

Paper Reference(s)

**6959/01**

# **Edexcel GCE**

## **Applied Information and Communication Technology**

**Unit 9: Communications and Networks**

**11–29 January 2010**

**Assessment window 3 weeks**

**Time: 10 hours**

**Materials required for examination**

Short treasury tag

**Items included with question papers**

Cover sheet

### **Instructions to Candidates**

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Complete your candidate details on the cover sheet provided.

At the end of each session you should hand your materials in to your teacher.

All tasks must contain your name, candidate number, centre number and activity number.

At the end of the examination use a treasury tag to attach your printouts to Page 2 of the cover sheet in the correct order, as shown.

### **Information for Candidates**

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There are **five** activities in this examination totalling **88** marks. **2** further marks are allocated to Standard Ways of Working, giving a paper total of **90** marks.

The marks for parts of the activities are shown in round brackets: e.g. **(2)**.

There are suggested timings against each activity: e.g. **(15 minutes)**.

### **Advice to Candidates**

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Read the Scenario carefully.

Work through the activities in order.

Attempt **ALL** activities.

Label your printouts clearly as instructed.

Printing must be undertaken within the examination period.

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## Scenario

### Dornton Castle

In 1880, Amos Dornton bought the ruins of a medieval castle originally built in 1352 and renamed it Dornton Castle. Amos had a few parts of the castle repaired as a folly and had a large manor house built nearby to live in.

Over the years, each generation of Dorntons extended the property, adding gardens, a stable block, servants' quarters, and other buildings. Dornton Castle is now a rambling collection of buildings and outdoor spaces extending over several acres.

The current owners are Christopher and Sarah Dornton, who live in one wing of the manor house. They manage the rest of Dornton Castle as a tourist attraction, conference centre, and event venue.

Their latest venture is to hold Live Action Role Play (LARP) events called 'Warriors, Wizards, and Witches'. Groups of people hire sections of Dornton Castle and then act out fantasy adventures using rubber swords, spell powders, etc.

Christopher and Sarah have observed several LARP events and have realised that some aspects of the adventures could be improved to attract more customers.

These include:

- each group spending a lot of their own time setting up their adventure before it begins
- having to use members of the group wearing masks to represent non-human characters, animals, ghosts, etc.
- not being sure who a spell is aimed at and what effect it should have.

Christopher has some experience with special effects from working in the film industry and Sarah has produced theatrical events at the castle. They think that there is a gap in the market and want to use technology to create more exciting adventures. They will then charge people to take part, rather than simply hiring out the space.

Each adventurer will still wear their own LARP costume and equipment. They will be provided with a headset and gloves. These will be connected by cables to a small backpack containing batteries and a WiFi transmitter-receiver. The backpacks will also contain radio-frequency identification (RFID) transponders that allow the adventurers' positions to be located.

Each headset will contain projectors that can show images through a pair of augmented reality goggles to create the illusion that the adventurer is looking at an object. The headset and gloves will contain positional sensors that detect head and hand movements.

The Dorntons have already signed a contract with another company to provide adventurer packs (gloves, goggles, headsets, WiFi transmitter-receivers, transponders, and augmented reality software).

Dornton Castle staff will dress up and act as human opponents in the adventures. Fantasy creatures will be projected by the headsets. Spells will be cast by hand gestures, with their effects being projected, accompanied by suitable sounds. The system will also control special effects such as lights, sounds, and smoke.

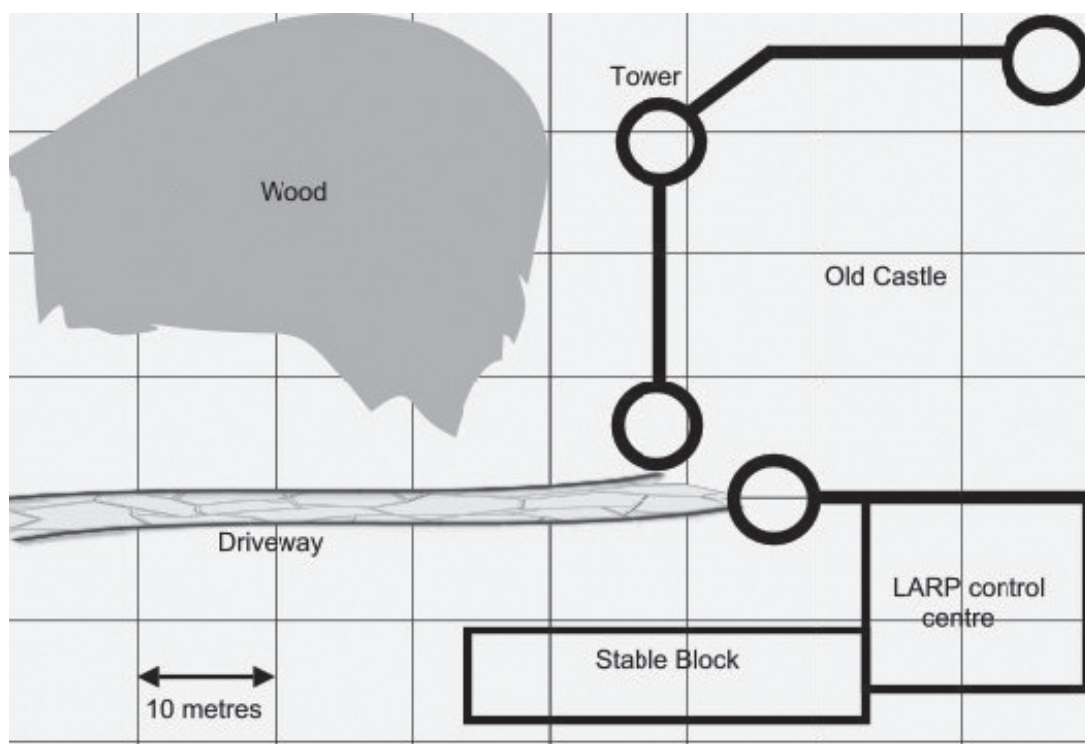
The Dornton Castle staff will have similar headsets to the adventurers, except that they will project information that will help in the running of the adventure, such as a map showing where people are. Their headsets will also have a microphone and earpiece so that staff can talk to each other. Their gloves

will be the same as the adventurer ones as they must also be able to cast spells.

A new LARP control centre will be located in an empty building that contains a single 15 metre square room. The control centre will be connected to an existing LAN which serves the rest of the buildings in Dornton Castle. The building has a power supply but no I.T. facilities and is 20 metres from the existing LAN server.

The LARP adventure area, shown on the sketch map, contains a small wood, a stable block, and part of the old castle. Each of the four castle towers has an underground cellar, a ground floor, and two other floors. Walkways along the walls can be reached using doors in the towers at the level of the upper floors. There are ample power outlets in the adventure area but no network infrastructure or equipment.

Sketch map of the LARP adventure area



### Your project

You are an I.T. consultant and have been hired by the Dorntons to help them to set up the new LARP system.

The Dorntons' priorities for the new system are that it must be:

- **reliable.** There is a part-time technician who deals with the Conference Centre when it is being used. He will be taken on full-time so that he can look after the LARP system as well
- **easy to maintain.** When things wear out or go wrong, repairs and replacements should be simple to perform
- **robust.** Parts of the system will be situated outdoors
- **value for money.** This is a business venture, so budgets must be set, justified, and kept to.

Christopher and Sarah are competent I.T. users but rely on their technician to configure and maintain the Dornton Castle I.T. systems.

All word processed documents 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.

A minimum font size of 10 should be used in all word processed documents, using a font suitable for business purposes.

Diagrams should be large enough for the detail to be read.

Documents should be fit for purpose. Where a specific type of document is required as evidence, it should be written in an appropriate style.

### Activity 1 – Network architecture and topology (suggested time 2 hours and 40 minutes)

Following preliminary discussions about how the LARP system might be laid out and configured, Christopher needs to make decisions on:

- **network topology** – whether the system should use a mesh, a star, or a hybrid of both
- **connection technology** – whether the system should use cable, WiFi, or a combination
- **network architecture** – whether the LARP software should be run from a central server in the control centre or whether the adventurers’ backpacks should contain a mobile computing device that can run the software in a peer-to-peer system.

To help Christopher make these decisions you need to prepare briefing notes on each topic. The notes must be understandable by a non-I.T. specialist and must include appropriate diagrams.

The notes should explain advantages and disadvantages of each option but you do **not** need to make any recommendations.

**Remember** when preparing the notes, the LARP system must be reliable, easy to maintain, robust and value for money.

#### Evidence to be submitted

On no more than **one** A4 page per topic, briefing notes on:

- network topology (10)
- connection technology (8)
- network architecture. (6)

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(Total 24 marks)

## Activity 2 – Network connectivity and security (suggested time 1 hour and 30 minutes)

Sarah will be in charge of co-ordinating the staff who are representing the human opponents. She is concerned about the security of the WiFi links in the network. She has looked at the manual that comes with the WiFi transmitter-receivers for the backpacks and has read that they can work with three different password enabled systems:

- 64 bit Wired Equivalent Privacy (WEP)
- 128 bit Wired Equivalent Privacy (WEP)
- WiFi Protected Access (WPA).

The manual also mentions **MAC address filtering** and **Service Set Identifiers (SSID)**

Sarah has asked you to explain the terms to her and to recommend what action she should take to secure the network.

### Evidence to be submitted

On no more than **one** A4 page,

write brief notes for Sarah explaining the terms:

- 64 bit Wired Equivalent Privacy (WEP)
- 128 bit Wired Equivalent Privacy (WEP)
- WiFi Protected Access (WPA)
- MAC address filtering
- Service Set Identifiers (SSID).

**(10)**

make your recommendations on how best to secure the network.

**(3)**

**(Total 13 marks)**

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### Activity 3 – Components of a network (suggested time 2 hours)

**Important note to candidates.**

**The network description given for this activity is there so that you have something to work with when designing a suitable network. The choices made about network topology, connection technology, and network architecture should NOT be taken as a guide to correct answers for Activity 1.**

During a meeting with Christopher you agreed the following points about the LARP system. These are:

- the adventure locations will consist of the wood, the stable block, and three of the four castle towers
- the fourth castle tower, the one nearest to the control centre, will be used as a staff dressing area and for props storage. It will require a cable link from the control room and a WiFi point
- the control centre will be linked to the Dornton Castle LAN
- the wood will be linked to the control centre by a single cable laid in an underground conduit
- the stable block will be linked to the control centre by a single cable passing through the wall
- each tower will be linked by its own cable, running along the walls at walkway level
- the augmented reality software requires that the system is server based. A pre-loaded server cluster will be provided and located in the control centre
- the company that is supplying the adventurer packs (backpacks, headsets, gloves and goggles) will also supply the transponder detectors (RFID)
- each adventure location (wood, stable block, and three towers) will require a network connection for the RFID equipment
- the adventurers must stay connected to the network as they move between adventure locations
- there are adequate power points at all locations
- there must be two network connections available in the wood, the stable block, and in each of the three towers for the connection of special effects equipment
- you will budget for a PC in the control centre to monitor and control special effects
- you will decide on the number, type and location of WiFi points in the system
- you will decide on the number, type and location of any other network devices that are needed
- you will arrange the WiFi system so that it can provide alternative links should a cable fail
- the system must be built to cope with the failure of any one WiFi point

- your equipment and materials budget is a maximum of £2500
- you will provide a contingency plan for improving reliability in the future should that prove necessary. The budget for this is £500.

**Evidence to be submitted**

On no more than **one** A4 page:

Produce a table for Sarah and Christopher that:

- identifies the hardware and cabling components to be used in your design
- states and justifies the quantity of each component to be used in your design
- gives a reason for the use of each component in your design
- gives the cost for each component
- shows the total cost of your design.

**(8)**

You have agreed that:

- you will arrange the WiFi system so that it can provide alternative links should a cable fail
- the system must be built to cope with the failure of any one WiFi point.

On no more than **one** A4 page, explain how you will arrange the:

- required fault tolerance in the system

**(4)**

- reliability of the system.

**(5)**

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**(Total 17 marks)**

#### **Activity 4 – Network design (suggested time 2 hours)**

Having talked to Christopher about his requirements and investigated the possible options, you now need to design an appropriate network solution for the LARP system.

- Use network design software to produce a network design for the LARP system as specified in the scenario and Activity 3.
- Explain and justify any decisions that you have made regarding the type and positioning of network devices and equipment.

#### **Evidence to be submitted**

On no more than **one** A4 page each:

- a design for the entire LARP system (12)
- notes justifying each major decision made about the network design. (6)

**(Total 18 marks)**

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### **Activity 5 – Network management (suggested time 1 hour and 50 minutes)**

Sarah will be managing the LARP events. She needs to produce staff training resources and has asked you to provide some of the material.

Sarah is aware that WiFi and mobile computing equipment are prone to minor malfunctions. She does not want the I.T. technician to have to respond to problems that can be solved by users. Sarah wants the staff to find and fix simple faults with the LARP packs (headset, gloves, goggles and WiFi transmitter - receiver).

Sarah wants to produce a poster containing two flowcharts.

One flowchart should show what a staff member should do if one of a pack's components (headset, gloves, goggles) stops working.

The other flowchart should show what a staff member should do if all of a pack's components (headset, gloves, goggles) stop working.

Her requirements for the flowcharts are that they must:

- be easily understood by staff who are not I.T. specialists
- convey the information with the minimum amount of text explanation.

**(16)**

#### **Evidence to be submitted**

- On **one** A4 page two flowcharts that show the actions that a staff member should take in the event of a fault.

**(Total 16 marks)**

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#### **Standard Ways of Working.**

**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.**

**Pages must be securely fastened to the cover sheet and in the correct order.**

**Minimum font size of 10 should be used for all word processed documents.**

**(Total 2 marks)**

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**TOTAL FOR PAPER: 90 MARKS**

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