GCE EXAMINERS' REPORTS

GCE (NEW)
COMPUTER SCIENCE
AS/Advanced

SUMMER 2017

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GCE COMPUTER SCIENCE (NEW)

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UNIT 1 FUNDAMENTALS OF COMPUTER SCIENCE

The majority of candidates demonstrated that they understood and could answer questions on most of the examined topics. The mean mark would suggest that candidates found the paper slightly more accessible than last year and it was particularly pleasing to see many candidates answer the mathematical content confidently and construct an algorithm effectively, which was an improvement on the previous series.

It was slightly disappointing to see many candidates not giving enough technical detail on the storage structures and file attributes, object oriented approach to programming and primitive data types.

Individual Questions

1. Many of the candidates were able to correctly complete the given truth table and this was the best answered question on the paper.

2. The minority of candidates were able to give a real technical comparison of the functional characteristics of Hard Disc Drives and Optical Drives. The majority of candidates however were unable to do so and only had a superficial understanding of how each of the technologies work.

3. Around half of candidates were able to answer the questions on networks effectively.

   Most candidates stated that a protocol is an agreed set of rules, but only around half of candidates stated that this allowed devices to communicate.

   Most candidates were able to correctly identify SMTP as the most appropriate protocol for sending an email from one server to another. A few candidates were able to correctly identify DHCP and TCP/IP for the other two examples given.

   Many candidates were able to confidently answer the questions on handshaking, data collisions and how data is routed on a packed switched network.

4. Only a few candidates were able to answer the question on primitive data types well.

   Many candidates were able to calculate the minimum storage requirements for integers correctly within the range 0_{10} to 127_{10}.

   Only a few candidates were able to give the correct signed range and describe the use and advantages of the Unicode character set.

   Surprisingly, only a few candidates were able to compare the storage requirements of a character and string. This was due to incomplete answers being given, which did not include suitable examples as required in the question.

5. Many candidates were able to describe potential threats to computer systems, but only a very few candidates were able to describe how contingency planning can help recover from disasters.

6. A minority of candidates were able to simplify the given Boolean expression. A few candidates were penalised as they hadn't clearly shown each step as required by the question. A few candidates incorrectly simplified $A.\overline{A} = 1$.

7. Many candidates answered this question well and there was a clear improvement in standards nationally in relation to this type of mathematical question.

   Most candidates were able to convert between different counting systems confidently and accurately.

   The majority of candidates were able to convert the given real number into the stated floating-point form.

   The majority of candidates were able to calculate the denary value of the given floating-point number, but a few did not state the denary value of the original mantissa.

8. The majority of candidates were able to answer the question on database systems well.

   Many candidates were able to use an example from the scenario given to explain what was meant by a foreign key. These candidates were also able to confidently explain the difference between flat file and relational database systems.

   A minority of candidates were able to construct an entity relationship diagram to represent the scenario given.

9. Only a few candidates were able to describe the object-oriented approach to programming effectively. A few did not attempt the question at all and this was one of the worst attempted questions on the paper. The main issue was a lack of technical understanding of the paradigm.

10. Around half of candidates, which is a significantly higher proportion of candidates than in the previous series, wrote a fully functioning algorithm to the given problem.

    The use of self-documenting identifiers was of great assistance to the marking process.

11. Only a few candidates were able to answer the questions on storage structures and file attributes effectively and this was surprisingly the worst answered question of the paper.

    It was clear from the answers given that many candidates were unfamiliar with the term *file attributes*, with these candidates giving answers in relation to encryption, compression, serial, sequential, random access, etc.

12. A minority of candidates answered the question on sort algorithms effectively, with a very few not attempting the question. Again, a lack of technical terminology prohibited a majority of candidates accessing high marks in this questions, particularly for the insertion sort aspect.

13. A minority of candidates were able to answer the question on the impact of the Data Protection Act in organisations effectively. Most candidates knew some of the principles, but not enough to access higher marks.

14. A minority of candidates wrote a response that showed an adequate line of reasoning with elements of coherence, relevance and logical structure with regards to high and low level languages and the use of IDEs in developing them.

    These candidates showed an adequate understanding of the requirements of the question and a satisfactory knowledge as specified in the indicative content on operating systems.

    These candidates used appropriate technical terminology referring to the indicative content.

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UNIT 2 – PRACTICAL PROGRAMMING TO SOLVE PROBLEMS

Introduction

Unit 2 is a practical examination with candidates required to demonstrate the application of knowledge and understanding at all times.

General Remarks

Most of the candidates demonstrated a good understanding of the specification. Questions attempted data was unavailable this series. Many candidates were well prepared and many excellent answers were evident. There was evidence also that some candidates had been well prepared for the majority of the practical programming elements found in section B, however, performance when using file handling code was disappointing.

Comments on Individual Questions:

Section A:

Q1: This was well answered by most candidates, however, some candidates could identify foreign keys.

Q2: Many good answers were seen although some candidates did could not select appropriate validation methods for different fields.

Q3: This question was generally not well answered. A majority of candidates used incorrect flowchart shapes and the logic was often difficult to follow.

Q4: Candidates did not perform well in this question. They invariably failed to apply their knowledge to the scenario.

Q5: Many candidates did not have a depth of knowledge required to discuss different backup strategies, whilst they could often name appropriate backup storage devices, it was not accompanied by a method of backing up (nightly) or a backup regime (such as grandfather - father - son, etc).

Q6: As is usually the case with algorithm questions, some candidates scored full marks but a large number seemed to have no clear idea about algorithm design. It was very difficult to follow the logic used at times as candidates would begin loops or selection (if) statements but not end them in any meaningful way.

Section B:

Q1: This question was deemed to be slightly less accessible when set, with the candidates required to fix broken file handling code, this was not done as well as previous series, possibly due to the increased rigor of the question.

Q2: Generally, this was not well answered. Many candidates were unable to implement validation checks nor deal with file handling, however, more attempts were seen at this question, suggesting a slightly stronger attempt by candidates in the lower mark ranges.

Q3: This question was generally well answered. Many candidates showed detailed annotation of the code.

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UNIT 3 – PROGRAMMING AND SYSTEM DEVELOPMENT

Many candidates demonstrated that they understood and could answer questions on most of the specification. Candidates were well prepared for the exam and many good answers were evident, particularly for the questions requiring the application of knowledge and understanding of principles and concepts (Assessment Objective 2).

Individual Questions

1. HCI. Touch screen and voice input.

   (a) Most candidates stated at least one benefit of using a touch screen on a mobile device.

   (b) Very well answered, most candidates described difficulties in creating a natural language interface for voice input.

2. Object Oriented Programming

   Some candidates produced precise explanations of Class, Object and Method, but many candidates confused objects with controls used in event driven programs and omitted any explanation of a method.

3. Truth table and masking. (AO 2)

   (a) Very well answered, most candidates produced a correct truth table, although several candidates failed to produce a table containing all 8 possible values of A, B and C.

   (b) Very well answered, most candidates designed a suitable mask and applied it correctly using AND. Several candidates suggested the use of XOR to extract the required bits.

4. Program translation.

   (a) Most candidates described the processes carried out during lexical and syntax analysis. Only a minority of candidates correctly described processes carried out during the semantic analysis stage.

   (b) Poorly answered. Few candidates based their response on a comparison between compiling and interpreting, as required.

   (c) As item (b). Poorly answered, with few comparisons made.

   (d) Most candidates described the purpose of an assembler, but few produced a technical description of the source codes.

5. Boolean Algebra (AO 2).

   (a) Very well answered, with many candidates gaining full marks for this question.

   (b) As item (a). Very well answered.

6. Bubble sort algorithm

   Most candidates produced an algorithm in pseudo-code, as required. Many candidates designed a loop that compared two elements and indicated a swap, although few included a 'temp' variable or an outer loop with terminating condition. Very few candidates considered the length of the array of integers referred to in the question.

7. Syntax and BNF

   (a) Syntax diagrams were well done by most candidates, although the null, or skip arrow was often omitted and many responses would have benefited from greater care in the drawing of the diagrams.

   (b) BNF definitions were not as well done, with most candidates limiting their responses to simple definitions of letter or digit, without developing a string, or similar, for use in the final definition of the constant.

8. Efficiency of an algorithm.

   Many candidates gained a mark by stating $O(N^2)$, but few explained the growth rate for the time performance with reference to the given algorithm.

9. Recursive algorithms.

   (a) Well answered. Most candidates produced precise definitions of the term 'algorithm' and identified an alternative to pseudo-code.

   (b) Very well answered. Most candidates described the two main characteristics of a recursive algorithm.

   (c) As item (b). Most candidates described two disadvantages of using a recursive algorithm, with many references to stack overflow in addition to complexity.

10. Design review.

    Poorly answered. Many candidates were evidently not aware of this part of the specification and based their responses on types of program testing.

11. Linked list and binary tree (AO 2).

    (a) Very few candidates explained the difference in adequate detail to gain both marks for this part of the question.

(b) All three sections were well answered, with most candidates correctly completing the ‘Next Pointer’ columns.

(c) Most candidates produced a correct binary tree.

12. Debugging tools

Most candidates gained marks by describing the function of the three debugging tools, but few expanded their answers to cover the purpose of each of the tools.

13. Systems analysis and programming paradigms.

Most candidates described the features of waterfall and agile approaches to systems analysis and many candidates included descriptions of different programming paradigms, but few related the paradigms to the systems analysis approach. A summative question which refers to more than one section of the specification is a requirement for the assessment of this unit.

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UNIT 4 - COMPUTER ARCHITECTURE, DATA, COMMUNICATION AND APPLICATIONS

Many candidates were well prepared and demonstrated a wide knowledge of the topics in the specification.

In general, questions requiring precise answers to programming or mathematical problems were better answered than questions requiring descriptive answers.

Candidates could often have gained higher marks in descriptive questions by including relevant diagrams, or by referring to practical examples of the use of the computing techniques discussed, for example: in commerce or industry.

Individual questions

1. Most answers demonstrated a correct use of SQL keywords and command structures. In part (c), many candidates produced a query across two tables by use of nested SELECT commands. A minority used a JOIN construction, which was equally acceptable.

2. This question about the advantages of distributed databases was generally answered poorly. Many candidates explained the term 'distributed database' correctly, but few went on to provide reasons for selecting a distributed system in preference to a single centralised computer accessible over a wide area network.

3. (a) This question was well answered, with many candidates writing programs which produced the required number sequence. However, in a number of cases the candidate wrote individual assembly language commands for each of the required outputs, rather than using a more efficient loop structure. Candidates should be aware that the use of jump commands is expected in appropriate situations, in order to gain maximum marks.

   (b) A majority of answers demonstrated a clear understanding of the given sequence of assembly language operations. In some cases, however, candidates lost marks through failing to display the contents of registers at each step as requested.

4. This question was generally answered well, with Amdahl's formula often presented correctly as justification for the speed limitation of parallel processing. In some cases, candidates showed a confusion between parallel processing with multiple processors, and multiple threading by time share of a single processor.

5. This question was answered reasonably well, with a good proportion of candidates understanding how absolute and relative errors are calculated. It was disappointing that relatively few candidates were able to give correct definitions of rounding and truncation as reducing the number of digits in the fractional part of a number. Few candidates seemed to be aware that ROUND and TRUNCATE commands in programming languages generally convert real numbers to integers.

6. This question was pleasingly well answered, with a majority of candidates demonstrating a good understanding of two's complement integer arithmetic and floating point binary representation.

7. (a) Good answers were produced. A minority of candidates showed confusion between the process states of a scheduler, and the stages of the fetch-execute cycle.

(b) Detailed descriptions of interrupts were given by many candidates. In some cases, however, answers were insufficiently precise and referred only in general terms to 'hardware and software errors' or 'input and output processes'.

(c) Double buffering was correctly described by a majority of candidates. A minority were under the misapprehension that double buffers are arranged in sequence, with the first buffer transmitting data to the second, or that a second buffer was added simply to increase the total data storage capacity.

8. (a) Relatively few candidates provided a detailed comparison of the advantages of symmetric and asymmetric encryption methods. Some candidates did, however, give excellent descriptions of the use of symmetric encryption of documents on a single computer, and asymmetric encryption for the transfer of confidential data over the internet during an on-line transaction.

(b) XOR encryption was carried out correctly by a majority of candidates.

(c) Most candidates were able to give at least one reason why the proposed encryption method was unsatisfactory.

9. (a) A majority of candidates identified the computer hardware needed to operate a wireless network, and many appeared to have practical knowledge of its use.

(b) Answers generally contained insufficient description of the use of office applications. Candidates referred, for example, to 'e-mail' or 'file-sharing' without giving examples of how these applications might be used in day-to-day business activities.

10. This question was answered well by some candidates. In other cases, responses focussed on describing the operation of expert systems without clearly identifying the advantages to an organisation of using such systems. Some candidates showed a confusion between expert systems and other types of computer application, such as: real-time control systems, computer aided design, or scientific mathematical modelling applications.

11. Some good answers were seen, but in many cases candidates did not provide a suitable example of a three-level index using successive refinement of the range of search values. A minority of candidates failed to illustrate an indexed sequential file system as required, but instead described a hierarchical menu system for storing files on a hard disc.

12. Many candidates provided adequate answers to this question, but few gave detailed technical explanations of the way in which a voice print is recorded by sampling the frequencies and intensities of sound at tiny intervals as a specified word is spoken. Candidates generally had limited appreciation of the level of security provided by speech recognition in comparison to other biometric techniques. Few candidates commented on the need for an alternative entry method, for example: for invited visitors, or for the emergency services.

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UNIT 5 – PROGRAMMED SOLUTION TO A PROBLEM

General Comments

Many projects of a good standard were submitted for moderation this summer. Moderators saw some work of an excellent standard. Many centres had assessed the work accurately and had clearly explained their assessment decisions.

This specification requires work to be submitted electronically. In addition, the candidates' functional solutions should also be included in the coursework submission. Centres should ensure that candidates' solutions are presented in a format that allows moderators to run the candidates' programs with ease.

In too many instances, moderators received CDs that could not be read. Centres should check the media before it is sent to the moderator. Centres should also ensure that candidates' solutions are functioning correctly once transferred from the centre's network.

Coursework samples should be despatched to the named moderator in good time to meet the awarding body's deadline. Centres should ensure that they submit the correct sample for moderation. When centres fail to submit the correct sample the moderation process is delayed. Should moderators' request additional samples of work centres must ensure that the work is provided as quickly as possible. This allows the moderation process to be carried out in accordance with the awarding body's timescales and ensures that results will be available for candidates in August.

The following information is provided to help centres guide candidates through the NEA in future. During the moderation process, it appeared to become clear which centres had attended CPD prior to the submission of the work.

In general, many centres had not recognised the importance of the discussion section to the identification of suitable substantive problem situation. This is a good opportunity to steer candidates away from unsuitable ideas.

The prototype section of work is intended to allow candidates to trial part of their design and to reflect on the method of solution chosen. In many cases, candidates included feedback from others in this section of work. This was not appropriate as this section of the work relies on self-reflection.

The refinement of design section of the work considers third party feedback in addition to self-reflection to move the project forward.

It is essential that feedback in the discussion work and in the refinement of the design work is provided by informed third parties who are able to move the project forward rather than end users.

Unit 5 – Non Examination Assessment

Most candidates had chosen suitable problem situations as a basis for their project work that provided them with sufficient scope to produce a fully working system at an appropriate level for this qualification. However a minority of candidates had chosen problem situations that did not provide the opportunities for data handling that are required to access marks for design, implementation and testing at this level.

Candidates should consider whether their choice of problem situation provides them with sufficient:

- Opportunities to carry out an investigation in appropriate depth to provide evidence to allow them to complete the analysis, problem definition and objectives sections of the work to an appropriate level of complexity for an A2 qualification.
- Complexity to provide the opportunities needed to access the full range of marks.
- Data handling process to allow thorough testing processes to take place.

Discussion

It is important to recognise the importance of the discussion section. It allows the candidates to present their problem situation to their teacher and peers and for them to receive informed feedback that will help them to firm up their ideas and ensure that unsuitable topics are revised.

This is an opportunity to ensure that the chosen problem is suitably substantial. In preparing the materials for the presentation/discussion allows students to reflect on their ideas and the problem situation. If necessary, the candidates are able to reframe their problem situation or even identify a different, more appropriate problem situation.

Investigation

Where candidates had chosen suitable real-life problems they have the opportunity to carry out an investigation of the current system. Candidates should identify the data collected, processed and output by the current system. In many cases candidates did not carry out this investigation and analysis but provided narrative accounts of problem situations that did not allow them to identify suitable objectives for their solutions nor form the basis for a comprehensive design.

This specification requires all candidates to carry out desk-based research into similar commercial solutions created to solve similar problems. This is an important part of the project as it should inform the design process. In addition, candidates will be required to evaluate their final solutions against the commercial systems.

It is important that candidates produce a comprehensive working specification and that measurable objectives are set that will inform the design, prototyping and testing processes.

For each objective, candidates should:

- Design input and output facilities and appropriate data structures
- Produce algorithms for processing
- Develop a prototype if relevant and redesign if necessary
- Fully develop the solution
- Testing should cover each objective
- Evaluation of the solution for each objective

Prototype
Candidates should identify the areas to be prototyped. These areas should cover the essential sections of the solution.

Candidates should not include facilities such as logon facilities and validation that will complicate the testing process. It is not necessary to include all fields for data files. Centres should note that the extent of the prototype will reflect the nature of the chosen problem. The prototype work is intended to allow self-reflection on the chosen method of solution and the design work. It is not appropriate to include feedback from third parties.

Post-prototype refinement of design
This part of the work is intended to allow candidates to consider third party feedback and to decide what changes, if any, should be made to the original design. It is important that candidates realise that this section of work requires refinement of design not redesign.

Candidates should justify their acceptance or rejection of feedback.

Testing
It is important that the testing work should focus on the functionality of the solution in terms of:

- Input facilities including measures to ensure reasonable data entry
- Processing facilities to ensure correct and accurate output
- Appropriate output including screen and paper-based outputs

The testing work should cover each objective with data designed to measure the outcomes of the system against the desired outcome. The quality of the commentaries accompanying the testing evidence have a major role in identifying the marks to be awarded for this section of the work.

Evaluation
The evaluation section should cover the effectiveness of the programming language and a justification of the tools and techniques used.

Candidates should then compare and contrast their completed solutions with the commercial systems considered during the investigation section of the work. This comparison should allow candidates to identify and discuss the good features and shortcomings of their work. It is important that candidates describe significant potential improvements to their systems that would more reflect the facilities of the commercial solutions to the chosen problem.

Candidates should also consider their own strengths and weakness and how they would adapt their approach to improve their performance if faced with a similar task in the future.

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