



GCE A LEVEL EXAMINERS' REPORTS

COMPUTER SCIENCE A LEVEL

SUMMER 2022

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COMPUTER SCIENCE

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COMPONENT 1

General Comments

Most candidates were well prepared and demonstrated an expected standard of knowledge and application required for A2 given the candidates' distributed learning over the past two years. There was a wide range of answers with many candidates achieving higher marks in questions applying Boolean algebra and explaining various data structures. As mentioned, it is difficult to compare candidates' responses to previous years due to the disruption of learning caused by the pandemic. All questions were very well attempted by the candidates.

Comments on individual questions/sections

Q.1 Mean mark of 2.8 out of 8 with a facility factor of 34.8

Most candidates demonstrated a sound understanding of hash tables and array data structures. In part (a) candidates responded with very good responses which included full explanations of what happens when collisions occur. In part (a) marks were often lost as candidates did not provide a suitable example or did not state that a hash table uses a key/value pair. Part (b) was very well answered by candidates although at times candidates did not fully explain the benefits of using a one-dimensional array e.g. ease of searching and sorting.

Q.2 Mean mark of 5.2 out of 10 with a facility factor of 52.1

The Boolean algebra questions were well answered, and many candidates simplified their expressions to their simplest form using a variety of methods. Candidates are reminded that they should check their answers methodically and be able to apply negation beyond double negation. Some candidates correctly applied many Boolean algebraic identities although arrived at the incorrect answer due to a single misapplication at an earlier stage.

Q.3 Mean mark of 4.6 out of 11 with a facility factor of 41.9

The question required candidates to evaluate an algorithm using Big O notation. The question proved to be challenging for some candidates with a lower mean than what was expected given the consistent format of this item and how frequently it has appeared in previous papers. In part (a) some candidates who were able to identify the algorithm as polymorphic / $O(n^2)$, went on to describe and evaluate the algorithm well. Part (c) was also well answered with most candidates drawing the correct growth rate. Centres are reminded to ensure candidates correctly entitle their sketched graphs. In part (c), most candidates were able to correctly determine the correct growth rate. This could be because the correct response is like that seen in similar questions in previous papers.

Q.4 Mean mark of 1.3 out of 4 with a facility factor of 33.0

The question was well attempted and fairly answered by some candidates. Many candidates provided responses which were awarded quite low marks. In part (a) most candidates were able to be awarded marks for identifying the lifetime of the variable is within the function straightLine, only some responded with when the function ends the lifetime of the variable ends. In part (b) most candidates did not state how the variable cannot be accessed outside of the function straightLine.

Q.5 Mean mark of 2.6 out of 8 with a facility factor of 32.6

The question proved slightly more demanding for candidates with a lower accessibility rating than the majority of other items. Most candidates were awarded marks for their explanations of the Data Protection Act (2018) and the Computer Misuse Act (1990), fewer went on to fully explain the Investigatory Powers Act (2016). Many candidates provided responses which included non-awardable content such as the Copyright, Designs and Patents Act (1988) and GDPR.

Q.6 Mean mark of 5.0 out of 10 with a facility factor of 50.4

The question proved less demanding for many candidates with an acceptable accessibility rating. In parts (a) and (b) many candidates were able to fully identify the purposes of the DIV and MOD operators, fewer went to fully describe their functions, but many provided suitable examples.

In part (c) many candidates were able to dry run the algorithm and state how it was identifying and counting the number of odd numbers in the array. In parts (c) ii and iii many candidates were able to state the purpose of sequencing and selection although fewer went on to provide examples from the algorithm. Centres are reminded it is good practice to encourage candidates to provide examples where an item is asking for an explanation of a principle or concept.

Q.7 Mean mark of 3.4 out of 6 with a facility factor of 56.1

The question was well answered by most candidates, with many getting 3 - 4 marks. candidates are very familiar with BNF as it has appeared frequently in previous papers. Many candidates only were awarded 4 marks as failed to define a hexadecimal number only being able to include A – F and included all uppercase letters instead.

Q.8 Mean mark of 2.0 out of 8 with a facility factor of 25.6

The question was more inaccessible to candidates compared to other items, also with a much lower mean mark. The question asked candidates to explain the use of programme version management. Many candidates were awarded marks stating version management can be used to 'roll back' a system to a working state. Fewer candidates went on to fully explain the various features of version management and version management tools and their features. Many candidates went on to describe the use of versioning numbers i.e. V1.1, V1.2 etc for which no marks were awarded.

Q.9 Mean mark of 1.8 out of 6 with a facility factor of 29.4

This item was well answered by candidates with a high mean mark overall. The majority of candidates were able to fully explain the concepts of abstraction and decomposition. Centres should be commended on their delivery of this topic. Although many candidates offered examples of these concepts fewer went on to contextualise them to the given scenario for which marks would have been awarded. Centres are reminded to ensure candidates contextualise their responses to scenario-based questions.

Q.10 Mean mark of 4.2 out of 9 with a facility factor of 47.0

The question was well attempted and answered by most candidates. Many candidates demonstrated the full bubble search algorithm. Some candidates provided an algorithm which sorted in ascending instead of descending order. However, many candidates were still awarded marks for the other features of the sorting algorithm. Centres should be encouraged to utilise the algorithms provided in previous series' marking schemes as learning materials to prepare candidates.

Q.11 Mean mark of 2.6 out of 8 with a facility factor of 32.0

The question has a lower mean mark than was expected. Most candidates were able to define what was meant by natural language and offered an enriched discussion on the importance of avoiding ambiguity in computer language syntax. Many candidates confused natural language syntax with natural language interfaces where they went on to discuss dialects, accents, colloquialisms etc. for which they were awarded no marks.

Q.12 Mean mark of 3.5 out of 12 with a facility factor of 29.0

This question required candidates to describe and give examples of promoting professional behaviour given the social changes that have occurred as a result of developments in computing and computer use. Few candidates achieved high marks on this question. Most candidates were awarded marks for outlining their generic knowledge of social changes without relating them to professional behaviours in the computing industry. Centres are encouraged to ensure candidates can suitably structure a response to extended answer questions using in-depth knowledge, technical terminology and supporting real-world examples.

Summary of key points

Candidates should be encouraged to include more technical terminology when answering knowledge-focused questions such as the question on promoting professional behaviour. Centres should also encourage a deeper understanding of topics such as computer security legislation and ensure candidates fully read and comprehend the context of the questions when applying their knowledge.

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COMPONENT 2

General Comments

The examinations were completed following advance notice of areas of specification content suggested as key areas of focus for revision and final preparation. The notice identified six key areas of content and confirmed that content not identified could still be assessed in low tariff and synoptic questions.

Many candidates were well prepared and demonstrated a wide knowledge of the topics in the specification. As in previous series good responses were seen for questions requiring precise answers to programming or mathematical problems, whereas in descriptive questions, candidates sometimes provided answers which were correct in general terms but lacked sufficient detail to gain high marks.

Comments on individual questions/sections

- Q.1 Data types and associated storage requirements. This question was intended to provide an accessible start to the paper and most candidates demonstrated a clear understanding of Boolean data. Several candidates found the required description of the storage requirements of a fixed length string to be more challenging.
- Q.2 Floating point representation. Most candidates produced accurate calculations, although part (d) was found to be more challenging where several candidates were not able to illustrate their description of underflow with an accurate example.
- Q.3 Methods of file access. This question was well answered by candidates familiar with the methods of file access identified in the specification. Candidates less familiar with the specification content put forward responses based on access levels and permissions.
- Q.4 Relational databases, advantages and design. The database designs were generally well done, and most candidates gained high marks for this question. To avoid any confusion, it is suggested that candidates should confirm the convention they have used to indicate foreign keys.
- Q.5 SQL commands. A familiar and accessible topic. Most candidates were able to form well-structured and accurate commands using precise syntax as required.
- Q.6 Open source and utility software. Most candidates based their response for open source software on reliability and the potential for customisation and many were able to identify suitable examples of file management utilities, although anti-virus software was a frequent suggestion.
- Q.7 Assembly language programming. A familiar topic where most candidates were able to program a logical sequence using the instruction set provided, although the DAT statements were a frequent omission.

- Q.8 Primary functions of a search engine. This topic introduced to cover an area of the specification not previously tested in any detail and most candidates were able to gain some marks based on their own experience and background knowledge of search engine functionality.
- Q.9 Operating system and character sets. In general, the responses for part (a) on the roles of the kernel would have benefitted from more technical responses which referred to roles other than providing the hardware / software interface, which was given in the question. For part (b) many candidates compared ASCII and Unicode character sets and correctly identified the benefits that the more extensive system would offer the scenario business.
- Q.10 Networking standards and BYOD policy risks. Part (a) on standards was generally well done, but responses to part (b) tended to be limited to malware infiltration and often did not provide the scope required for more than two marks.
- Q.11 System upgrade (64 bit, multi-core, increased memory). As for previous questions the responses would have benefitted from more technical content based on memory utilisation and multitasking within the given context of a system used for CAD.
- Q.12 Computer system disasters and contingency planning. This question was band marked with five main areas identified in the indicative content of the mark scheme. Most candidates were able to describe data back-up procedures, but few extended their responses to cover areas such as loss of system components, software replacement or restore strategies.

Summary of key points

Programming, calculation and database questions were generally well answered. In descriptive questions, candidates should concentrate on the technical aspects of the topic and include appropriate examples to illustrate the points being made.

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COMPONENT 3

General Comments

Administration

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 which aided the moderation process.

This specification requires work to be uploaded. In addition, 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 found that solutions included absolute rather than relative pathways to files that prevented the solutions from functioning correctly.

It would aid the moderation process if centres would ensure that candidates' work and documentation are saved with filenames that clearly identify the centre number, candidate number and candidate name. As detailed in the specification for this qualification, "For example Diane Smith (centre number 69999, candidate number 12345) would store her work in a folder named 69999_12345_SM_D. In addition, candidates should ensure that they have linked their work to the GCE Computer Science Component 3 Task sheet (U3e).

It is an essential requirement that all candidate work is authenticated, and the authentication sheets are uploaded with the candidates' work. In the recent series much time was spent by moderators and WJEC officers contacting centres to request the missing paperwork.

The Joint Council for Qualifications (JCQ) document "Instructions for conducting nonexamination assessments" states that:

"All candidates must sign a declaration to confirm that the work they submit for final assessment is their own unaided work. Teachers must sign a declaration of authentication after the work has been completed confirming that:

- the work is solely that of the candidate concerned;
- the work was completed under the required conditions;
- signed candidate declarations are kept on file."

It should also be noted that any additional candidates' work and/or paperwork requested by moderators should be provided in a timely manner.

Candidates' work

The following information is provided to help centres guide candidates through the NEA in future. There was evidence of some confusion regarding the following sections of the project work.

In general, many centres do not appear to have recognised the importance of the discussion section for the identification of suitably substantive problem situations. This is a good opportunity for teachers to steer candidates away from unsuitable ideas that will lack the scope required to produce work to a standard and level appropriate for this qualification.

The investigation gives candidates the opportunity to explore the problem they have identified, while covid restrictions made this difficult some candidates used diverse methods to collect information and fully analysed the flows of data in the current system.

During design work candidates should identify the objectives for their problem solutions. These objectives should inform all sections of the candidates' work from this point onwards. 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

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. In some cases candidates provided evidence of programmed solutions to their feedback, it is essential this is a change to the original design.

In some cases, candidates produced final solutions that were over reliant on application packages such as relational databases and spreadsheets. This qualification does not allow the use of such applications other than as a vehicle for storage of files. Candidates should avoid making use of any of the facilities built into the application. All validation of data and sorts/searches of sets of data must be implemented through the creation of original code.

Centres should ensure that where candidates' solutions require the use of usernames and passwords that this information is included on the candidates' mark sheets or in a 'readme' document stored with the functional solution. It is essential that moderators are able to run the candidates' solutions to fairly assess the appropriate marks for the work.

Comments on individual questions/sections

Most candidates had chosen suitable problem situations as a basis for their project work. These problem situations would provide them with enough scope to produce a fully working system at an appropriate level for this qualification although this was not always fully exploited. 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 a level appropriate for this qualification.

The specification has been designed to provide two opportunities for feedback from teachers, competent third parties and peers that should have encouraged these candidates to refine or change their choice of problem as they will not be able to access the full range of marks.

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 that centres recognise the importance of the discussion section. This section provides opportunities for the candidates to present their problem situations to their teacher, peers and/or other competent third parties. Candidates should receive detailed informed feedback regarding the scope of their chosen problem and should reflect, in depth, on the discussions and feedback to allow them to firm up their ideas and ensure that unsuitable topics are revised or discarded. In many cases candidates report feedback but don't include their reflections on the feedback or a justification of their decisions to accept or reject specific feedback. The preparation of the materials for the presentation/discussion provides opportunities for the candidates to reflect on their ideas and the problem situation. If necessary, candidates can reframe their problem or even identify a different, more appropriate problem.

Investigation

Where candidates had chosen suitable real-life problems, they have the opportunity to carry out an investigation into 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.

All candidates are required to carry out desk-based research into similar commercial solutions created to solve similar problems. This research is an important part of the project as it should inform the design process. In addition, it is essential to note that the final section of the NEA requires candidates to evaluate their final solutions against the commercial systems. This is intended to provide candidates with informed ideas for further development of their systems.

Where candidates are not able to identify a real-life problem, they should carry out extended research into similar commercial systems, identifying common characteristics and should base the conclusions of their investigations on the information that they have been able to gather.

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

Prototype

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

Candidates should not include features such as logon facilities and validation that will complicate the prototype development and 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 in this section of the work.

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. This feedback should come from competent third parties and not from end users who are likely to lack the technical knowledge to give the constructive advice required to refine the work to date. 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 has 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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