

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

INFORMATION SYSTEMS

March - Morning
Time: TWO hours

Section A and Section B each carry 50% of the marks. You are advised to spend about 1 hour on Section A (30 minutes per question) and 1 hour on Section B (12 minutes per question).

Answer the Section A questions you attempt in Answer Book A
Answer the Section B questions you attempt in Answer Book B

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are NOT allowed in this examination.

General comments on candidates' performance

The evidence shows that the majority of candidates understood the rubric although future candidates are advised to consider the number of marks attributed to each part of a question; this gives an indication of the amount of time which should be spent and the length of an answer.

SECTION A
Candidates were required to Answer 2 questions (out of 4).

A1

- a) Students apply to their local library for membership. Each member is able to borrow up to three books over a period of 4 weeks, after which a fine is raised for each week or part of a week a book is overdue. The library may hold more than one copy of a book. The value of the fine varies according to the number of weeks overdue. Books cannot be borrowed if there is an outstanding fine. Books can be reserved, these are kept for 1 week. Once they become available the student is notified by email. If the student does not pick the copy of a book up in time, the copy is returned to the shelves.
- i) Draw a simple high level diagram depicting the current system. **(12 marks)**
- ii) Identify the entities and the relationships between them. Give one example of possible attributes for each entity and identify primary and foreign keys. **(12 marks)**
- b) Outline two different tools that can assist in the development process. **(6 marks)**

Answer Pointers

- a) i) External entity – student, data flow – application, loan, reservation, fine, payment, data stores – student(member), loan, reservation, book, borrowed copy, fine, payment, process – deal with application, loan a book, reserve a book, calculate fine, pay a fine.
- ii) Entities – book, borrowed copy, loan, reservation, student (member), fine. Attributes – name, member no (PK), book – ISBN (book no), no of copies, title, borrowed copy (loan) - borrow ref, (PK), book no(FK), member no (FK), borrowed date, reservation – reservation no,(PK), member no (FK), Book no (FK), Fine – Fine no (PK), member no(FK), value
- b) Typical examples; CASE, IDE, ADE, RDBMS, OODBMS, 4GL, multimedia software etc.

Examiner's Comments

It is acceptable to identify the external entities, data stores and processes before attempting the dataflow diagram. Similarly identify entities, relationships, primary and foreign keys and cardinality before attempting the entity model. The evidence shows that many candidates missed the concept of copy and book. A library has many copies of a book, it is the copy which is borrowed at a particular point in time and it is this loan (borrowed copy) which is checked for date of return. This resolves the relationship between member (student) and book which is a many to many relationship, a member borrows many books and a book is borrowed by many students.

A2

a) Compare and contrast the following:

- | | |
|---|------------------|
| i) PERT and GANTT charts | (5 marks) |
| ii) The role of a programmer and a database administrator | (5 marks) |
| iii) Packaged software and in-house developed systems | (5 marks) |
| b) How can object oriented techniques provide a more robust system? | (2 marks) |

b) Briefly describe the following object oriented terms:

- | | |
|------------------|------------------|
| i) Class | (2 marks) |
| ii) Method | (2 marks) |
| iii) Inheritance | (2 marks) |
| iv) Persistence | (2 marks) |

c) A librarian describes the following process for overdue books :-

‘For all overdue books, I check the date of return on my records. If it is up to two weeks overdue, the student has to pay a fine of £1. If it is between two and three weeks late, the fine goes up by 50 pence. Between three and four weeks late the fine is £2.50. After four weeks, I mark the record with ‘NR’, set the fine to £5 and inform the Finance Department.’

Describe the process using Structured English or pseudocode. **(5 marks)**

Answer Pointers

- a) i) An example of each chart is expected, the main difference is in the complexity, PERT charts contain the ability for change, identification of critical paths, earliest and start dates. GANTT charts are simpler indicating blocks of time.
 - ii) A programmer deals with the efficient coding of an application, testing and providing solutions using the specifications provided. A DBA is concerned with the control, security and maintenance of data in both logical and physical states.
 - iii) Packaged software refers to software developed by an external company and often referred to as 'off the shelf'. Typically this would be application software such as accounting packages or utility software such as word processing. The advantage is that they would be well tested and less costly (although there will be annual maintenance charges), but they may not meet all the company's requirements. In-house application development will take more time and be more costly initially and will require thorough testing, but should meet the company requirements. They are more adaptable and can be amended as the business requirements change.
- b) Object oriented techniques are used to combine data and function allowing re-usability within system development.
- i) Class – a set of objects that have the same structure, attributes and methods often referred to as the blue print of OO technologies.
 - ii) Method – the process, manipulation and behaviour of the object.
 - iii) Inheritance – classes can be divided into subclasses or superclasses and each inherits the characteristics.
 - iv) Persistence – the property of objects to persist in terms of identity, state and description through time, regardless of the processing.
- c) If `overdue_days ≤ 14` then fine = '£1'
 else if `'overdue_days > 14 and ≤ 21` then fine = '£1.50'
 else if `overdue_days > 21 and ≤ 28` then fine = '£2.50'
 else mark = 'NR' and fine = '£5.00'

Examiner's Comments

The difference between packaged and in-house developed systems caused problems. Object oriented techniques should be understood however the evidence shows that not all candidates could describe the terms. Most attempts at pseudo code were reasonable, a few candidates drew flowcharts.

A3

- a) Describe the type of information and typical software used at the three major different levels of management and draw a diagram illustrating your answer. **(12 marks)**
- b) Give reasons why normalisation is used and describe the three steps of normalisation to produce relations in third normal form **(8 marks)**
- c) Your manager is concerned about why a large project may fail; prepare a report describing possible reasons. **(10 marks)**

Answer Pointers

- a) Strategic – top level, director or board level, trends, patterns decision making, long term – EIS, KBS, DSS,
Tactical – middle level, middle management, summary, prediction and control, medium term e.g. monthly,
Operational - MIS– low level, supervisory, daily detail, short term, real time – TPS
- b) It is a mathematical set theory approach providing stable relationships removing duplication, insertion, update and deletion anomalies and redundancy and is the basis for physical design. Remove repeating groups (1NF), remove partial dependencies (2NF), and remove transitive dependencies (3NF). The relation in 3NF results in all attributes depending on the primary key and no non-key attribute depends on another non-key attribute.
- c) Inadequate requirements, poor project management, lack of user participation, inadequate resources, lack of managerial support, alterations to requirements, changing specifications, lack of planning, out of date technology, organisation changes, budget restraints, poor estimation of time, inadequate test planning and testing.

Examiner's Comments

Although this was well answered, some candidates based their answers of part c) on feasibility study rather than indicating the reasons for failure. It is not only the feasibility study but the analysis and design and project management that contribute to failure.

A4

a) There are many risks and threats which need to be considered when developing and supporting computer systems. Describe how you would protect the security of the following

- i) data
- ii) hardware
- iii) network

(3 x 5 marks)

b) Important issues must be considered by the systems analyst after a system has been developed and before the installation/implementation. Draft a memo to your manager detailing steps you would take to ensure a professional installation of a completely new system.

(9 marks)

c) Identify three different ways of installing this system including one different advantage and disadvantage of each and explaining typically when each is used.

(6 marks)

Answer Pointers

a) i) data – passwords, encryption, user views, the cloud, user roles and access levels, validation techniques, security software, backup and recovery etc.

ii) hardware – power protection, fire, theft, server room access, security monitoring (CCTV), proper maintenance etc.

iii) network – firewalls, authentication and authorisation methods, system protocols, virus guards, use of intranet and/or VPN, etc

b) Answers should include all measures taken such as user training, software and hardware installation, setting up of passwords, roles and access criteria, documentation finalisation, feedback sessions, question and answer sessions, problem follow ups, spot checks to ensure the system is being used effectively, metrics measuring system performance etc.

c) Direct changeover which is quick and useful when no existing automated system but risky

Parallel changeover when there is an existing system which can be run in parallel and is safe but takes time

Staged/phased implementation for large geographically split locations which can be advantageous but certain functionality may not exist in all areas and therefore not tested.

Examiner's Comments

This was the most popular question and answered reasonably well. There was a lot of repetition in describing security of the various components. There were descriptions of methodologies, although the question stated 'after the development'.

SECTION B

(Candidates were required to answer **FIVE** out of the eight questions set)

B5

SSADM recommends the use of Throwaway Prototypes.

- a) Discuss what a throwaway prototype is
- b) Discuss the advantages of throwaway prototyping
- c) Discuss the disadvantages of throwaway prototyping

(3 x 4 marks)

Answer Pointers

- a) One mark for each reasonable point
To get over half marks the answer must stress that the prototype is not used beyond this stage.
The prototype is used to gather requirements and a new system is built from scratch rather than building on the prototype.
- b) One mark for each reasonable point
The build should be more secure and robust. Requirements are gathered quickly. Any weaknesses in the code due to the prototype being built quickly are removed
- c) All the effort in building the prototype is not utilised
The prototype maybe close to a working model, but ALL of it has to be ignored.
The perceived time and cost of building the prototype seems to be a waste

Examiner's Comments

Some good answers, but lots were lists of facts on prototyping and therefore did not discuss the issues or benefits of this approach. Marks were lost when just a list of facts and not a discussion was provided.

The issues with throwing away the prototype were not always addressed

B6

Questionnaires are a fact finding technique used during the early stages of analysis.

- a) Discuss what is meant by open ended questions by use of examples
- b) Discuss what is meant by closed ended questions by use of examples
- c) Where else in the project may questionnaires be used?

(3 x 4 marks)

Answer Pointers

- a) A question that is not limited in the answers possible
This type of question is used to gain additional information from the survey.
Due to its nature, it is difficult to machine mark this type of survey. Open questions are often used at the end of questionnaires.
One mark for each reasonable point.
- b) A question that is limited in the type of answer that can be given.
Answer may be one or more from a predefined list. Very easy to machine mark and therefore very common
One mark for each reasonable point
- c) Anywhere where an opinion is required. Testing, for example, and especially usability testing. Customer acceptable testing.
One mark for each reasonable point

Examiner's Comments

Overall candidates understood the value and use of questionnaires.

The weakest answers were for part c). Only a limited number of answers showed knowledge that whenever you need to acquire opinions or obtain knowledge, a questionnaire is a cheap and quick way of getting that data.

Very few answers indicated that closed questions are easily automated and calculated.

B7

For less complex applications all the features of a Database Management Systems (DBMS) are not required.

Discuss what you consider to be the advantages and disadvantages of using a DBMS
(12 marks)

Answer Pointers

One mark for any reasonable comment

Advantages

- Third party product, with guarantees
- Centralised database
- Security / roles / permissions are centrally controlled
- Backup / recovery done centrally
- Probably industry standard
- Be able to employ people with required skills

Disadvantages

- Ties to one vendor, have to pay for support etc
- Perhaps organisation does not use all the DBMS functions and therefore paying for features not used
- Might be better using open source version
- May need to pay higher wages for skill set required
- Often DBMS are slow in functionality, so overall system may be slow
- Security issues with patches etc.

Examiner's Comments

A number of answers were along the lines of the benefits of entity relationship modelling (no repeating data values, links between tables etc.) and that is not what a DBMS is. You can still have poor data structures in a database, that is solved by good design. Some good answers, but there is evidence that candidates need to focus on what the database management system provides rather than what the data structures are.

B8

The use of multimedia is often seen as essential to the success of many websites. Discuss the guidelines you would recommend for the use of THREE different types of multimedia.

(3 x 4 marks)

Answer Pointers

Zero marks for discussion of TV, radio and newspaper

Usual media is text, audio, video, pictures. Animation, flash, avi etc all video.

One mark for each reasonable point

Text

Used to get across complex information when other media cannot.

Have to be careful with language, for example, UK and US have different meaning for the same words

May not be attractive to all types of users

Need to make sure it is readable

Audio

Used to express complex information

Cannot always be used successfully (i.e. someone working in an open office environment)

Need to use the correct sounds / quality.

If it is narration, make sure that the speaker is understandable

Care needs to be taken over sound levels - too high may cause damage, too low and may not be heard

Pictures

Usual saying, one picture paints a thousand words

May be copyright issues

Watch resolution, too high effects loading, too low and picture does not get message across

Care needs to be taken with file types

Examiner's Comments

Majority of answers were very good and on topic.

A large proportion of answers had videos and animation as different types of media. In effect, they are both visual media that show moving images.

Some candidates gave lists of technology such as avis, mp3s, flash etc. This did not answer the question and scored low marks.

B9

Discuss, with an example, what type of projects are best suited for the following type of methods.

- a) Soft methodology
- b) Hard methodology

(2 x 6 marks)

Answer Pointers

One mark for each reasonable point

- a) Used where the requirements cannot easily be identified or engineered
Acknowledges that people, politics etc. are a key factor in designs
One example may be where a series of semi related companies are merging and the requirement is to have one IT solution and to work out what the best practice is.
It can use Checklands shortlist, and tools like Rich pictures, Catwoe etc.
- b) Used where the requirements can be easily identified and engineered.
Acknowledges that solutions can be easily automated.
Used where there is a highly structured flow of information for example and order processing system.
The design focuses on the data rather than who does the job.
The focus is examining the relationship between pieces of data so techniques like CD, DFD, ERD etc.

Examiner's Comments

Many answers provided did not answer the question. Lots of answers stated that RAD is a soft method and that soft methods do not have any rigour or frameworks.

Soft methods do have frameworks but due to the nature of the problem that is to be solved these frameworks can be customised to meet the requirements of the projects.
Later versions of SSADM (traditional hard method) can also be customised.

B10

You have been asked to compile a report on what factors you should take into consideration when designing applications for visually impaired users. **(12 marks)**

Answer Pointers

Visually impaired does not just mean blind, could be any reduced in vision. Answer needs to address both issues.

Needs to have an alternative method of interfacing. Effectively the screen needs to be read to the user. The screen needs to be designed in such a way that the screen can be read to the user.

For example

It is not recommended that the company logo is top left of the screen, as this is not an object that a screen reader can read. If the company logo has to be there then alt tags must be placed on it.

Offering purely textual versions of pages is an alternative. Testing the website via an approved process to ensure that all users can view the site; e.g. <http://wave.webaim.org/> Or check on web standard; for example, <http://www.bobby-approved.com/>

Examiner's Comments

A large number of answers stated that hardware is the primary concern. These answers gained limited marks as a blind user usually has dedicated software that perform this function and as a developer / designer we should be maximising the design to assist this dedicated software.

The question is about design, providing alt tags on images so that the software referenced above can read the tags and describe the images.

B11

Briefly describe the following

- a) Black box testing
- b) White box testing
- c) Stress testing

(3 x 4 marks)

Answer Pointers

One mark for each reasonable discussion,

- a) Black box is testing without respect to the code.
Predicted outputs are checked against supplied inputs.
If they match it is assumed that the code is working.
BUT the test scripts must have examples of all possible inputs and outputs to say that the programme 100% workings
- b) White box testing tests with respect to the code.
The code is tested via a number of approaches; for example, data flow testing, branch testing, statement coverage, decision coverage
- c) Stress testing applies pressure to the cpu, hardware, number of users, data, database etc to establish the limits of the software, hardware etc. Puts load on the hardware/software beyond limits of normal operation.

Examiner's Comments

A reasonably well answered question. The weakest section was stress testing.

A large percentage of candidates clearly understood what black and white box testing were although a number of candidates gave very short answers.

B12

Data stored in a public cloud is often seen as one way small businesses can afford current technology.

Discuss the advantages and disadvantages of a small business using a cloud database.

(12 marks)

Answer Pointers

One mark for each reasonable discussion,

Advantages

- Company does not need to invest in hardware, expertise
- "Pay as you go" style contracts
- 24x7 support, uptime for database
- Outsourced management of database
- Does not worry about business peaks, done via cloud provider

Disadvantages

- Where is data stored?
- What happens if cloud provider goes out of business?
- Reliance on other company
- Lack on expertise in house
- How easy is it to migrate to another cloud provider?

Examiner's Comments

There were a number of very good answers which showed clear understanding of what Cloud Databases are.

A significant majority number stated that Cloud databases are insecure and can be **easily** hacked. If this were true, then cloud databases would not be so widespread. There were a number of answers that appear to have taken a number of media stories and applied it to every cloud database.

A number of candidates stated that cloud is available anywhere in the world as its major benefit. The question was asking about cloud databases rather than internet databases. A number of answers stated that cloud was more expensive than having local servers. This is not necessarily the case as an SME moving to a cloud system can provide financial savings.