General comments on candidates' performance

It was pleasing to see that time was not wasted by candidates answering too many questions in Section A, although there were still a few such papers. Answers were almost equally split over all four questions.

Please note that the answer pointers contained in this report are examples only. Full marks were given for alternative valid answers.

SECTION A

(Candidates were required to answer TWO out of the four questions set)

A1

A team of doctors are opening a new clinic. They require a system to deal with registering patients, arranging and cancelling appointments for existing and new patients, and recording the discussions. Patient details will be recorded and each patient is assigned a unique clinic number. Patients contact the receptionist to arrange or cancel an appointment. When the patient attends the appointment they enter their name and date of birth on a check-in screen. Confirmation will be displayed and the time, room number and clinic number for the appointment displayed. After the appointment the doctor enters the details of the consultation and prescriptions provided.

a) Using the above description

i) Draw a Context Diagram (4 marks)
ii) Draw a High Level Dataflow Diagram (10 marks)

b) There are several methods for analysing systems. Describe the stages in the following including techniques:

i) A typical waterfall method (10 marks)
ii) A typical iterative method (6 marks)

Examiner's comment

This question was attempted by half of the candidates with a pass rate of 53%. The standard of the diagrams has improved, with many identifying the main components of a diagram,
namely external entities, data stores and processes before attempting a diagram. The stages of waterfall methods were identified by most; however fewer could describe an iterative approach. I was pleased to see that an Agile approach is increasing in understanding.

**Indicative Answer Pointers**

(a) The diagram should include external entities doctor and patient and indicate the major flows.  
(b) A typical waterfall method such as software life cycle development and partly SSADM involves the stages of feasibility, analysis, design, development, testing and implementation. Techniques should include dataflow diagrams, entity relationship models, entity life histories etc.

**A2**

a) Describe what should be included in a feasibility report. (10 marks)

b) Discuss how you would manage a large information systems project which is estimated to take at least one year. (12 marks)

c) Briefly explain the following elements in object-oriented analysis and design:

   i) Use Case and Sequence diagrams. (4 marks)

   ii) Object Classes and Inheritance, including an example. (4 marks)

**Examiner's comment**

46% of candidates attempted this question with a 50% pass rate. There was little mention of problems, alternative solutions and benefits within the feasibility report. Once again, candidates failed to recognise the word ‘manage’ and just repeated the software life cycle, which although relevant did not include how the project could be managed. Surprisingly few candidates could describe OO techniques.

**Indicative Answer Pointers**

(a) A feasibility report should contain an overview of the requirements and existing problems, cost and benefit analysis, time scale and budgets, technical hardware and software requirements, staffing resources, legal issues, alternative solutions, operational considerations and project management details. The use of planning tools and statistical charts, SWOT analysis could be mentioned.

(b) The management of a large project requires meticulous planning. The manager needs to be aware of many aspects such as time scales, preparing plans using sophisticated software, staffing resources, allocation of teams, identifying tasks and subtasks within the
development, providing testing mechanisms, technical and budget considerations and ways of measuring these, feedback mechanisms, contingency plans, risk assessments, progress meetings and evaluation of the projects success. Modern methods include an Agile approach such as SCRUM enabling the use of sprint planning and an iterative development.

(ii) Use case diagrams provide an overview of user requirements by showing the association or actions between the actors within a system. Sequence diagrams model the flow or sequence of these actions to complement the use case diagrams.

(ii) A class describes the name, attributes and methods of objects within a system. Inheritance is the term for sharing common characteristics within an object such as sub classes or super classes. Examples are expected.

A3

a) The following is an example of a form used to manually record appointments.

<table>
<thead>
<tr>
<th>Appointment Date</th>
<th>Appointment Time</th>
<th>Doctor No</th>
<th>Doctor Name</th>
<th>Room No</th>
<th>Patient Clinic No</th>
<th>Patient Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/08/16</td>
<td>10.00</td>
<td>D1</td>
<td>Dr Jones</td>
<td>1</td>
<td>123</td>
<td>Mrs Brown</td>
</tr>
<tr>
<td></td>
<td>10.00</td>
<td>D2</td>
<td>Dr Chin</td>
<td>2</td>
<td>234</td>
<td>Mr Smith</td>
</tr>
<tr>
<td></td>
<td>10.30</td>
<td>D1</td>
<td>Dr Jones</td>
<td>1</td>
<td>345</td>
<td>Miss Ball</td>
</tr>
<tr>
<td>02/08/16</td>
<td>10.00</td>
<td>D1</td>
<td>Dr Jones</td>
<td>1</td>
<td>234</td>
<td>Mr Smith</td>
</tr>
<tr>
<td></td>
<td>10.00</td>
<td>D3</td>
<td>Dr Peters</td>
<td>3</td>
<td>123</td>
<td>Mrs Brown</td>
</tr>
<tr>
<td></td>
<td>10.30</td>
<td>D2</td>
<td>Dr Chin</td>
<td>2</td>
<td>345</td>
<td>Miss Ball</td>
</tr>
</tbody>
</table>

i) Describe the three stages of normalisation to provide 3NF (third normal form)  

ii) Identify the normalised relations in the form in part a) indicating primary and foreign keys  

iii) Draw an entity relationship diagram using these relations

b) Briefly discuss the advantages of using a database management system instead of separate files.

(2 marks)

c) What are the main functions of a modern database management system?

(12 marks)

Examiner's comment

This was the least popular question with the lowest pass rate of 46%. Most candidate could describe the three stages of normalisation. Identifying the relations was not so successful, so many candidates did not include room number in the doctor relation, and the form implied that the doctor was always in the same room. Although an assumption, this could have been recognised. As there were only 2 marks for part b, time was wasted and yet part c which was worth 12 marks was quite brief. Candidates should be reminded to look at the mark allocation.

Indicative Answer Pointers
(ai) The first stage (1NF) necessitates the removal of repeating items into separate relations using primary and foreign keys. 2NF removes partial dependencies, relations which only depend on part of a key. These are removed into new relations. 3NF involves ensuring that all attributes rely on the key and only that key, if not then they are transitive and removed into new relations.

(aii) Relations are doctor (doctor no (PK), doctor name, room no), patient (patient no (PK), patient name), appointment (appointment date+appointment time, doctor no(FK), patient no(FK))PK).

(aiii) The diagram should identify the three relations doctor, patient and appointment and their relationships.

(b) The same data can be included in different files causing problems with duplication of effort, possibility of inconsistencies when updating and more storage and access problems.

(c) A database management system is sophisticated software provided by commercial companies. It is used to define, store, present, manipulate, query and maintain a company’s data. It also provides reporting and development functions and efficiency. Security issues such as user control with usernames, passwords, user views, user roles etc are provided. Concurrency control prevents anomalies. Backup and recovery mechanisms ensure integrity in event of an error.

A4

a) When planning the final installation of a system, discuss how you would organise training, system testing and conversion of existing data. (10 marks)

b) Briefly discuss the advantages and disadvantages of choosing packaged software rather than developing customised software. (8 marks)

c) Discuss measures taken to ensure as high a level of security as possible for the following:

i) Providing on-line ordering and payment systems over the internet. (6 marks)
ii) Protecting computers, terminals and networks in a company. (6 marks)

Examiner's comment

This was the most popular question with a good pass rate of 74%. Part a) was well answered, although there was little mention of data conversion. Customised systems are designed and developed by professionals (either internal or external) exclusively and would be tested and delivered according to a company’s stringent requirements – this was often misunderstood.

Indicative Answer Pointers

(a) All staff from management to operational users need to be trained and user manuals provided. Sessions should be set up so that the minimum of interruption is made to the normal duties. Timing is essential. Differing methods can be used from formal presentations and practical demonstrations to on hand practice for the users. Staff need to know how to recover from errors, when to back-up etc. Testing should have taken place throughout the development. System testing should include the production of test plans, metrics, performance, quality, integrity, control and security. Once the system is ready for conversion existing required data needs to be transferred from the old system to the new. This could be
manual entry but that would be time consuming and prone to error. More likely special programs could be developed to transfer the data automatically. It would also depend on the implementation method chosen. Documentation should be provided to support the installation process.

(b) Packaged software has the advantage of being developed by professional developers. It would be well tested and used by a large variety of users thus reducing errors. The disadvantage would be that it is costly; companies have to pay maintenance costs which could spiral out of control. It may not provide all the required facilities which can be provided when developed specifically. It may not be easy to adapt current business practices. Security, control and performance issues may not be as controllable. Customised software is developed exclusively for a company, it can be costly but the system is designed according to the exact requirements and would follow development methods, management and control techniques.

(cii) Simple measures such as password protection can be enhanced by ensuring passwords contain a variety of letters, use of uppercase and lowercase, numbers and symbols. Frequent change of passwords can be enforced despite this causing frustration to customers. Feedback mechanisms sent to customers such as generating a code which can be sent to mobile phones for confirmation can be introduced. Payment protection software and gateways can be provided together with security protocols e.g. HTTPS.

(cii) Network protectors and protocols, virus and anti-hacking software, firewalls, locks, fire alarms, smoke detectors, reducing access to computer/network rooms, physical recognition etc

SECTION B

B5

Define what is meant by the following cloud computing terms and what the potential benefits for a small computing company are:

a) Infrastructure as a service
b) Platform as a service
c) Software as a service

(3 * 4 marks)

Indicative Answer Pointers

One mark for each relevant point

a) Provides virtualisation for a business
   A third party provider host virtually all the resources required by a company – that is software, hardware, server’s storage and other elements of infrastructure
   The third party will handle all maintenance, back up recovery etc.
   Effectively a small company can outsource its entire computing provision to a cloud provider
   Some discussion on advantages about not needing expensive people, machines etc or discussion about over reliance on third party etc

b) Provides an environment that allows developers to build applications and services
   Might be a point and click development environment where key components have already been built (almost off the shelf)
   These services are managed by the cloud provider.
   Usually a subscription service
   Advantage – company does not have to purchase an infrastructure, using existing pre-build apps should increase security.
Disadvantages – reliance on third party code, reliance on cloud provider etc

c) Removes the need for an internal data centre
   A third party hosts the data, and performs all the associated backup and recovery.
   May be a pay as you go style contract
   Allows the ability to upscale or downscale depending on requirements
   Does not required expensive on expensive highly trained individuals
   But does rely on the third party provider

Examiner's comment

This was a poorly answered question. It was clear that some candidates knew these terms and applied their knowledge

Some candidates clearly knew a little about cloud and tried to apply their knowledge and this results in some marks being awarded.

Clearly an address of weakness for most candidates and as SMEs will potentially use cloud services to reduce the costs of their infrastructure IS students need to have an understanding of this area.

B6

Discuss software solutions that can be implemented to ensure that a blind person can successfully use a web page.

[Focus only on software – there are no marks for discussing hardware related solutions]  

(12 marks)

Indicative Answer Pointers

1 or 2 marks were awarded for each relevant point.

This question is about providing alternative means of providing information.

The top left should be a textual description of site with contact details. All images should have alt tags or a textual description of what the image is. The language should be simple and not use slang or a large number of TLAs. Perhaps there is a text only version of the page.

Feedback needs to be given. The page needs to be consistent within the site and consistent with accepted internet norms

A third party tool has been used to check the page for consistency issues with respect to legislation.

Training should be taken / given to make sure that developers are fully aware of any issues / legislation.

Examiner's comment

An extremely poorly answered question. The majority of answers were to use voice recognition and screen readers along with AI or natural language processing. Three or four marks were awarded for those answers.
Again, had discussion of using touch screen, braille keyboards, etc which were off topic. A blind person does not have to “speak” to the computer, mobile phones etc. They can use a normal interface and the machine reads the screen back to them. They can use the textual version of Facebook, for example, not the version with loads of images. Facebook have developed alternative means of using their web site.

The question is about having alternative designs of web site that assist those would cannot access them using traditional means.

B7

Discuss, using examples, the advantages and disadvantages of closed and open questions in a questionnaire.  

(2 * 6 marks)

Indicative Answer Pointers

Closed question.

Multiple choice or a selection from a list
Maybe a scale from 1 to 10 (i.e. comment on how good / bad this product is)
Restricts the user’s choice
Very good for mass audiences
Can be machine marked
Very poor for allowing the user to add value to the answers
Very efficient

Open ended questions

The user is free to express an opinion
Hard to machine process as the user can answer how they wish
Very good for getting personal opinion or where the requirements may be unclear
Usually structured, but when it comes to face to face interviews usual to be prepared and have a structure.
Very good for small groups
Time consuming

Examiner’s comment

A reasonable attempt by candidates but there were a lot of comments about how the style the person used to answer the questionnaire could tell whether they were lying or not. There is no real evidence to support this belief.

Where any answer was a note dump on questionnaires (no reference to open or closed) limited marks were awarded as limited knowledge was shown.

The biggest weakest in the answers was a lack of examples, which were required.
With reference to an example and the type of information shown, describe:

a) Pie Charts
b) Scatter Charts
c) Bar Charts

(3 * 4 marks)

Indicative Answer Pointers

Three times 2 marks for a reasonable attempt at drawing each chart with a decent example
Three times 2 marks for a discussion on why you would use that graph

*Pie Charts*

Used to display percentages as slices of a pie
The arc length is proportional to the amount represented
Very good for representing fractions of the whole (i.e. what is the breakdown on the monthly shopping bill)
Soon can become unreadable if there is a reasonable amount of data

*Scatter charts*

Can suggest correlations between variables
Able to show non-linear relationships between variables
Needs enough data to make the correlation
May also require a domain expert to interpret the results

*Bar Charts*

A graph that represents grouped data
Maybe grouped or stacked to show more data
Usually scaled and can be in any order
Can be used to show data over time

Examiner's comment

This would have been an excellently answered question if part B had been omitted.

There was a clear lack of knowledge about scatter charts. Most answers showed a line graph.

Another area of weakness was lack of examples.

B9

Discuss methods of ensuring that a data centre is physically secure.  

(12 marks)

Indicative Answer Pointers
Opened end question
1 or 2 marks for each reasonable point

This is a question about physical not logical security, therefore there are no marks for reference to logical security

Examiner's comment

You do not tell anyone where your data centre is – no employee who has access to the data in the data centre need direct access physical access

Keep access to the data centre to a minimum – cleaners, operations staff etc.

Have security on the front / bad doors.

Ensure there are CCTV camera

Ensure all employees are recognised and wear badges.

Ensure backup power generators are maintained and have the required amount of fuel to function for the agreed time.

Any reasonable and relevant comment will be awarded marks

Examiner's comment

Some reasonable answers but a lot of answers were extremely short

A significant portion showed a lack of understanding of what a data centre is and assumed it was a server – one answer suggested backing the data centre up on a USB pen and taking it home.

Biggest issue with the majority of answers was the lack of depth.

Marks were awarded for passwords, encryption etc but often did not say why encrypt and how it helps with security

Likewise, answers stated having a backup generator but don’t explain why and how long it lasts for.

The answer to this type of question needs more depth and not just a note dump list of points.

B10

With reference to the type of decisions, define

a) Operational Management
b) Strategic Management
c) Tactical Management

(3 * 4 marks)

Indicative Answer Pointers

a) These are day to day decisions
May be done by junior management
Usually simple
Routine
Maybe what stock do we need in the next week, or do we have enough staff to cover
this week’s rota
Normally precise
Uses internal data mainly

b) These are long term decisions
Complex
None routine
Policy decisions
Forecasts – estimates
May used external data to make decisions

c) These are medium term decisions
Less complex
May be in the realms of middle management
May inform policy

Examiner’s comment

Over the previous years, the papers have been trying to set questions that do not lend
themselves to a simple note dump style. And this is a case in point. The question needed the
candidate to show that they understand the area and not simply note dump.

This area in order in Strategic, Tactical and Operational. Or Operational, Tactical and
Strategic.

A majority of candidates simply noted dumped in the order that they were taught and did not
read the question.

The next area of weakest was the type of decision. Few candidates addressed this. Some
did – for operational - staff rotas, staff holidays, stock requirements for next week etc.

B11

Define what is meant by the following terms
   a) Multimedia
   b) Hypertext
   c) Metadata
   d) XML

(4 * 3 marks)

Indicative Answer Pointers

One mark for a reasonable point made, but not restricted to the list below:

   a) Use of different types of media to convey a message
      Typically, a combination of text, audio, images and moving images (only 1 mark for
      this statement)
      Can be used to convey a message to different types of users or users of different
      ability
Maybe linear or non-linear  
Can be interactive

b) Restricted to text  
Text may have embedded links (hyperlinks)  
Enables user to use in either a linear or non-linear manner  
Underlying concept of Worldwide Web

c) Data / information that provides data about data  
Example is alt tag comments on a web page describing an image  
Is used to provide additional information – for example a DTD with an XML file  
Can be used as a control file for the import of data into a database

d) Use to exchange data in text format  
Consists of data within tags that are used to describe the data  
Does not have to conform to the relational model for data  
Can be free form in structure  
May have a document type definition associated with it, which will provide information about the structure of the XML file

**Examiner's comment**

Where a note dump on media was a list 2 marks were awarded. Allocation of a third mark I needed some additional information, The use of multimedia is the most appropriate, or is used to convey a message etc.

Hypertext was extremely poorly attempted. There is clearly a confusion with HTML. Where the answer was reasonable a considerable amount failed to state that it is useful for non linear applications and learning.

Metadata was poorly answered. It is not a programming language and you cannot build web sites with it,

XML was also poorly answered. Again it is not a programming language and you cannot build a web site with it.

The answers to the questions show a clear lack of understanding with respect to these areas.

**B12**

What is meant by the following software maintenance related terms?  
   a) Legacy System  
   b) Software Bug  
   c) Version Control  
   d) Software Patch  

(4 * 3 marks)

**Indicative Answer Pointers**

One mark for each relevant point

a)
A legacy system is a computer system that a company no longer wishes to support. It still works but not bugs or updates will be issued. It is possible that a third party may maintain the software but it has deemed to have reached the end of its life.

b) A bug is an error in the software. It could be terminal (cause the application etc to fail) or may cause an error too occur in an action (for example an error in a calculation) Normally a compiler or development environment will remove syntax errors A bug may also be implemented due to a faulty design.

c) Version control is related to documentation and software A library is established with previous versions Use to ensure that different version of documents and software can be maintained

d) A patch is used to fix an error in a piece of software Patch Tuesday is a traditional day when patches are released. A reported patch may show a flaw in a piece of software that could be used for an attack. Patch management is an important part of any company

Examiner's comment

A vast majority of answers for Legacy Systems clearly did not know the term, and assumed that legacy was related to legal and answered with respect to legal issues.

Software bug was reasonably well answered

Version control was mixed with version numbers and the majority of answers were about software and how it is numbered. Very few answers addressed the need to maintain version control of documentation.

Software patch was confused with software bug but there were some answers that showed the difference.

Another question where there is clearly a lack of understanding in this area.