# GCE EXAMINERS' REPORTS

## GCE
## COMPUTER SCIENCE
## AS/Advanced

## SUMMER 2023

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**UNIT 1**

## General Comments

The mean total for Unit 1 this series was approximately 49 out of 100 marks. This represents an increase when compared with the mean total of 42 out of 100 in 2022. Candidates were given access to advanced information prior to sitting this unit.

The effect of the pandemic remains evident in candidates' literacy skills and their use of technical terminology, but less so than in 2022.

## Comments on individual questions/sections

Q.1 Around half of candidates were able to complete the given table on data types. These candidates were also able to describe how character sets are used in a computer system.

Q.2 The majority of candidates were able to describe how a quad-core processor would process the given calculation. Many were able to state the name given to this method of processing data. A minority were able to state the purpose of four components in a CPU, with some only being able to state the purpose of two components or less.

Q.3 This was the third worst answered question of the paper, with a significant number of candidates leaving the question unattempted (12%). Only a minority of candidates were able to demonstrate how the state of the most significant bit can be determined using a logical operation. A number of candidates seemed unfamiliar with the term 'most significant bit'

Q.4 Around half of candidates were able to explain how performance is affected by data fragmentation. These candidates were also able to describe how the effect of fragmentation can be reduced on a HDD.

Q.5 Many candidates were able to state what is meant by the term handshaking. Only a few were able to explain the importance of having networking standards. Many candidates were able to name two standard networking protocols and describe their function, but fewer candidates were able to describe their importance.

Q.6 This was the second best answered question of the paper. Most candidates were able to describe simplex, half duplex and full duplex data transmission methods and the majority were able to give an example use for each.

Q.7 This was the third best answered question of the paper, which was very pleasing. The question required candidates to write an algorithm using pseudo-code, which would allow a user to enter the radius to calculate the area and circumference of a circle. Where candidates lost a mark, it was due to the algorithm not validating the radius input correctly.

Q.8 Around half of candidates were able to simplify the given Boolean expression. Many candidates incorrectly simplified the $Q.(\overline{P}.P)$ aspect of the expression to $Q.\overline{P} + Q.P$. This resulted in 0 marks being awarded. For other candidates who did not make this mistake, they often attained full marks.

Q.9 This was the best answered question of the paper. Many candidates were able to write down the order in which each number will be accessed when performing linear and binary searches on `myArray`. Most candidates were able to give one advantage and one disadvantage of a binary search over a linear search.

Q.10 A significant number of candidates left this question unattempted (11%). Around half of candidates were able to describe the principles of data compression algorithms. Most were able to name lossy and lossless compression types but lacked depth in their understanding beyond naming them.

Q.11 Many candidates were able to describe the term data structure and why data structures are used in computing. Around half were able to give examples from the table when describing a field, record and primary key. Only a very few candidates were able to describe a field and record.

Q.12 This was the worst answered question of the paper, with a significant number of candidates leaving the question unattempted (12%). It is the first time that this topic has been assessed in this specification and only a few candidates were able to describe sequential files and how records are added to them.

Q.13 This is the second worst answered question of the paper. Only a minority of candidates were able to describe one type of maintenance performed on a computer program. Common incorrect answers seen were related to alpha, beta and acceptance testing.

Q.14 Many candidates were able to calculate the denary range of numbers that can be stored by the first method. Only a few candidates were able to calculate the denary range of numbers that can be stored by the second and third methods. A majority of candidates were able to compare the advantages of representing numbers in integer and floating point forms.

**Summary of key points**

Candidates had a reasonably good understanding of data transmission, writing an algorithm and searching algorithms. They performed best in these questions.

Candidates found the questions on masking, sequential file storage and system maintenance difficult. This was reflected in the low facility factor for these questions.

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**UNIT 2**

## General Comments

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

Most of the candidates demonstrated a good understanding of the specification. 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 class/form setup code was surprisingly disappointing.

It has been requested by examiners that candidates write their name and candidate number in the answer document. Possibly in the header. It would also possibly help examiners if the candidate noted which language they intend to use as they often submit all three languages and not just the one they have attempted. Or only upload the language they have attempted. It would also be suggested to centres that they MUST follow the folder naming convention in the specification. Many thanks to the vast majority of centres who do this already.

## Comments on individual questions/sections

Q.1 (a) This was well answered by most candidates, however, some candidates could not identify foreign keys.

(b) Many good answers were seen although some candidates did not select appropriate validation methods for different fields.

Q.2 This question was generally well answered. A majority of candidates used applied it to the scenario at times to gain the AO2 marks available.

Q.3 This was considered originally to be a more demanding question, requiring candidates to apply data security and integrity knowledge to the scenario.

Q.4 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:

Q.1 This question was deemed to be slightly less accessible when set, with the candidates required to fix broken code, this was done well by most candidates.

Q.2 This question was generally well answered. Many candidates showed detailed annotation of the code.

Q.3 Generally, this was not always 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.

**Summary of key points**

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

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**UNIT 3**

## General Comments

| All Candidates performance across questions | | | | | | |
|---|---|---|---|---|---|---|
| Question Title | N | Mean | S D | Max Mark | F F | Attempt % |
| 1 | 652 | 3.6 | 1.6 | 8 | 44.9 | 99.7 |
| 2 | 621 | 3.0 | 1.9 | 8 | 37.6 | 95.0 |
| 3 | 604 | 0.4 | 1.1 | 4 | 10.4 | 92.3 |
| 4 | 636 | 5.9 | 3.3 | 10 | 59.5 | 97.3 |
| 5 | 531 | 2.1 | 2.0 | 8 | 26.6 | 81.2 |
| 6 | 647 | 1.9 | 1.2 | 4 | 46.4 | 98.9 |
| 7 | 639 | 4.9 | 3.2 | 10 | 49.0 | 97.7 |
| 8 | 613 | 2.9 | 2.0 | 9 | 32.2 | 93.7 |
| 9 | 582 | 2.8 | 1.7 | 5 | 55.7 | 89.0 |
| 10 | 621 | 2.1 | 1.4 | 4 | 52.8 | 95.0 |
| 11 | 627 | 3.9 | 2.2 | 8 | 48.3 | 95.9 |
| 12 | 574 | 2.6 | 2.2 | 9 | 28.7 | 87.8 |
| 13 | 614 | 4.3 | 3.1 | 13 | 33.1 | 93.9 |

The majority of candidates were well-prepared and demonstrated the expected standard of knowledge and technical skills required for A2. There was a wide range of responses, and the overall standard was comparable to that of Summer 2022. Some candidates achieved high marks in technical questions, including BNF and Boolean algebra.

## Comments on individual questions/sections

Q.1 A mean mark of 3.6 out of 8 with a facility factor of 44.9

Candidates demonstrated a thorough understanding of hash tables. The accessibility of the item was <50% even though similar style questions have appeared on every past paper. It is evident that many candidates fully utilised past papers and marking schemes in their learning, and centres should continue to encourage this to ensure candidates are aware of how to approach different examination question styles.

Q.2 A mean mark of 3.0 out of 8 with a facility factor of 37.6

The question was well attempted and answered by most candidates. Many candidates demonstrated a sound understanding and knowledge of programming paradigms. Most candidates were able to identify and explain the key features of both object-orientated and procedural programming. Some candidates were not able to offer a suitable example for each paradigm, with many stating the IDE 'Greenfoot' as an example of the object-orientated paradigm, in place of the actual programming language it uses, Java.

Q.3 A mean mark of 0.5 out of 4 with a facility factor of 10.4

The question was significantly inaccessible to candidates, with many candidates receiving low to zero marks. The question asked candidates to express a truth table as a Boolean expression. This question style has not been asked for this particular specification, which could be indicative of the significantly low facility rating. Many candidates were able to achieve marks from their responses to Boolean algebra and truth table questions but were unable to apply that knowledge and skills in the context of this item and style of questioning. Centres are encouraged not only to utilise the past papers in their teaching and learning but to explore other question styles to deepen the knowledge of candidates and enable them to apply their skills and knowledge in a wider range of contexts.

Q.4 A mean mark of 5.9 out of 10 with a facility factor of 59.5

As in the previous series, the Boolean algebra questions were very well attempted and answered, with many candidates simplifying their expressions to their simplest forms using various methods successfully. Some candidates correctly applied many Boolean algebraic identities though they arrived at incorrect answers due to misapplication at earlier stages.

Q.5 A mean mark of 2.1 out of 8 with a facility factor of 26.6

The question proved demanding for many candidates as it required them to write a quicksort algorithm. Some candidates were able to achieve marks in declaring variables and utilising a loop, but many of the marks were not able to be awarded to the responses provided by candidates. Centres are encouraged to utilise the algorithms provided in previous series' marking schemes as learning materials to prepare candidates for this type of question in future.

Q.6 A mean mark of 1.9 out of 4 with a facility factor of 46.4

The question proved demanding for many candidates with a lower accessibility rating than the average item on the paper. Many candidates fully demonstrated their knowledge of verification and validation and provided suitable methods. Some candidates did confuse verification with authentication, which should be addressed in some centres.

Q.7 A mean mark of 4.9 out of 10 with a facility factor of 49.0

The question was well answered by the majority of candidates, with many getting 5 - 6 marks. Many candidates were able to fully describe the various methods of binary tree traversal and offered suitable generic examples i.e., copying a tree, deleting a tree etc all of which were awarded marks. The significant majority of candidates were able to draw a balanced binary tree. Given this was the first time this topic has been assessed on this specification, the context was kept generic enough for it to be accessible to candidates, and the item was well answered and received by most centres.

Q.8 A mean mark of 2.9 out of 9 with a facility factor of 55.7

The question was fairly well answered and accessible to the significant majority of candidates. The question required candidates to describe various software tools. Many candidates were able to identify and describe the features of an IDE, although fewer were able to identify and describe software tools used in analysis and planning, with many candidates discussing interviews and observation techniques. There were a significant number of centres that achieved high marks in the identification and description of version control including e.g., the use and features of Git and GitHub.

Q.9 A mean mark of 2.8 out of 5 with a facility factor of 55.7

Typically, 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 lost marks as they failed to include the special characters in the password definition or missed the recursion in the definitions.

Q.10 A mean mark of 2.1 out of 4 with a facility factor of 52.8

This question on translation and execution errors was well answered by most candidates. Most candidates clearly demonstrated their knowledge on this topic, offering suitable examples and descriptions such as runtime errors, syntax errors etc. Candidates that scored highly on this question, seemed to do so on a centre-by-centre basis.

Q.11 A mean mark of 3.9 out of 8 with a facility factor of 48.3

The question required candidates to describe the difference between compilers and interpreters. The question was well answered by most candidates and centres. Although candidates demonstrated their knowledge, centres should work with students on structuring a response to a question based on the command verb and taking into account the number of marks for the item on offer.

Q.12 A mean mark of 2.6 out of 9 with a facility factor of 28.7

This question required candidates to evaluate a basic algorithm using Big O notation. As in the previous series, the question proved to be challenging for candidates with the average mark being 2.6/9. The format of this item has appeared frequently in previous papers, although what seems to be a pattern is candidates not breaking down and tackling the problem in the correct way. Many candidates just give a response of $O(n^2)$ for the time complexity and O(1) for the space complexity which is likely a rote response to the question as this has frequently been the correct answer in past papers. Candidates needed to fully decompose the problem and evidence each step to achieve higher marks.

Q.13 A mean mark of 4.3 out of 13 with a facility factor of 33.1

This question required candidates to discuss contemporary approaches to human-computer interaction (HCI). Many candidates were awarded marks for providing generic knowledge of touchscreen devices, natural language interfaces and VR and AR. However, for higher marks, candidates needed to apply this knowledge to the context of the question and discuss how the use of these interfaces improves the user experience. This was not done effectively by many candidates and as such they were not awarded the full range of marks. Centres should work with candidates on contextualising their knowledge and understanding of this topic, and appropriately planning and structuring extended responses to discussion questions.

**Summary of key points**

As in previous years, candidates should be encouraged to include more technical terminology when answering knowledge-focused questions, such as those concerning human-computer interaction (HCI) and in particular the quicksort algorithm. Candidates should ensure that their handwriting is fully legible; if this cannot be achieved, they should explore suitable alternative methods, such as word processing in the examination, where appropriate

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**UNIT 4**

## General Comments

The majority of candidates were well prepared and were able to demonstrate a wide knowledge of the topics in the specification, as required at A2 level. Questions requiring precise responses to programming or mathematical problems generally produced high marks, whereas questions requiring more descriptive answers often produced responses that were correct but lacked adequate reasoning or detail to gain high marks.

## Comments on individual questions/sections

Q.1 Voice input applications. Mean mark of 3.0 out of 6 with a facility factor of 49.9. This question was intended to provide an accessible start to the paper and most candidates identified suitable examples of at least two of the three applications. The reasons given for using voice input tended to concentrate on convenience and often did not differentiate between the given applications.

Q.2 Parallel processing. Mean mark of 1.9 out of 4 with a facility factor of 47.9. The majority of candidates were able to explain the relationship between the calculations that would prevent parallel processing. Candidates who analysed the scenario of part (b) and produced a simple calculation based on time and parallel % tended to produce a correct answer. Candidates who applied Amdahl's law tended to produce an accurate processing time but did not go on to identify the parallel running time as required by the question.

Q.3 Assembly language. Mean mark of 4.0 out of 6 with a facility factor of 67.5. This is a well taught and practised topic, and most candidates were able to translate the logic of the given algorithm into assembly code, using the instruction set provided.

Q.4 Batch and real time transaction processing. Mean mark of 3.3 out of 8 with a facility factor of 41.6. Batch processing proved to be a familiar and accessible topic, with many clear explanations given with relevant examples. Real time transaction processing also proved to be an accessible topic, although several candidates missed the implication of 'transaction' processing and therefore provided an inaccurate explanation and incorrect example.

Q.5 Floating point representation. Mean mark of 3.3 out of 6 with a facility factor of 55.5. An accessible and well-practised topic. Most candidates were able to describe the representation of negative numbers correctly, although many responses would have benefitted from clear examples that could have been used to clarify the descriptions. For part (b) most candidates converted the given floating point value correctly.

Q.6 Arithmetic shifts.
Mean mark of 0.8 out of 4 with a facility factor of 19.3. The question with the lowest facility factor. Candidates have confidently demonstrated arithmetic shifts in previous series, and it was surprising to note how difficult candidates found it to describe the process. Using an example as a basis for the description helped some candidates to structure their response.

Q.7 Direct and sequential file access. Mean mark of 2.6 out of 6 with a facility factor of 43.1. This question was answered well by candidates who were able to apply their knowledge of the methods of file access specified to the given context. When responding to questions of this type candidates should avoid stating disadvantages that are simple opposites of identified advantages, without further explanation.

Q.8 Process states. Mean mark of 2.0 out of 6 with a facility factor of 33.7. Candidates could gain half marks by stating the three basic states, but many candidates concentrated on multi-tasking which is mentioned in the question and produced detailed descriptions of time slicing, without reference to process states.

Q.9 Automation and control systems. Mean mark of 4.4 out of 8 with a facility factor of 55.4. A familiar topic where most candidates were able to describe the benefits and drawbacks of automating a manufacturing process and, for part (b), to explain the purpose of a safety critical control system. Providing an explanation, with an example, of a safety related control system proved to be more challenging.

Q.10 SQL commands. Mean mark of 3.7 out of 7 with a facility factor of 53.2. This is another well taught and practised topic, and most candidates were able to produce the required commands correctly, although some candidates failed to distinguish between text and numeric fields (‘…’) as required.

Q.11 Databases. Mean mark of 3.5 out of 9 with a facility factor of 37.9. The descriptions of disadvantages of flat file databases tended to concentrate on redundancy and wasted storage with some candidates developing a response that covered problems connected with lack of consistency. For part (b) most candidates were familiar with the design work required and data tables tended to be reasonably well done, although the allocation of foreign keys caused several problems.

Q.12 Distributed systems. Mean mark of 2.7 out of 6 with a facility factor of 29.1. A relatively low facility factor with many candidates missing the geographical aspect of a distributed system. Advantages of the system for the business tended to concentrate on resilience in cases of hardware failure and tended not to cover advantages relating to performance and flexibility.

Q.13 Encryption. Mean mark of 4.2 out of 9 with a facility factor of 47.2. Most candidates demonstrated some understanding of public and private keys and correctly described advantages in terms of simplicity for single key and improved security for double key. Several candidates correctly encrypted the given word, although carrying out the encryption in alphabetical order was a common error.

Q.14 Wireless networks. Mean mark of 1.8 out of 6 with a facility factor of 30.3. Many candidates did not identify devices or protocols that are Wi-Fi specific, although most identified the security risks associated with public wireless networks.

Q.15 Effects of the internet. Mean mark of 3.2 out of 9 with a facility factor of 35.4. A large topic within the context of health issues and expert systems. The question was band marked with a range of points identified in the indicative content of the mark scheme. Most candidates were able to describe some benefits and drawbacks associated with the use of the internet for medical advice, but few covered effects on health professionals or specific advantages provided by expert systems.

**Summary of key points**

As in previous series programming, calculation and database questions were generally well answered. For descriptive questions candidates should concentrate on the technical aspects of the topic and include examples to illustrate and help structure their responses.

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**UNIT 5**

## 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. All candidate work was uploaded correctly as per the specification. In addition, candidates' functional solutions should also be included in the coursework submission. In too many instances, moderators found that solutions included absolute rather than relative pathways to files that prevented the solutions from functioning correctly. Centres should ensure that candidates' solutions are presented in a format that allows moderators to run the candidates' programs with ease. If this is not possible due to additional requirements of the system, evidence of a functioning system should be provided through thorough testing or video evidence of the system being used.

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 68999, candidate number 12345) would store her work in a folder named 68999_12345_SM_D. In addition, candidates should ensure that they have linked their work to the GCE Computer Science Unit 5 Task sheet (U5e). The centre should make note on the Centre Mark Sheet the nature of any assistance given and the extent to which the solution actually works as stated in the report there should also be specific reference to the assessment objectives in the comments written on the work and coversheets.

It is an essential requirement that all candidate work is authenticated, and the authentication sheets are uploaded with the candidates' work. There were some instances where this was not the case, which then required WJEC officers to contact centres to request 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.

## Comments on individual questions/sections

### 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.

Candidates often received limited or no response to their feedback in numerous instances. The process of preparing presentation/discussion materials offers candidates the chance to consider their ideas and the problem at hand. If needed, candidates have the option to reconsider their problem or potentially identify a different, more suitable problem situation.

### Investigation

When candidates selected appropriate real-life problems, they were presented with a chance to conduct an investigation into the existing system. Candidates were expected to identify the data collected, processed, and produced by the current system. Where this did not take place, the investigation tended to be more narrative and therefore the ability to identify suitable objectives could not take place. The investigation of the existing system should be thorough.

All candidates are required to carry out desk-based research into similar commercial solutions created to solve similar problems. In numerous cases, candidates are only looking at this in a superficial manner and not considering the importance of this area, which 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 them 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, software development and testing processes.

### Design

The design stage is an opportunity to effectively plan and develop the technical elements of the functional solution before its implementation. This should be forward-thinking and include a range of elements, including:

- designs of screen layouts
- consideration of all forms of inputs and outputs required
- evidence of all data structures with methods of access
- consideration of data validation
- design of programming routines for the functional solution using a recognised convention such as pseudocode or flowcharts.

Many centres included most elements of the design section, however, there were centres that did not effectively utilise this opportunity to thoroughly design the solution to the problem. Some design work lacked the technical content required by the specification with limited or no consideration of methods of access or detailed data validation. Candidates did not always present the processing stages of their proposed solution in pseudo code, flowcharts or another recognised convention and in some instances, this was displayed as code from a specific language. Some centres used screen shots of already developed code as a way of considering the processing stages. This section should be completed before the prototyping and software development stage and not retrospective.

**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 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.

**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.

**Software Development**
To access the higher mark bands all programs should fully exploit the language, using advanced programming features and well-structured data normalised to 3NF, this was not always evident.

There should be examples of effective searching and sorting at the programming end and output content as requested by the user. The system should aim to cover all the objectives identified and fully exploit the programming facilities of the language.

Many solutions had limited validation methods but did cover basic validations for some key components. It is a requirement of this section to provide evidence of the completed user interface with discussion of the features that make it fit for audience and purpose, however this was often lacking in the software development section.

Often the program contained some self-documenting identifiers, however this was not there for all variables and structures.

Many centres provided solutions that could not be run due to additional packages/libraries requirements, in this instance these should be provided or information on these additions provided in a ‘README’ file and the cover sheet. It may be of benefit to provide additional video evidence of the system being used to support this section. Where centres did this, the moderation process was made easier.

**Developmental Testing**
This section should focus on two areas to effectively meet the higher mark bands; comprehensive testing at each stage of the development and evidence of all problems encountered, fully justifying and evidencing the actions taken to overcome these problems. Some centres did not discuss or consider the second area, which is an essential part of developmental testing and an area that all candidates would have experienced during their development of the solution.

**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. Not all centres produced a test plan which considered typical, extreme and invalid data for testing.

**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. Many candidates showed strengths in some areas during the evaluation stage but did not cover all areas of the requirements.

**Summary of key points**

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. 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 that is relevant and redesign areas based on feedback
- fully develop the solution
- develop testing which covers each objective with a testing strategy
- 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. 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 can move the project forward rather than end users.

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 not make use of any of the facilities built into the application and 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 can run the candidates' solutions to fairly assess the appropriate marks for the work. In some instances, the only way to locate the username and passwords for the solution was to search through the testing section, making the moderation process harder.

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