

# Mark Scheme (Results)

Summer 2015

Applied ICT (6959) Unit 9:  
Communications and Networks

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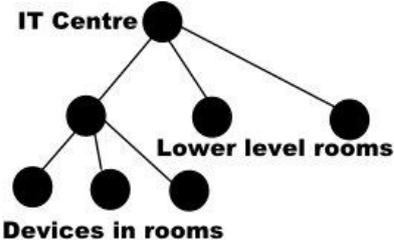
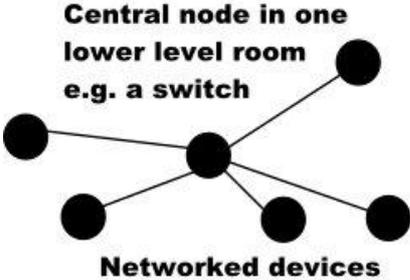
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## General Marking Guidance

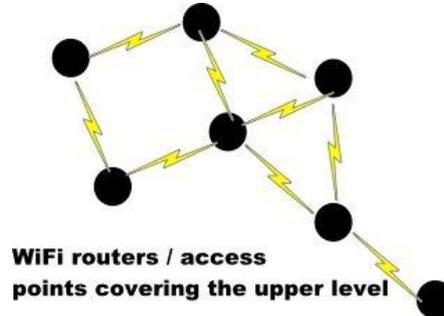
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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 - Network topologies and transmission media.**

Question Number	Answer	Mark
<p><b>1(a)</b></p>	<p>Describe, with the aid of diagrams, how the tree, star, mesh and hybrid topologies could be used at the Dungeon of Doom site.            NOT paragraphs / diagrams from Wikipedia or similar website.</p> <p>For each topology, to a maximum of 3 marks per topology.            A diagram produced by the candidate, showing that topology (1)            The diagram labels reflect the context of the scenario (1)            The description relates the topology to the scenario (1)            The description refers to an aspect of the basic plan or the constraints posed by the building (1)</p> <p><b>Tree</b></p>  <p>The tree topology is hierarchical. In this case, the base node is in the IT centre. The nodes in each room form the second level and the devices in each room form the third.</p> <p><b>Star</b></p>  <p>In a star topology, one central node is directly connected to several other nodes. In this case, the central node could be a switch which is connected to several networked devices that trigger booby traps and automatic paint guns.</p>	<p><b>(12)</b></p>

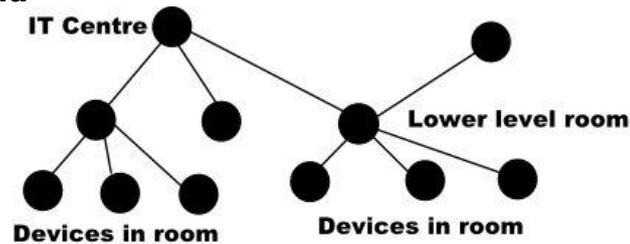
**Mark scheme for 1(a) continues on the next page.**

**Mesh**



In a mesh topology, each node is connected to one or more other nodes and is able to relay signals. In this case, a series of WAPs could relay signals from e.g. the IT Centre to Reception. Would be unsuitable for lower level due to all the concrete.

**Hybrid**



A hybrid topology is formed by combining two other topologies. In this case there is a tree topology with the IT Centre and the three rooms, combined with star topologies in two of the rooms.

Question Number	Answer	Mark
<b>1(b)</b>	<p>Describe where twisted pair cable, fibre optic cable and radio links could best be used at the Dungeon of Doom site.</p> <p>For each transmission medium.</p> <p>A scenario-related description / diagram of where the medium could be used. (1)</p> <p>The description states why that's the best place to use that medium / better than the alternatives / states, with reason, that it is not suitable. (1)</p> <p>The description gives up to two other items of supporting evidence. (2)</p> <p>Maximum total of 9 marks for the three media.</p> <p><b>Twisted pair cable</b></p> <ul style="list-style-type: none"> <li>• Best used for short structural runs such as the ones joining the lower level rooms to the Evil</li> </ul>	<b>(9)</b>

	<p>Genius Lair or a central switch / links to devices that have RJ45 ports. (1)</p> <ul style="list-style-type: none"> <li>• Cheaper than fibre optic and WiFi would be blocked by the concrete walls. (1) Robust and easy to lay through the ceiling space / bend around corners. (1)</li> <li>• Max distance within the lower level is about 75m, well within capability of twisted pair cable. (1)</li> </ul> <p><b>Fibre optic cable</b></p> <ul style="list-style-type: none"> <li>• Best used for high traffic runs such as a single connection from the IT Centre to the lower level / Evil Genius Lair. (1)</li> <li>• Carries a much higher bandwidth than twisted pair and WiFi would be blocked by the concrete walls. (1)</li> <li>• Can easily carry signals from all rooms / devices in the lower level in a single cable. (1)</li> <li>• There is limited access from the upper to lower level, so a single cable is easier to route than numerous twisted pair cables. (1)</li> </ul> <p><b>Radio links</b></p> <ul style="list-style-type: none"> <li>• Best used for the upper level, the scenario states mobile devices need to be used. (1)</li> <li>• Cheaper and easier to set up than fibre optic or twisted pair cable. (1)</li> <li>• The walls are wood and plasterboard, so the signal would not be obstructed very much. (1)</li> <li>• The distances inside the upper level would allow coverage with only a few access points. (1)</li> </ul>	
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**Activity 2 – Research, network design and benefits.**

Question Number	Indicative Content
<b>2(a)</b>	<p>A briefing document for Burt, outlining:</p> <ul style="list-style-type: none"> <li>• how each method would detect people</li> <li>• what range each could be used for</li> <li>• one benefit and one drawback of each in the Dungeon of Doom</li> </ul> <p><b>Passive IR</b></p> <ul style="list-style-type: none"> <li>• Uses an IR sensitive / pyroelectric material</li> <li>• Detects changes in temperature / body heat</li> <li>• Can detect movement direction (with appropriate electronics)</li> <li>• Common / cheap / off the shelf detectors have a range of about 10m</li> <li>• More expensive ones can see up to 25m +</li> <li>• This means the range would be good for rooms but may</li> </ul>

		<p>be too low for some corridors.</p> <ul style="list-style-type: none"> <li>• PIR can see people in dark / low light situations</li> <li>• PIR could be confused by / need shielding from warm items, although this is not a problem if they are used as motion detectors.</li> <li>• Would not be suitable for following multiple targets, although this would not be a problem if it is just triggered by presence.</li> </ul> <p><b>RFID</b></p> <ul style="list-style-type: none"> <li>• Uses active detection system with a chip / tag and a reader</li> <li>• Chip / tag can be passive / powered by radio signal from reader</li> <li>• Range up to 1 - 2 m</li> <li>• Longer range systems exist but are more expensive</li> <li>• Long range systems require active / battery powered tags</li> <li>• Detects presence</li> <li>• Tags can carry data, so could detect individual paintballers</li> <li>• Could trigger for e.g. the leader / when two or more are in range</li> <li>• Multiple readers could detect movement direction but would be expensive</li> <li>• Requires paintballers / their equipment to carry RFID tags</li> <li>• Tags could be exploited by paintballers if they know about them</li> </ul> <p><b>Other system</b></p> <ul style="list-style-type: none"> <li>• e.g. Active IR / beam systems, pressure sensors, noise activated, optical cameras.</li> </ul> <p><b>NOTE</b>, systems which could potentially harm paintballers are not appropriate. e.g. tripwires.</p>
Level	Mark	Descriptor
	<b>0</b>	No rewardable material
1	<b>1-4</b>	<p>A limited response such as.</p> <p>An outline of at least one of the given detection systems, covering at least three of detection method, range, benefit, drawback.</p> <p>May mention the second given method but little detail.</p> <p>May not give a candidate's choice method.</p> <p>May have little or no context.</p> <p>The candidate uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy.</p>
2	<b>5-8</b>	<p>A detailed response such as.</p> <p>A description of both of the given detection systems, covering at least three of detection method, range, benefit, drawback.</p> <p>Candidate choice method is plausible but has insufficient detail.</p> <p>Will give suitable context for most answers.</p> <p>The candidate uses some terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy.</p>

3	<b>9-12</b>	<p>A comprehensive response such as.</p> <p>An explanation of both of the given detection systems, covering detection method, range, benefit, drawback.</p> <p>Candidate choice method is plausible and explained in a similar manner to the given methods.</p> <p>Will put all answers into context.</p> <p>The candidates uses a range of appropriate terms and shows good focus and organisation. Spelling, punctuation and the rules of grammar are used with considerable accuracy.</p>
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### Activity 3 - Components of a network - (suggested time 2 hours)

Question Number	Answer	Mark
<b>3</b>	<p>A table detailing the hardware and cabling components for the system, with reasons.</p> <p>Must have detail of the items, not just e.g. printer, server, PC, WAP</p> <p><b>1 mark per component, 1 mark per sensible reason. To a maximum of 18 marks</b></p> <p>Reason needs to be in context</p>	<b>(18)</b>

Component	Qty	Reason	Notes
Basic business PCs	2+	For reception and admin office, in scenario. May be extra for IT Centre and Lair	Look for basic spec, Suitable to run office SW Assume monitors, keyboards, etc. are included. <u>Needs detail.</u>
Server	1+	Needed to run the LAN. May be extra in Lair, backup	Need to be capable of running the LAN. i.e a server, not a PC. Assume monitors, keyboards, etc. are included. <u>Needs detail.</u>
Backup server / device	1	Backup is essential for a business setting	Needs to be a dedicated server / system, not a PC running DVD burner etc.
Printer	2+	For reception and admin office, in scenario. May be extra for IT Centre and Lair	Needs to be business grade, not e.g. a cheap inkjet. Extras for IT Centre / Lair could be simpler models. <u>Needs detail</u>
Router-modem (cable)	1	Internet connection as required by the scenario	May be combined devices. May have WiFi capability as well. <u>Needs detail</u>
WAP / Wifi router	2+	Network and Internet access in upper level	Number depends on location of devices. Needs at least two. <u>Needs detail</u>

Main Switch	1	Cable connections required from IT Centre to lower level	Should be a business grade item, with fibre optic port(s) if fibre is used. <u>Needs detail</u>
Subsidiary switches / switch-routers	8+	Used to reduce cable runs from main switch, give more flexibility in each area.	8 would give one switch per two rooms in the lower level. 16 would be one per room. One or more should have fibre optic port(s) if fibre is used. <u>Needs detail</u>
Fibre optic cable	25m +	To make link from IT Centre to lower level / other plausible link.	25m would be enough to go from the IT Centre to the bottom of the stairs. Quantity should be higher if a longer / extra link is made.
Twisted pair cable	2 x 305m box	Cable connections for most areas in the lower level	Could be given as individual lengths / number needed linked to device numbers. Amount depends on use of switches / devices.
RJ 45 ends	100+	to connect cables to PCs / waps, defence devices, etc.	Accept any plausible number over 100. Accept included as made patch leads.
Other sensible device		With reason	May include: UPS, patch panels, cabinets, data sockets Accept up to 2 devices for 1 mark each.

**Total for Activity 3 - 18 marks**

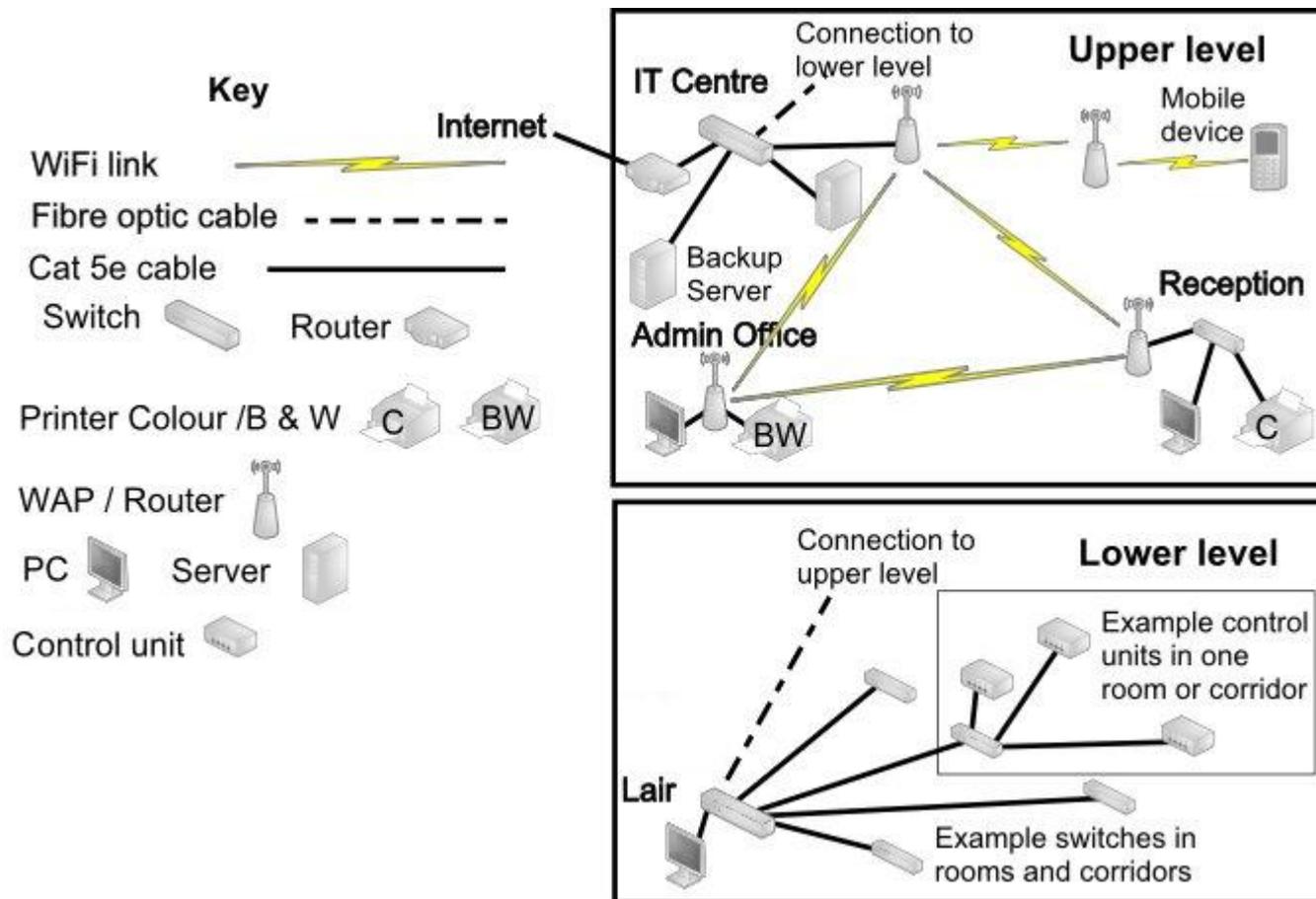
## Activity 4 – Network Design

Question Number	Answer	Mark
4(a)	<p><b>a network design for the complete project</b></p> <ul style="list-style-type: none"> <li>a) diagram shows at least: upper and lower levels, IT office, admin office, reception, Lair, example rooms / corridors in lower level</li> <li>b) cable types shown</li> <li>c) WiFi coverage shown – any on upper floor</li> <li>d) IT Office, server</li> <li>e) IT office, router</li> <li>f) IT office, main switch</li> <li>g) IT office, link from server to router. Direct or via one switch.</li> <li>h) IT office, direct link from router / modem to Internet</li> <li>i) admin office, PC and printer</li> <li>j) reception, PC and printer</li> <li>k) upper level, enough WiFi connections to cover whole area.</li> <li>l) WiFi links to reception and admin office</li> <li>m) upper level, at least one mobile device connected to WiFi U</li> <li>n) backup system in suitable location</li> <li>o) clear link from upper to lower level</li> <li>p) lower level, Lair, PC</li> <li>q) lower level, main switch in Lair / suitable location</li> <li>r) lower level, switches in rooms / corridors</li> <li>s) lower level, defence controls / connections shown in one room or corridor.</li> </ul> <p>Max 16 marks</p>	<b>(16)</b>

**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



Question Number	Answer	Mark
<b>4(b)</b>	<p>Notes justifying each major decision made with regard to the network design.</p> <p>There are no marks for descriptions of what is on the diagram.</p> <p>1 mark per explanation which justifies a decision, to a maximum of 6.</p> <p>eg. I have used a fibre optic cable from the IT Centre to the Lair = 0</p> <p>I have used a fibre optic cable from the IT Centre to the Lair because there is limited space to route cables down the stairs and one fibre optic link can replace several twisted pair cables = 1</p> <p>Answers may include justifications of:</p> <ul style="list-style-type: none"> <li>• type of backup system</li> <li>• router position</li> <li>• network protection, e.g. cabinets, position WAPs out of reach of paintballers</li> <li>• number of switches</li> <li>• switch positions</li> <li>• WiFi provision and / or coverage</li> <li>• provision for expansion</li> </ul>	<b>(6)</b>

**Total for Activity 4 - 22 marks**

## Activity 5 – Network management

Question Number	Answer	Mark
<b>5(a)</b>	<p>An explanation of how security may be achieved for the Paintball part of the LAN 1 mark for each relevant factual statement about a usable security measure. To a maximum of 4 marks.</p> <p>Answers may include:</p> <ul style="list-style-type: none"> <li>• Electronic security methods. e.g. <ul style="list-style-type: none"> <li>◦ have the Paintball part on a separate domain / subnet (1)</li> <li>◦ use virtual servers to separate Paintball and Admin (1)</li> <li>◦ Use managed switches to keep Admin traffic away from Paintball (1)</li> <li>◦ have passwords for all defence device admin web pages / control systems (1)</li> <li>◦ use access levels / domain security policies / policy objects to restrict access to Paintball hardware (1)</li> </ul> </li> </ul> <p>Accept other workable electronic security methods.</p> <ul style="list-style-type: none"> <li>• Allow <b>one</b> physical method. e.g. <ul style="list-style-type: none"> <li>◦ network hardware hidden / secured from tampering (1)</li> <li>◦ access control to IT Centre (1)</li> </ul> </li> </ul>	<b>(4)</b>

Question Number	Answer	Mark
<b>5(b)</b>	<p>A description of the required network settings and software for accessing the internal web pages 1 mark for each relevant factual statement to a maximum of 3 marks.</p> <p>Answers may include:</p> <ul style="list-style-type: none"> <li>• must be running a TCP / IP based network (1)</li> <li>• must have fixed IP addresses for the control boxes <ul style="list-style-type: none"> <li>◦ OR need names / MAC addresses to locate boxes (1)</li> </ul> </li> <li>• needs a browser to access the pages <ul style="list-style-type: none"> <li>◦ OR using names / MAC addresses with bespoke software (1)</li> </ul> </li> <li>• IP addresses / names of boxes are stored. e.g. as bookmarks, in a database, as a list of hyperlinks. (1)</li> </ul>	<b>(3)</b>

Question Number	Answer	Mark
<b>5(c)</b>	<p>An explanation of how Burt could access the BEGEE sites from the company head office or from his house.</p> <p>NOTE. Software that requires connection to be assisted from the site end cannot be awarded software marks but the method may still score for hardware and procedures.</p> <p>1 mark for each relevant factual statement to a maximum of 8 marks.</p> <p>Answers may include explanations of:</p> <ul style="list-style-type: none"> <li>• setting up server / admin PC as remote access server (1)</li> <li>• setting up home PC / head office computer as remote access client (1)</li> <li>• running server software as a service / always on (1)</li> <li>• site router must have NAT / port forwarding enabled (1)</li> <li>• site router must have port for remote software open (1)</li> <li>• remote software client (on home / company PC) connects to router public IP address at the site (1)</li> <li>• remote software client (on home / company PC) connects to correct port on router at the site (1)</li> <li>• router at site is listening on correct port and allows the connection (1)</li> <li>• router at site translates / forwards the signal to the server / target machine (1)</li> <li>• server software on target machine recognises the client and allows log in / control / access (1)</li> </ul>	<b>(8)</b>

**Standard ways of working. 2 Marks**

**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**

