identified on the network (1) using MAC address (1)

To Max 2

[Max 2]**(ii) Gateway:**

- links two networks (1) which are dissimilar (accept example) (1)
- provides a single point of entry to a secure network (1) allowing all machines on the network to access the internet through a single cable (1)
- acts as a firewall (1)

To Max 2.

[Max 2]**(c) Explain why the owners have installed a firewall**

Any four from:

- prevents external users (1) from gaining unauthorised access to the cafe's computer system (1)
- limits/filters the data that can be received (1) or sent (1) (to external users)
- could block certain types of data coming into the cafe's computer system (1)
- to stop hackers/viruses from entering the cafe's computer system (1)

[Max 4]**(d) Describe how access to data on the network can be restricted**

One for point, one for expansion eg:

- user names and passwords (1) which determine appropriate facilities for individual users (1)
- organising users into groups (1) according to their needs (1)
- access levels - read only ... etc (1) according to authority of user (1)
- physical access to computer system (1) restricted by locks on doors (1)

[Max 4]

(e) **Describe methods that could be used to detect errors during data transmission.**

- **parity check** (1)
- 1 bit (of each byte) is reserved as a parity bit (1)
- eg if the system uses odd/even parity (1)
- the number of bits in the byte must be odd/even (1)
- if even/odd, then an error has occurred (1)
- example of parity error (1)
- can be horizontal and vertical parity checking (1)
- **cyclic redundancy check/checksum** (1)
- used on blocks of data (1)
- a standard mathematical calculation is performed (1) on the data block
- and the result is appended to the block (1)
- the same formula is applied at the receiving end (1)
- if results differ then an error has occurred (1).
- **hamming code** (1)
- is a more sophisticated error detection method (1)
- and may sometimes detect and correct errors (1)

NOT check digits

Accept any other valid method.

[Max 6]

(f) **Explain the role of layering when connecting computer systems.**

One mark for point, one for expansion eg

- breaks down complex activity (1) into smaller ones, logical model (1)
- each layer has specific task (1) separates tasks into logical sets (1)
- each layer can only talk to adjacent ones (1) separates processes into discrete steps (1)
- layers operate independently (1) aids fault finding/error detection (1)
- application layer (1) supports end-user processes/authentication/data privacy (1)
- presentation/syntax layer (1) translates data between application/network (1)
- session layer (1) manage connections (1)
- transport layer (1) completes data transfer/flow control (1)
- network layer (1) switching/routing/error handling (1)
- data link layer (1) encoding/decoding of data (1)
- physical layer (1) conveyance of data (1)

[Max 4]

(g) **State one advantage to the owners of using optical communications in their network.**

- security implications (1) - do not leak light (1)
- difficult to hack (1)
- higher bandwidths possible (1)
- rate of transfer (1) (**'faster' or 'quicker' needs quantifying.**)
- doesn't degrade over distance (1)
- video conferencing (1)
- future growth can be handled (1)
- not prone to interference (1)
- needs fewer repeaters (1)
- (optic fibre) cable not subject to corrosion (1)

[Max 1]

2 (a) **Explain the importance of bandwidth when showing live TV programmes.**

- A low bandwidth implies slow transmission of data (1) or a small volume of data (1).
- TV programmes include speech and video so there is a high volume of data (1) which needs to be transmitted in real-time (1)

Allow examples eg 'slow and jerky'

[Max 4]

(b) Explain why the transmitted data may need to be encrypted.

eg

- to ensure that only the customers who have subscribed (1) to that particular channel can receive (1)

[Max 2]

(c) Describe how a call made from a mobile telephone in the UK is routed to the call centre

Allow diagram awarding marks for suitable annotation.

Any six points:

- the UK is broken down into cells (1)
- each cell has a cell tower/cell base station (1)
- the caller dials the required number (1)
- this is sent to all adjacent cell bases (1) via a digital control channel (1)
- as the caller travels between cells the cell base receiving the strongest signal takes control (1)
- the call is relayed to a computer controlled mobile telecommunications switching office (1)
- the cell base allocates a transmission frequency (1)
- the mobile phone automatically tunes to the frequency on request (1) via the control channel (1)
- the call is routed from the mobile switching office to the main exchange (1)
- the main exchange routes the call to an international exchange (1)
- the call is then sent to the receiving international exchange via undersea cable or satellite transmission (1)
- call is then passed to the Public Switched Telephone Network (PTSN) of the receiving country (1)
- to a local exchange which routes the call to a telephone box attached to the receiving building (1)
- call then handled by the internal network of the receiving call centre (1)

[Max 6]

(d) Explain how information and communication technologies may be used in making a telephone directory enquiry.

- enquiry could be by phone (1)
- if using phone, speak to operator (1)
- who will ask for name of person required, or company (1)
- and address or post code (1)
- search(1) a database (1) (for the information)
- return either number, or number not available, or number not found (1) number found can be sent direct to the enquirer's mobile phone (1)

for internet description similar points to above

for purchased database description similar points to above

[Max 6]

3 (a) Explain the importance of standards when connecting computer systems.

One mark for point, one for expansion eg

- to enable devices to communicate together (1) through shared protocols (1)
- to allow devices to be guaranteed as reliable (1) through consistent protocols (1)
- to allow purchasers to know the device will work (1) with existing system (1)
increase choice in marketplace (1) different manufacturers can produce devices (1)

[Max 4]

(b) (i) Describe three features of a GUI.

One mark for feature, one for expansion eg

- windows (1) divide the screen into different areas (1) give consistency across applications (1) display separate applications concurrently (1) group similar functions together (1) can be moved/manipulated/re-sized to suit user (1)
- icons (1) small pictures that represent commands, files, or windows (1) easier to use for novices (1) graphics representing functions are followed more logically than reading textual descriptions making operation less complicated (1) provides a shortcut that can be followed catering for differing abilities performing the same task (1)
- mouse (1) allows direct manipulation of objects (1) the user can move objects or transform them as if in real life situation (1) gives more functionality than a keyboard (1)
- menus/pulldown menu (1) group similar items together (1) allows execution of commands by selecting a choice (1) user is not required to remember lengthy or complicated commands (1)
- pointer (1) adds functionality to the interface (1) functions become intuitive (1) movement (If mouse or finger is mimicked on screen) (1)

[Max 6]

(ii) Describe how a computer can give feedback to the user.

- sound (1) eg bleep to alert user to missing or wrong response (1)
- dialogue box/error message (1) to give more specific information on what is required (1)
- animation (1) to catch the attention of the user (1)
- colour/highlight (1) to draw attention to particular area of screen (1)

Accept other valid answers

[Max 6]

(c) Describe, using examples, the purpose of three different input devices that could be used by the staff at the cafe.

Purpose must be stated for both marks, to max 6

No single marks for just input devices

eg

- keyboard for producing text based documents (1) entering information into an on-line form (1)
- trackerball/mouse/touchpad to provide accurate positioning of the pointer (1) when undertaking design work (1)
- mouse/touch pad for pointing and selecting items on screen (1) to navigate through web pages (1)

- numeric keypad to enter numerical data into a financial package (1) to input numbers whilst logging on to an on-line banking site (1)
- microphone utilising voice recognition software (1) to construct letters/orders(1)
- digital camera to input digital pictures for viewing and manipulating (1) to upload pictures to a web site (1)
- scanner to input photographs into documents (1) to copy source material to upload to a web site (1)
- touchscreen/concept keyboard to select customer choices (1) for bill to be produced (1)

[6]

- 4 (a) **State two other pieces of physical data which can be used for identification purposes.**

Any two from:

- fingerprints (1)
- DNA (1)
- iris pattern (eye) data (1)
- face recognition (1) (2 and 3 dimensional)
- voice patterns (1)
- palm scan (1)

NOT Retina data

[Max 2]

- (b) **Explain how advances in technology may overcome these limitations.**

One for point, one for full expansion.

Must be a full **Explanation**.

A Point:

A *relevant* point that relates to the question and involves advances in technology. It is not expanded upon or implications given.

An Expansion:

The point is applied to the situation, expanded upon

The only codes to use are:

- **P - Point**
- **E - Expansion**

Identified points to cover may include eg:

- capacity of storage media is increasing all the time as cost reduces **(P)**
- varied biometrics can be stored on a greater number of individuals and on a wider range of media which is portable and cost effective **(E)** or, eg
- data is analysed and compared more accurately from the amount and variety that can be stored, meaning the verification of individuals' identification for medical, governmental and law enforcement purposes is more accurate. **(E)**
- increase in speed of data transmission and bandwidth available **(P)**
- substantial amounts of data transferred between sites within a small time frame, individuals' identities can be verified globally **(E)** or, eg
- access to sensitive data such as finances can be done securely without a username and password which could be held without authorisation, so reducing security breaches and enabling greater control of an individual's access to services. **(E)**
- data collection technology increasingly more accurate and captures a wider variety of data in a shorter time **(P)**
- parallel architecture in a system speeds calculations, the increased speed of processing enables applications to analyse and process collected data in a shorter time **(E)** or, eg
- data can be used instantaneously to uniquely identify individuals, shorter turnaround in the production of documents requiring biometric data. **(E)**
- methods of securing data during storage and transmission have become increasingly more complex **(P)**

- full disk encryption uses authentication and encryption to protect against theft or loss, encrypting and decrypting all data travelling to and from hard drive making it unreadable **(E)** or eg
- allowing software applications to store biometric data in secure partitions of the hard drive, preventing data protected under legislation falling into the wrong hands and lawsuit for the organisation. **(E)**

Not just **for example** 'more bandwidth means more data can be sent.'

[8]

Max 3 per limitation

5 Discuss the development of networking.

High 7-9	<p>The candidate is able to discuss clearly the impacts and consequences.</p> <p>Candidates will show a detailed level of understanding and be able to explain in detail both the impacts and consequences of more than one position.</p> <p>Logical arguments are produced to demonstrate a clear understanding of the question.</p> <p>Ideas will be expressed clearly and fluently using specific knowledge to support and inform the discussion.</p> <p>There may be a reasoned conclusion based upon prior discussion. Subject specific terminology will be used appropriately and accurately.</p>
Medium 4-6	<p>The candidate is able to explain superficially the impacts and consequences.</p> <p>Candidates will show a limited understanding and be able to explain both the impact(s) and consequence(s) of a given position, however explanations may lack specific detail and/or concentrate on either impact(s) or consequence(s) with a limited explanation of the other.</p> <p>There may be a reasoned conclusion.</p> <p>Specific knowledge appropriate to the discussion will be evident. Subject specific terminology will be used accurately.</p>
Low 0-3	<p>The candidate is able to explain superficially an impact or a consequence.</p> <p>The information will be more than a list of points.</p> <p>Subject specific terminology may be limited but will be used. Ideas may be poorly explained or be logically disjointed.</p>

Points to cover may include;

- cabling
- speed of communications medium
- network traffic
- infrastructure upgrade
- digital services such as ISDN and ADSL
- bandwidth
- optical cabling
- email and/or internet access
- wireless application protocol (WAP)
- radio waves
- microwave links
- satellite communications
- IPV6

[Max 9]

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