

# BCS THE CHARTERED INSTITUTE FOR IT

## BCS Higher Education Qualifications

### BCS Level 6 Professional Graduate Diploma in IT

September 2017

#### EXAMINERS' REPORT

#### IT AND THE ENVIRONMENT

The evidence shows that several answers were focused more on the facts on which the questions were based. Improved answers could discuss the implications of those facts to the issues raised, showing a deeper understanding. Candidates are encouraged to look for the pointers in the questions so that they can relate their answer to the questions asked.

Some answers provided repeated facts for a question, which may or may not have been a "pass mark" depending on how well articulated and complete they were. Candidates are reminded to provide evidence of knowledge but also to show the application of that knowledge to the given scenario.

#### Section A

A1. An environmental charity is seeking ways in which it can monitor soil temperature across remote areas as part of a study into climate change. The areas do not have electricity or fixed telephone connections.

A suitable sensor and data storage device has been selected. You are asked to provide advice in gathering data remotely from field locations.

- a) Outline the practical problems of collecting data from these remote areas. **(5 marks)**
- b) Describe THREE technologies you could employ to collect data from a hundred or more of these remote areas. **(12 marks)**
- c) For ONE of these technologies, discuss how you could manage and store incoming data, evaluate it and make it widely available. **(8 marks)**

## Answer Pointers

### Part a)

Candidates should outline issues which impact on data collection from remote areas. The answer should indicate an appreciation of (for example) issues of poor environment and logistics.

### Part b)

Candidates should describe three technologies which would achieve the goal set out in the scenario. These could be, but are not limited to:

- Arduino style mass market systems which allow large scale implementation at very low cost. These might rely on placement/retrieval by volunteers rather than online data management. They may be considered “disposable” given their low cost.
- More sophisticated (and more expensive) single board computer systems with access to GSM data communications – or SD cards might be used for data collection.
- Bespoke data recorders designed for long lifetimes in harsh outdoor environments. May have formal calibration systems and more sophisticated communications systems such as mesh networking

Better answers will show an understanding of the practical problems of recording this kind of data in uncontrolled field conditions. For example, the need to protect devices from adverse weather conditions, disturbance by humans or animals and the means of access to the field sites. Stronger answers will balance the economics of the various options discussed for data collection with the quality and breadth of data required by the project. A range of answers were possible and were given appropriate credit.

**Syllabus Coverage:** Remote Sensing, 2.1, 2.2. Environmental Effects of Communication Systems, 5.1.

### Part c)

This section discusses the needs of the project in terms of data management, data quality/verification and availability. Answers might consider a simple web based solution where flat files of data are stored. More sophisticated answers might examine crowd-sourced quality management using examples from current citizen science projects such as SETI. Concepts such as management of missing values might be introduced. Stronger answers might provide a discussion of an extensive cloud infrastructure developed against a complete specification of requirements, adding innovative ideas and suggestions for future development. A range of answers were possible and were given appropriate credit.

**Syllabus Coverage:** Remote Sensing, 2.1, 2.2. Environmental Effects of Communication Systems, 5.1.

## Examiners' Comments

There were some good answers, but overall there was a low pass rate on this question. The evidence shows that Part (a) was answered well however part (b) was often not answered well. A common problem was that candidates listed sensor technology but did not address the issue of gathering the data. Often, the sensor technology was not relevant to the problem. For part (c), some answers were short and provided little detail.

- A2. As the IT service manager of a large manufacturing company in the UK, you are seeking to replace about 200 desktop PCs as part of an upgrade programme.

You wish to recycle the old PCs in the most effective way. Several organisations from different parts of the world have offered to collect them from you without cost (or payment) to the company.

- a) Identify FIVE key questions which you would ask these organisations prior to choosing one of them as the recycler of your PCs. For each question, give your reasons for asking that question. **(15 marks)**
- b) A document will be created, which the selected organisation must sign, detailing the way the recycling must be carried out and what UK laws must be observed by the organisation. Discuss which UK laws and regulations must be referred to in the document. **(10 marks)**

### Answer Pointers

#### Part a)

Candidates are expected to ask questions which reflect the legal and ethical issues around the question. Answers might include, but are not limited to, the following:

- Is your company a Licensed Waste Handler?
- Do you have formal accreditation to an environmental standard, such as ISO 14001?
- Where (country and/or jurisdiction) does the recycling take place?
- Do you pass the materials on to a third party for any part of the recycling process? If so, how is this process managed?
- Is any part of the recycling process carried out outside the UK/EU/European Economic Area?
- What policies do you have for the prevention of environmental degradation which might result from recycling processes? How are they enforced/monitored?
- What industry schemes does your organization adhere to?
- Has your company ever been under investigation, or prosecuted, for any breach of UK/EU environmental legislation?

Stronger answers will provide a linked set of questions designed to draw out additional information from the responder.

**Syllabus Coverage:** Legislative and Regulatory Provisions, 1.1. Environmental Impact Analysis, 3.1. Environmental Impact of Information Systems, 4.1.

#### Part b)

Reference to the UK Environmental Protection Act 1990 is likely to be core to this answer. This is likely to be aligned with the EU WEEE directive and the regulations which stem from it. More sophisticated answers might include reference to the ethical as well as legal obligations and how they might impact on the organizations concerned. Stronger answers will include how the benefits of the recycling process are managed, how the agreement will be monitored and how action could be taken in the event of the agreement being breached.

**Syllabus Coverage:** Legislative and Regulatory Provisions, 1.1. Environmental Impact Analysis, 3.1. Environmental Impact of Information Systems, 4.1.

### Examiners' Comments

There were some good answers, but overall there was a low pass rate on this question. The evidence that Part (a) was answered reasonably with some relevant points however part (b) was often not answered well. Some of the answers were short and provided little detail.

### Section B

- B3. In 1975, a city sited alongside a large river installed a flood warning system which is still in use.

The system is made up of twenty float level sensors located at 100m intervals along the river bank. These sensors are connected to an electrically powered bell; when any float rises above a preset level, it operates an electrical switch which makes the bell ring. On hearing the bell, the city police and others begin to raise flood barriers and open emergency shelters. The system gives approximately 30 minutes' warning of a flood. It has operated ten times since 2000, but it is now reaching the end of its useful life and needs to be replaced.

The city is taking the opportunity to develop a replacement system which will be more flexible and have a wider spread of sensors. It will also allow different kinds of alert to be generated.

- a) Explain how a replacement system could use sensors and monitors connected to the Internet of Things (IoT). Your answer should show how using IoT sensors can provide more data. By reference to the types of sensors available, you should explain the opportunities to improve the data collection and reporting, and how the range and variety of this data is increased. **(13 marks)**
- b) Identify THREE possible drawbacks of the IoT approach and explain how they might be managed. **(12 marks)**

### Answer Pointers

#### Part a)

Can deploy sensors of the same type as currently used, but because of the benefits of IoT technology, these can be increased in number and located at suitable places. In addition, other types of sensor can be used e.g. flow rate to determine how quickly water levels are changing; wind speed and direction to allow for wind effect on water flow.

The use of IoT means that sensors can also be added elsewhere in the environment- e.g. upriver to provide earlier information about water flow; downstream to allow the effects of tide and other blockages to be included. IoT also give access to the global weather monitoring and forecasting systems, so allowing information from these sources to be built into the overall system.

As a result of the IoT connection, all this can be provided as input into a computer program, which can provide more detailed – hopefully more accurate – predictions of risk. Finally, the IoT connectivity allows a wider range of output options, emergency services and affected residents can be contacted by SMS, email, IM.

**Syllabus Coverage:** Environmental Impact Analysis, 3.1.

#### Part b)

Include points such as:

The most obvious drawback is the dependence on internet connection (assumed wireless) to provide the system – is vulnerable to weather effects.

Can be alleviated by multiple data paths, and mitigated by the number of sensors deployed, so some information may get through.

Loss of power at the “base station” could knock out the entire system.

UPS and other backup power arrangements can be deployed to address this.

The system could be overwhelmed by – possibly conflicting – data from such a range of sources.

System specification and design should take account of the data sources

As an internet-based system, it is potentially vulnerable to hacking.

Deployment of modern, reliable and maintained security systems.

**Syllabus Coverage:** Environmental Impact Analysis, 3.1.

### Examiners' Comments

Few candidates attempted this question. The evidence shows that answers provided included some very good and detailed considerations of the problem. However, some of the answers were poorly organised and did not provide relevant discussion of the problem.

B4. A national government is developing its environmental policy in the areas of data centres and home working.

- a) The government wishes to become a major host for international data centres. It wants to be sure that all data centres on its territory are operated with concern for the environment. To do this, they are considering applying the EU Code of Conduct for Data Centres.

What are the advantages and drawbacks of (i) making the code a legal requirement, and (ii) making it voluntary? In both cases you should explain how a data centre which does not follow the code would be treated. **(13 marks)**

- b) The government also wishes to promote the use of home working / telecommuting among its own employees. Discuss TWO advantages and TWO drawbacks of home working / telecommuting. **(12 marks)**

### Answer Pointers

#### Part a)

Making the code a legal requirement gives it the full backing of an enforceable code. It shows the seriousness of the government to the issue.

The problems are caused by the need to enforce the Code of Conduct – some form of assessment and approval system will be required, and action will have to be taken if breaches are found. The assessment process will be costly in time and resources and may put off some potential clients.

If a data centre is found to have broken the Code of Conduct, then it is assumed some form of legal action will be taken – there could be a fine; or the data centre could be given time to make good, or the data centre could be closed. All of these are potential sources of unpleasantness.

Making it voluntary “waters down” the level of commitment shown and expected. The opportunities to require adherence are much more limited; there can be no fines or other legal measures but companies not following the Code of Conduct could be shamed.

Stronger answers might comment that it allows the hosting of data centres which are compliant with the Code of Conduct, therefore attracting users who share the government’s environmental ideals. Making it voluntary places the emphasis on organisations’ commitment to socially responsible behaviour and will require openness in reporting compliance.

**Syllabus Coverage:** Legislative and Regulatory Provisions, 1.1.

**Part b)**

Considers and discusses two advantages and two drawbacks. Other relevant advantages and drawbacks will be given credit.

Advantages of teleworking could include: reduces commute traffic and pollution; supports flexible working patterns; reduces office infrastructure requirements;

Drawbacks could include: loss of management control; loss of face-to-face meetings; reliance on technology; cost of supporting multiple “home offices” which will typically be less energy efficient than a single central office location.

Stronger answers could include extended detail in the discussion, for example the consequences of the drawbacks (e.g. loss of management control affecting profits).

**Syllabus Coverage:** Legislative and Regulatory Provisions, 1.1.

**Examiners’ Comments**

This question was answered well overall, with relevant issues discussed for both parts of the question. The evidence shows that a number of candidates provided more than the requested two examples. Some candidates wrote a lot about what a Data Centre is before addressing the question about the Code of Conduct. Marks are awarded for answers which address the question.

B5. The residents of a tower block have decided to create their own environmentally friendly community. They plan to install wind and solar technology on the building. This will include a heat management system in which hot air from the sunny side of the building is transferred to the colder side. The plan also includes a water harvesting system where rain water and recycled waste water is used to flush toilets.

- a) Explain the IT systems which will be needed to operate the technologies in this tower block. Your answer should consider how the data is used.
  - i. The energy collecting parts (wind and solar power).
  - ii. The heat management system.
  - iii. The water harvesting system.

**(10 marks)**
  
- b) The local power company wants to support this scheme and has proposed that they install smart electric and water meters for each apartment in the tower block.
  - i) Discuss the advantages and disadvantages of this plan from the residents’ view. 

**(9 marks)**
  - ii) Discuss opportunities for the power company to manage demand. 

**(6 marks)**

## Answer Pointers

### Part a)

Will require limited IT, to monitor operation and provide fault diagnosis as this technology is relatively self-managing.

Monitoring to manage and control the flow of heat as required, hence sensors to determine temperature and heat transfer systems (vents, pumps etc.) to make the transfers.

Again, the main requirement here is for management and fault monitoring, the systems are relatively low tech and should require little ongoing IT.

A stronger answer might also consider an alternative approach might be to consider using the existing building management system, with the new systems as inputs and outputs, or to describe how the system control might be enhanced by the addition of external inputs such as temperature and rain predictions to allow greater responsiveness to weather conditions.

**Syllabus Coverage:** IT in the Service of Power Generation & Energy Conservation, 6.1.

### Part b)

i)

Advantage: that the residents will have local control of their energy and water systems, therefore should see an overall reduction in the prices paid to the supply companies. Better answers might expand on this, e.g.: more information about their energy use, allowing them to have closer control over the way they use energy; ability to “sell” surplus energy to the power company; closer control of the house while they are away (increase / decrease the air conditioning or heating according to expected time of getting home).

Drawback: No provision for back up / maintenance / alternative supplies in case of failure / shortage of supply. Better answers might expand on this, e.g.: Others have more information about energy use so can use this to invade privacy. Greater vulnerability to intruder attacks and other forms of damage; cost of installation and maintenance – even if initial install is free, there is no guarantee that future charges will not be made.

ii)

The smart meter allows direct control of supply in response to external supply position and availability of power. An explanation of the process by which smart meter interacts with the power grid to respond to demands, and how the meter interacts with devices in the home to control *their* responses. A power company can use the data gathered to modify its power generation and supply behaviour – using historical data to plan the use of power station supplies; using differential pricing to control demand.

**Syllabus Coverage:** IT in the Service of Power Generation & Energy Conservation, 6.1.

## Examiners' Comments

This question was answered well overall. There is evidence that some candidates wrote a great deal about what a Smart Meter is before addressing the question about the demand (Part b ii). Some candidates misinterpreted the issue of managing demand and answered how to manage the demand for the provision of smart meters, however the question was about the demand for energy.