Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE Applied in Information and Communication Technology (6959) Paper 01

Unit 9: Communications and Networks

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Activity 1 - Types of network, components of a network.

Question Number	Answer	Mark
1a	(a) Produce a poster that explains PAN, LAN, WAN Set out as a poster with good balance of text and images, covering a complete page of A4 (1) Award 1 mark each for a suitable image of: • PAN (1) • LAN (1) • WAN (1) Award a maximum of 6 marks for a primary-level explanation of the network types in context. Award a maximum of 4 marks for an explanation without context or not at an appropriate level. **PAN** e.g. Devices carried by an individual person / pupil / member of staff (1) Within a range of approx. 10 metres (1) Phones / tablets/ laptops/ other portable devices (1) Can use WiFi / bluetooth / IR (1) Other sensible explanation (1) **LAN** e.g. Devices within a limited area such as the primary school (1) Can be connected by cable and / or WiFi (1) Will involve switch / router / WAP / other network infrastructure devices (1) Other sensible explanation (1) **WAN** e.g. Devices within a large geographical area such as between the school and the Education Ministry (1) Uses Internet / telecommunications links (1) Usually connects two or more LANs (1) Other sensible explanation (1)	**10**

1b	(b) Produce a poster that explains the route that a document follows from the school to the Ministry. Set out as a poster with good balance of text and images, covering a complete page of A4 (1) Award a maximum of 9 marks for a suitable image and primary-level explanation Award a maximum of 6 marks for an explanation without context or not at an appropriate level. a) Originating device / PC / tablet / etc. to modem / router by wifi / cable OR reverse at Ministry end (1) b) modem / router at the school, for internet access (1) c) router / firewall / server at the Ministry, for accepting the connection / document (1) d) digital subscriber line access multiplexer (DSLAM) at the telephone exchange for multiplexing (1) e) digital subscriber line access multiplexer (DSLAM) at the telephone exchange for connecting to a backbone / high speed channel (1) f) internet / ISP router, for directing traffic on the internet (1) g) switch / router at the Ministry, for directing internal network traffic (1) h) twisted pair or other appropriate for 'last mile' / school to exchange (1) i) ethernet cable / CAT 5 or 6, simple explanation of a technical aspect, e.g. bandwidth, length constraints (1) j) fibre optic cable for high speed link to Precipaurbo (1) k) fibre optic cable simple explanation of a technical aspect, e.g. bandwidth, multiple channels (1) l) media converter for cable to fibre / fibre to cable (1) m) use of IP addresses for where data comes from / goes to (1)	**10** **(20)**

Activity 2 – Research, network design.

Question Number	Indicative Content
2(a)	**A report for Viro on an "everything-in-one-box" solution**

For printer and router:
- plug-and-play
- has simple set-up procedures

For router:
- can act as DHCP server (for other devices)

For mobile computing devices:
- Easy to use
- uses common GUI based OS, e.g Windows, Linux
- software components have clear shortcuts / means of launch
- software components have common / similar layouts

Be able to join a WiFi network:
- has WiFi capability, with no requirement for a dongle or other add-on

Have sufficient battery life for a school day:
- stated assumptions about length of school day
- battery life sufficient for full day's work, not just standby

Be able to run suitable ICT software:
- stated specification, processor, RAM, storage

Root / administrator access:
- comes with root / administrator access
- or simple procedure to gain root / administrator access
- simple but secure unlock / relock procedure

Any extra component(s). May include:
- multi-plug system for charging devices
- battery back-up / UPS for WAP, router.
- Security hardware for protecting devices out of school hours
- Backup system
- RJ45 jacks, faceplates, tools, etc.

□

Software, suitable for primary age users:
- Operating system
- a word processor
- a spreadsheet
- a music package
- a graphics package
- an app development package
- a programming / coding package.

Budget:
- Costed solution for both price points, £2500 and £4000

Level	Mark	Descriptor
	0	No rewardable material
1	**1-4**	A limited response such as: Not set out as a report. An outline of the package, covering the required components at one price point. Budget may be unrealistic or incomplete. Recommendations may be unrealistic or incomplete. May mention extra components but little detail. May give factually incorrect statements about the capabilities of the hardware and / or software. May not link requirements to package components. The candidate uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy.
2	**5-8**	A detailed response such as: Some attempt to use a report format. A description of the package, covering the required components at both price points. Budget may not meet the required price points but will be realistic for each item. Recommendations may be incomplete but will be realistic. Will show some awareness of the limitations of the hardware or software available. Will link requirements to extra components. Will make reference to the scenario but may not keep everything in context. The candidate uses some terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy.
3	**9-12**	A comprehensive response such as: Set out as a report. A description of the package, covering all of the requirements at both price points. Will meet the budget for both price points. Recommendations will be complete and sensible. Will show some awareness of the limitations of the hardware available and relate it to the ages of the users. Will link requirements to extra components and write the report in the context of the scenario. Will show awareness of the age of the users. The candidate uses a range of appropriate terms and shows good focus and organisation. Spelling, punctuation and the rules of grammar are used with considerable accuracy.

Activity 3 - Network management – system configuration

Question Number	Answer	Mark
3a	A five point plan for placing WiFi antenna For each of the five points: Award 1 mark for each valid point Award 1 mark for an appropriate explanation of a point. Answers may include: Find a central location for the required area of coverage (1) Most wireless routers have omnidirectional / 360 antenna / will radiate equally in all directions. (1) Avoid physical obstructions (between router and device) (1) Any barrier / object will absorb some of the wireless radiation / signal (1) Avoid reflective surfaces (1) These can bounce the signal away from the required direction / set up interference patterns (1) Avoid other devices that may broadcast signals (at a similar frequency) e.g. cordless telephone base station, staffroom microwave oven (1) These may cause interference (1) Avoid electrical equipment such as motors and generators (1) These often produce radio signals / interference (1) Place the router above head height (1) People are physical obstructions and will absorb some of the signal (1) Adjust the alignment of the router / angle of the antenna (1) A router's omnidirectional antenna is rarely completely omnidirectional (1)	**10**

3b	A guidance sheet for setting up DHCP Award 1 mark for each valid point Award 1 mark for an appropriate explanation of a point Max 10 marks Answers may include: Only have DHCP turned on for one router. (1) If two routers have DHCP they will both try and allocate IP addresses and cause a clash (1) Ensure that you have no more than 253 devices (1) This is the largest number of devices that can be addressed on a single subnet (1) If you have more than 253 (or other router specific value) devices (1) you will need a second DHCP server using a different address range / will need to have a router that can address a larger range (1) Identify any devices that need to have the same IP address all the time (1) e.g. printers, routers, so that other devices don't need to search for them (1) Make reservations for devices that need fixed IP addresses (1) So that their IP address doesn't change each time they connect to the network. (1) Set the lease time, how long a device keeps an IP address (1) Set long leases to reduce the processing load on the router (1) Other sensible explanation e.g. router specific limitations (1) Method of connecting to router set-up page (1) Reminder to save changes / settings on router (1)	**10** **(20)**

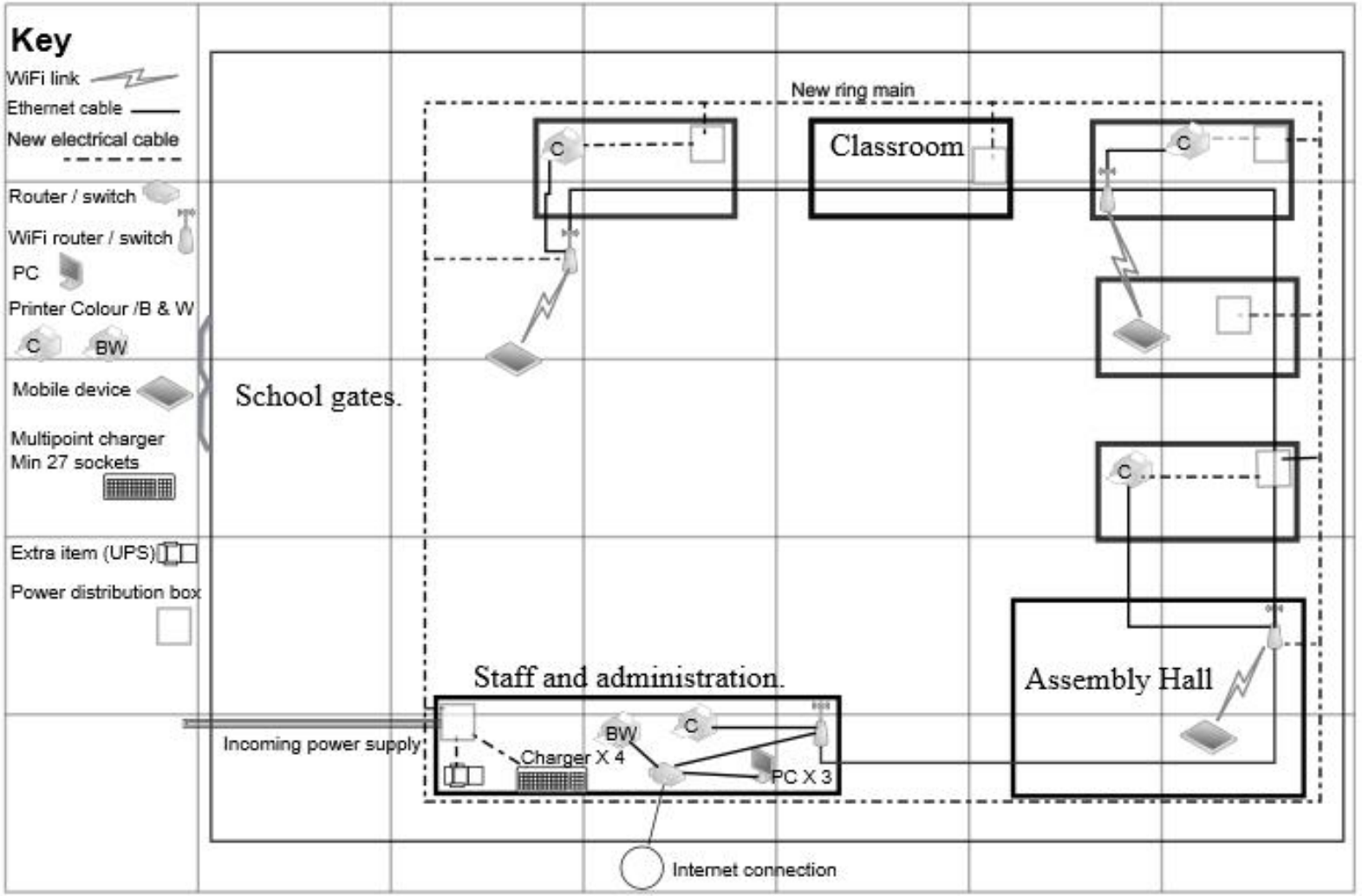
Total for Activity 3 - 20 marks

Activity 4 — Network Design

Question Number	Answer	Mark
4(a)	**A network and power design for the complete project** Award 1 mark for each of: a) diagram shows at least; staff and admin module, hall, five classrooms, power and network items b) cable types shown c) WiFi links shown d) staff and admin module; three PCs, laser printer, internet router with switch e) direct connection from internet router to Internet f) staff and admin module; power supply box (in top left corner nearest gates) g) staff and admin module; WiFi router h) sensible placement of three other WiFi routers, with connection to network (allow two if one explained as being a spare) i) maximum of five connections to any router / switch j) maximum of 400m CAT 6 cable (look for use of router / switches to reduce cable lengths) k) sensible placement of four printers, with connection to network (allow three if one explained as being a spare) l) sensible location for additional equipment from Activity 2, e.g. UPS, backup system m) charging equipment shown / labelled for at least 108 mobile devices n) power supply shown for WiFi routers o) power supply shown for printers p) power supply shown for charging system q) indication of mobile device connection via WiFi Max 14 marks	**(14)**

Network Diagram follows on the next page.
NOTE. This diagram:

- is **not** the only answer
- is probably not the best answer
- is drawn to illustrate all of the marking points


Key
WiFi link
Ethernet cable
New electrical cable
Router / switch
WiFi router / switch
PC
Printer Colour /B & W
C
BW
Mobile device
Multipoint charger
Min 27 sockets
Extra item (UPS)
Power distribution box
New ring main
Classroom
C
C
C
School gates.
Staff and administration.
Assembly Hall
Incoming power supply
BW
C
Charger X 4
PC X 3
Internet connection

Question Number	Answer	Mark
4(b)	Notes justifying each major decision made with regard to the network design. There are no marks for descriptions of what is on the diagram. 1 mark per explanation which justifies a decision, to a maximum of 6. e.g. I have used a WiFi router in the middle of the compound = 0 I have used a WiFi router in the middle of the compound so as to cover the outdoor areas = 1 Answers may include justifications of: • location of routers • location of printers • WiFi coverage of key buildings • WiFi coverage of other areas • use of switches to reduce cabling • type of backup system • use of UPS • type of charging system • electrical loads	**(6)**

Total for Activity 4 - 20 marks

Activity 5 – Network management – policy documents

Question Number	Answer	Mark
5(a)	An explanation of white lists / black lists, ISP filtering, and DNS filtering. For **each** method. 1 mark for each relevant factual statement to a maximum of 4 marks. **White lists / black lists** Answers may include: Implementation: • needs list of allowed / disallowed sites as e.g. Hosts file / part of security application (1) • could be on mobile devices or Internet router (1) Difficulties: • must be put on every device and kept updated (1) • sites change frequently / new sites appear (1) Circumvention: • typing an IP address rather than a URL may bypass the lists (1). **ISP filtering** Answers may include: Implementation: • needs lists of allowed / disallowed sites at ISP level (1) Difficulties: • would need legislation to enforce compliance (1) • all schools would have to have the same ISP / all ISPs would have to have the same filter lists (1) • sites change frequently / new sites appear (1) • danger of blocking education sites for e.g. drugs, sex, relationships (1) Circumvention: • logging in to a VPN / proxy (1) • using https instead of http often works (1). **DNS filtering** Answers may include: Implementation: • needs lists of allowed / disallowed sites at DNS level (1) • DNS server must be under government control / legislation (1) • DNS settings made at device level / all devices use approved DNS (1) Difficulties: • all schools would have to have to use the same / an approved DNS server (1)	**12**

	• sites change frequently / new sites appear (1) • danger of blocking education sites for e.g. drugs, sex, relationships (1). Circumvention: • logging in to a VPN / proxy / altering DNS address on device if allowed (1) • using https instead of http often works (1) • typing an IP address rather than a URL should avoid using DNS (1) • using cached pages instead of the main URL (1).	

Question Number	Answer	Mark
5(b)	A description of a viable method for controlling what the pupils see. 1 mark for each relevant factual statement to a maximum of 4 marks. Likely to be some form of Walled Garden / closed platform, but accept other viable methods. Answers may include: Implementation • requires central server / device, e.g. at Education Ministry with list of allowed sites / mirrors of allowed sites (1) • list should include http, https, IP address (1) • Internet connection at school goes to central server for filtering (1) Difficulties: • lists would need expert maintenance to avoid blocking education sites for e.g. drugs, sex, relationships (1) • possible slowdown of traffic as more schools join the system (1) Circumvention: • main weakness is staff / adults may have a password to the wider internet (1).	**4**

Total for Activity 5 – 16 marks

Standard ways of working. 2 Marks EE

All printouts must have a header and a footer. The header must contain the activity number. The footer must contain your name, candidate number and centre number.

Minimum font size of 10 should be used for all word processed documents.
Submitted work must meet the page limitations given in each activity.

Total for Paper – 90 marks

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