COMPUTING ADVANCED LEVEL

Paper 8959/5216

Computer Systems, Communication and Software

General comments

The Examiners felt that the paper was similar in difficulty to previous sessions. This was supported by the candidates' results which were certainly as good as in previous sessions with, perhaps, a small reduction in poor scripts. Some of the candidates produce really good work and are to be congratulated, as always, in being able to produce such impressive efforts to a difficult set of questions, answered in what is often a second language and in the stressful environs of an exam room.

The evidence of the two different types of question, context based and non context based, providing very different degrees of difficulty to candidates was striking. The final question showed this very forcefully, most candidates being able to define the various utilities, but far fewer being able to relate their use to the copy editor.

The standard of presentation was very high, candidates showing a pride in their work which is very pleasing. The use of diagrams is becoming more prevalent which is encouraging. Centres should bear in mind that the examiners are looking for evidence, in whatever form, and candidates should be encouraged to use whatever form suits them best. The only exceptions are when the question specifies the form that the answer should take, although questions like this are comparatively rare.

The use of bulleted lists is becoming more prevalent. This is to be encouraged as long as the candidate shows a little discipline in writing their answer in this fashion. Where this ceases to be acceptable is when the list becomes a list of everything the candidate can possibly think of on the basis that if the candidate writes down enough, some of it stands a chance of being correct. This is a high level qualification and examiners do expect candidates to show a sense of discrimination in their responses. Examiners will, to a great extent, find the worthy responses but should not be expected to search through long lists.

There was no evidence of time trouble being suffered by candidates and little evidence of problems with language, save the ones listed in the comments on individual questions, below.

Comments on specific questions

Question 1

(a) This was a very good discriminator across all but the top of the mark range.

Most candidates could provide 3 methods of information collection (although a sizable proportion gave three stages of the life cycle) though far fewer could give an advantage of using the method. Presumably all candidates will be doing some information collection for real, quite soon when they start their project, hopefully, by then, they will be able to be a little bit more discerning about the various methods available to them than they are at the moment.

(b) Fewer were able to answer this part effectively. This is expected as this was meant to be a far harder question. It isn't really, because it is simply another section of the life cycle but examiners think candidates find this harder because this stage seems to come after the problem is solved. It is 'tacked on at the end' and is consequently less obvious to explain. The acceptable responses to this and all other questions on the paper are available in the published mark scheme which Centres are encouraged to consult.

Question 2

(a) Some good responses here. The only problem was caused by trying to relate it to the scenario, but plenty of detail was given so candidates did not seem to find this particularly troublesome.

(**b)** Candidates should not use the same words that are in the question to provide their answer. A typical answer here was that the records were in sequence. **(ii)** was poorly answered. The almost universal response was that having a sequential file made it easy to find a particular record and also to add a new record when a new worker arrived. Both of these are very good reasons for not using a sequential file.

(c) Well answered.

Question 3

(a) The question quite clearly instructed the candidates to "Write down the outputs…" Many candidates were penalised for writing down 'C = 4' or some other variant along those lines. This algorithm style question needs to be answered quite specifically. The exercise is a test in whether the candidate can read a set of instructions clearly and the examiner is, as much, looking out for a failure to follow instructions in the algorithm as they are looking for evidence of finding a correct response.

(b) Again, this is an algorithm. The question was quite generous in not expecting a specific method for describing the algorithm, but it did need to be well presented and academically rigorous to gain the marks. The most disappointing feature of the responses was the very poor nature of the loops used (if at all). The candidates have, presumably, been using these constructs in their paper 2 work during the course of the year and it is surprising to see so few candidates able to translate the knowledge across from one paper to another.

Question 4

(**a)** Well answered.

(b) The question asked for the factors that should be considered by the analyst. While the majority of candidates answered well, a sizable minority gave the standard design that they would produce. The candidate may have responded that they would make the language easy to understand, while the response that was expected was that the analyst would have to consider the ability of the users in the control room when deciding what sort of language to use.

Question 5

(a) Well answered, though you had to feel sorry for the occasional candidate who got the first one wrong and then had to try to make the others fit!

(b) Very much Centre based. The majority of candidates picked up 5 or 6 marks, the only problem being the need to think of the priority of the interrupt and that it is not automatically dealt with. There were a number of cases where the candidates had learned a generic set of stages in this process and these stages were presented as their answer with no justification in the area of the problem at all. There were others who lost marks because they talked about sending data to a printer rather than the hard drive.

(c) Well answered by those who had picked up the marks in part **(b)**, because they obviously understood the situation. However, for many others it was a lottery for the two marks, with little offered as justifications.

Question 6

(a) Surprisingly few sensible responses which could be given two marks each. The clues were all there in the question and the responses seem to point to a need to do some work with candidates about trying to pick out the important details in the stems of questions.

(b) Well answered.

(c) A very good discriminator. Many picked up the full 4 marks in confident fashion. Many others were rather reticent with their justifications while many others ignored the part of the question which said '…to allow this communication' and simply said a keyboard and a word processor or equally inappropriate pieces of hardware and software.

Question 7

(a) Some very good responses, though a common answer is that a message sent by circuit switching does not need to be reassembled at the destination. This is not true as messages will be sent in packets anyway so they will need to be reassembled, the point is that they will be in the correct order, so they do not need to be reordered which is true of packet switched messages.

(b) The ASCII explanation was generally fine, though the explanations of checksum and parity were generally less well done. This is a perennial problem, one where the use of language causes a stumbling block to many candidates. Examiners do try to understand the meaning in responses that a candidate is trying to convey, but if the response is wrong the examiner can do nothing. A typical response for the checksum was that all the bits were added up. Faced with this an examiner will think that they know what the candidate was meaning to say, unfortunately what they did say was understandable and wrong. There were a large number of candidates who described a check digit calculation instead of a checksum.

Question 8

Well answered. These were intended to be simple marks which would reward weaker candidates at this end of the paper, and so it proved.

Question 9

This question proved to be an excellent discriminator across the whole attainment range.

The first problem was understanding that these were pieces of software, not hardware. The big problem here was **(iii)** which many candidates interpreted without the 'r' and so thought they were storage devices. The second problem was interpreting **(i)** and **(ii)** as user software so the answer was aimed at correcting and editing the content of a book. The final problem which was only satisfactorily solved by more able candidates was explaining how or why the copy editor would use the software. In **(iv)** most candidates explained what compression software did (though many said ' it compresses a file') few were able to say something sensible like '… the copy editor would compress files before sending them as attachments to emails in order to speed up the process'.

COMPUTING

Paper 5215
Practical
Programming Project

General Comments

It was good to see so many short, high quality pieces of work, the vast majority of which were accurately marked.

Many candidates had chosen fairly straightforward ideas. So long as there is a need to define a file with a variety of fields, and manipulate that file to some end, candidates can use the programming skills that this paper asks for. Many Centres had got their candidates to list examples and reference where these skills had been used. This made marking the project simpler for the teacher and the Moderators. It also acted as a check list for the candidates.

The good projects were usually about 30 -35 pages long. They had detailed design of their program, along with detailed annotation within the code listing that taken together enabled anyone else to clearly see what the program did, how it was constructed and how it could be maintained. The testing produced a table of expected results to show that the program worked, along with the hard copy evidence, and then sufficient detail to enable a user to implement the program.

The main features of projects that were not highly marked were:

Producing projects that had elements of a system problem. There is no expectation or need in this paper to have an end user, an investigation, evaluation, and user letters.

Producing projects where some of the code was written using wizards or autocode facilities. Such code will not have been written by the candidate.

Writing code without annotation. The Moderators often see pages of well written code, but have no idea what it might do. It needs annotating so that the code can be related to the design, and so that any other person who wants to understand the code can do so without being an expert in the language used. Some candidates wrote a comment at the top of some blocks of code, but good annotation need to be a comment after most lines of code.

Limited testing. It was common to just test a few different items of data being entered to see if the validation methods work. This does not show that the whole program works.

These aspects were also the ones that teachers had the main difficulties over the allocation of marks.

Overall the quality of the work had gone up from the June 2006, and the Moderators enjoyed seeing so many well programmed, well documented projects.

COMPUTING ADVANCED LEVEL

Paper 8959/5218
Further Systems and Software

General comments

The examining team were agreed that this paper was no more difficult than in previous sessions, although some of the questions caused problems because they allowed candidates to think they could answer in a manner which was appropriate to paper 1 but not to this, more advanced, part of the syllabus. Examples of these questions and the errors made by candidates are outlined in detail below.

There was plenty of scope for able candidates to demonstrate their ability and it is good to be able to report that there are a number of candidates in this category whose papers are a joy to mark. Too many candidates, however, are not ready for this paper, either because of their knowledge or because of their maturity and the way that they attempt to answer the questions. It is not the intention of the assessment to highlight candidates who are unable to score marks in double figures though this happens. Candidates in this position really should not be made to endure the examination room. The experience must be terribly demoralising for them and one would hope that they could be identified and saved from the humiliation as nothing can be achieved.

The standard of presentation continues to impress. There were few candidates whose responses were difficult to decipher and the examiners do everything they can to understand the points that such candidates are making. It was good to see so many candidates answering in bulleted form, however, it should be mentioned that encouragement to answer in this way is not a licence for single word responses or communicating in some code which does not recognise the need for verbs. The use of bullets is invaluable to many candidates in order to help them arrange their thoughts in a coherent manner, not so that they can ignore the need to communicate in English. The examiner does not penalise such answers but the answers penalise themselves because they so often become ambiguous. For example in **Question 3 (ii)** "-One department is made to use the new system" is certainly worth a mark. "-One part uses new system" is ambiguous because it could equally apply to a phased introduction.

There was some indication of time trouble for a minority of candidates. These candidates were the ones who wrote very long prose style answers to questions. This is the other extreme to those who are cutting the responses so much that they become ambiguous. Both sets of candidates penalised themselves, in different ways. The happy medium lies somewhere in the middle and it is not suggested that a particular method for answering either fits all candidates or all questions, but it should be part of the examination preparation to learn and practice a suitable answering technique.

There were plenty of diagrams, particularly in **Question 10**. These should be encouraged. Candidates are advised to use any method with which they are comfortable in order to express themselves, the examiners will always credit knowledge, however expressed, as long as the meaning is understandable.

Comments on specific questions

Question 1

(a) The first three parts were very accessible to candidates. Indeed this was simply an alternative way to ask the fetch execute cycle. It was unfortunate that so many candidates wasted their time in describing the fetch execute cycle which did not answer the question, but happily most went on to then answer the question as set, having wasted a considerable amount of time. Again, examination technique was shown to be poor on many occasions. These first three parts could be a good test of a candidate's readiness to take the examination, as a failure to understand these shows a distinct failure to understand the basic bookwork necessary for this module. Part **(iv)**, however, was a little different, it fitted here because it is a register of the computer but was outside

the normal fetch execute cycle, and it showed with very few candidates picking up the 2 marks available.

(b) Some evidence of being able to suggest that parallel processing used more than one processor, but little else. The majority gave the stock answer that parallel meant having more than one wire to send data down and then decided that the application was either a bank or a supermarket, very un A2 responses.

Question 2

Good answers, but then, most have had experience of actually using these concepts in the project work, so were able to relate those experiences here. The one exception tended to be the secondary key. The acceptable response to this and all other questions on the paper are available in the published mark scheme.

Question 3

This question, once again, caused great problems to almost all candidates. This question is very similar to a question which might appear on paper 1. The difference is in the fact that the question starts with an application and then finishes with the words '…consider the effects of each method in this application. 'The three methods stated in the question were worth three marks each, the vast majority of candidates made sure that their maximum mark was three for the whole question because the response was totally generic and not related. "Parallel implementation is costly. "is not worth a mark whereas "…but it is worth it because the results are so important to candidates" is.

A number of candidates were unable to go further than saying that Pilot is when part of the system is upgraded. This does not make a distinction with phased because the word 'system' is ambiguous as it could refer to the computer or business system.

Question 4

Many candidates wrote long explanations of compilation, again wasting their time and showing a poor technique. Some forgot to mention the final stages having dealt with the lexical and syntactic stages, which gained no marks. It was encouraging to see such a high proportion of candidates producing well presented and accurate responses about linkers and loaded.

Question 5

(a) Most candidates scored well here, although, surprisingly, BCD caused many problems, unfortunately in some cases the candidate used up hexadecimal here and then had no sensible answer for **(iii)**.

(b) Very few candidates understood the significance of the MSB, the most common answer being 210.

The addition was done quite well with most candidates losing the carry but not knowing the significance of the carry in = carry out. The almost universal conclusion was that because there had been a carry out the answer must be wrong.

Question 6

The word 'other' in the question was even written in bold, yet the majority of candidates chose to ignore this and wrote about working from home. This changed the question into the classic paper 1 type question and earned them no marks. Others seemed to take their inspiration from the question paper and wrote about anything from working for an examination board to (very popular) using robots on Mars. The question is almost straight from the syllabus and was about none of these things, it was about the ways in which the use of computers change patterns of work. Centres are strongly advised to look at the published mark scheme for this question.

Question 7

Most candidates scored a mark in part **(a)** for the idea of a web page and then went on to score 3 marks in part **(b)** for three features, though describing how to implement them, or a detail about what they are proved more difficult. There were a number of Centres whose candidates showed no indication of understanding the concept of html at all. Centres should be very careful about picking and choosing from the syllabus content, it can be very dangerous.

Question 8

(a) This was intended as a safe 4 marks for the majority of candidates. Very few candidates were able to suggest 4 sensible input and output devices for a robot. Most candidates simply said 'Sensors' without any qualification, many of them giving this as an example of an output device. Other common devices were wheels, keyboards, mice and monitors. These answers are simply not good enough from candidates at this level.

(b) Most candidates simply ignored the fact that this robot was to work on Mars, many going in to detailed explanations of programming maps into its processor memory. There were a few good answers but only from the more able candidates, at whom this question was aimed.

(c) The majority simply gave an explanation of real time and batch processing. Those who went any further generally failed to identify which of the two robots they were writing about.

Question 9

Again, the majority of responses were very firmly based in the 'paper 1' mode of thought, simply regurgitating the question and saying that the jobs were put in queues according to priorities. It was only the stronger candidates that managed to explain the scheduling process.

Question 10

(a) Too many candidates failed to score because they simply wrote about the definitions and did not answer the question as asked. However, many did score well, though few were able to say anything sensible about a function.

(b) Some candidates will persist in saying that a local variable is "…used in a LAN", while a global variable is "…used in a WAN". Thankfully, only a few said that global variables were used all over the world. Many candidates scored full marks here with well stated definitions.

(c) Most candidates were unable to answer this sensibly. Some were able to define a stack (one memorable script using three pages showing diagrams of data going in and out of a stack, though to what end is somewhat dubious) while a few gave comprehensive responses and fully deserved the marks.

COMPUTING ADVANCED LEVEL

Paper 8959/5219
Programming Project

General comments

This report provides general feedback on the overall quality of project work for the Diploma in Computing candidates. In addition, all Centres receive specific feedback from their Moderator in the form of a short report that is returned after moderation. This reporting provides an ongoing dialogue with Centres giving valuable pointers to the perceived strengths and weaknesses of the projects moderated.

Centres are again reminded that the programming project must involve the use of an object-oriented programming language and may also involve the choosing and installing of hardware. Centres are also reminded that candidates need to identify opportunities to develop and deploy a limited set (5-6) of library elements in their solution. Also the project work is designed to test the understanding of the systems life cycle, these requirements are clearly set out in the syllabus. The guidance on marking projects on pages 32 to 40 can also act as a useful checklist setting out the expected contents of each section.

The selection of an appropriate problem by the candidate is extremely important, as the analysis, design and implementation of a computerised system should always involve consultation with a user, ideally a 'third party' user throughout the development of the system.

Project Reports and Presentation

The presentation of most of the reports was to a very high standard, with reports word-processed and properly bound. However, the use of proofreading and a spell checker is to be recommended.

It is recommended that the structure of the report follows that of the mark scheme, this gives a clear outline as to contents for the candidates to consider and also aids the assessment by teachers and moderation of the work.

The use and development of library elements, set out in the separate sections required in the report, is essential to the object-oriented approach required for this component. Unfortunately, this session only two Centres had ensured that their candidates had made good use of library elements and followed this approach.

Candidates can use library elements in different ways they can make use of pre-prepared libraries e.g. a library of date functions, they can identify new functions that the wish to use and either customise an existing library by adding new functions to it or set up a separate library of functions that is required for this particular system.

Project assessment and marking

Most assessment by Centres was too generous, particularly where there was no evidence of user involvement and no use library elements were evident in the candidate's report.

Centres should use the mark scheme set out in the syllabus and include a detailed breakdown of the marks awarded section by section together with a commentary as to why marks fit the criteria set out in the syllabus. This greatly aids the moderation of the projects allowing Moderators to identify why marks have been awarded.

The requirements are clearly set out on pages 42 to 51 of the syllabus in 'The Guidance on Marking the Computing Project' section. These requirements can also act as a useful checklist, for both teachers and candidates, setting out the expected contents of each section.

Centres are also reminded that candidates should use this guidance for the expected contents of their reports rather than some of the popular 'A' Level textbooks available for project work, which do not cover the full requirements of the CIE Syllabus.

Comments on Individual Sections

The comments set out below identify areas where candidates' work is to be praised or areas of concern and are not a guide to the required contents of each section.

(a) Definition, Investigation and Analysis

(i) Definition–nature of the problem

Most candidates described the organisation and some described the methods used but only the better candidates identified the origins and form of the data. Centres are reminded that a detailed description of the organisation covering many pages is not required here, just a short paragraph covering the appropriate areas.

(ii) Investigation and Analysis

Candidates should clearly document user involvement and agreed outcomes. Better candidates clearly showed evidence of observation, interviews and investigation of documents currently in use. A detailed requirements specification based on the results of the candidate's investigation should be produced.

Also alternative approaches need to be discussed in depth and applied to the candidate's proposed system in order to obtain high marks.

(b) Design of the Library Elements

This section was not present in the majority of reports. It should include the following elements:

(i) Nature of the solution - A clear set of objectives with a detailed and complete design specification, which is logically correct. There are also detailed written descriptions of all processes/sections and a clear, complete definition of any data structures. The specification is sufficient for someone to pick up and develop appropriate library elements. The library elements have been designed to be reusable and easily configured.

(ii) Intended benefits of the library elements have been identified and explained.

(iii) Limits of the scope of the library elements.

(c) Software Development, Testing and Implementation of the Library Elements

This section was not present in the majority of reports.

(i) Development and Testing of the library elements - the Examiner must be left in no doubt the library elements actually work in the target environment. Candidates should provide program listings in the form of printouts. Data structures should be illustrated as part of the listings where appropriate, detailing their purpose. There should be a full set of printouts showing input and output as well as data structures. All hardcopy should be fully annotated and cross-referenced. A full test plan, with evidence of each test run should be present in the report, together with the expected output for each library element. The test plan should cover as many different paths through the system as is feasible, including valid, invalid and extreme cases.

(ii) Appropriateness of structure and exploitation of available facilities used in the production of the library elements - some discussion of the suitability of methods used for the particular system should be included. Some recognition and discussion of the problems encountered and actions taken when appropriate should also be included. A log of such problems should be kept.

(d) Documentation of the Library Elements

This section was not present in the majority of reports. As many programmers work as part of a programming team, the documentation for the library elements is intended to allow the candidate to demonstrate their ability to work as a part of such a team.

(i) Technical - Much of the documentation will have been produced as a by-product of design and development work and also as part of writing up the report to date. However, a technical guide is a stand-alone document produced to facilitate easy maintenance and upgrade of a system. The contents of the guide should, where relevant, include the following: record, file and data structures used; database modelling and organisation including relationships, screens, reports and menus; data dictionary; data flow (or navigation paths); annotated program listings; detailed flowcharts; details of the algorithms and formulae used. Candidates should include a guide to the interface to the library routines - parameters, public and private data structures, formats etc. All parts of the guide should be fully annotated since this is important for subsequent development of the system. The specifications of the hardware and software on which the system can be implemented should be included.

(ii) Candidates must complete the User Documentation; it is not sufficient to state that library routines 'work in the background'. Clear guidance, as friendly as possible, should be given to allow the incorporation of the library elements in other solutions. Details of the public interface should be provided for each of the library elements. Some mention here of the relationship between the elements and the data they deal with may be relevant. The user guide should be well presented with an index and, where necessary, a glossary of the terms used.

(e) Design of the main solution

(i) Nature of the solution

Centres are again reminded that the requirements specification set out in the analysis needs to be discussed with the user leading to a set of achievable, measurable objectives that have been agreed with the user. These objectives will then form the basis for the project evaluation. Candidates often clearly set out proposed data structures and designs for input screens but then forgot to provide a detailed description of the processes to be implemented and designs the required outputs.

(ii) Intended benefits

Candidates need to clearly identify the merits of the intended system.

(iii) Limits of the scope of solution

Candidates need to discuss the limitations of the intended system and estimate the size of the files required.

(f) Software Development, Testing and Implementation of the Main Solution

(i) Development and Testing

Evidence of testing needs to be supported by a well designed test plan that includes the identification of appropriate test data, including valid, invalid and extreme cases, and expected results. In order to gain high marks in this section, candidates need to include evidence that shows the tests were completed as well as detailed test plans.

(ii) Implementation

Few candidates included an implementation plan. This should contain details of user testing, user training and system changeover that have been discussed and agreed with the user. These details need to be clearly related to the candidate's own project and not discussed in general terms.

Evidence of user testing is essential if high marks are to be awarded for this section. Better candidates included photographs of the user testing the new system, printouts of the testing together with signed comments from the user and/or a letter from the user commenting on the tests and their results.

(iii) Appropriateness of structure and exploitation of available facilities

Candidates should discuss the suitability of both hardware and software at this stage. Few candidates kept a log of any problems encountered together with details of how these problems were overcome. Any system developer encounters problems; these problems need to be noted together with the corrective action taken.

(g) Documentation of the Main Solution

(i) Technical

Very few candidates produced a stand-alone technical guide including the following: record, file and data structures used; database modelling and organisation including relationships, screens, reports and menus; data dictionary; data flow (or navigation paths); annotated program listings; detailed flowcharts; details of the algorithms and formulae used. Candidates need to annotate all parts of this guide since this is important for the subsequent development of the system. The specifications of the hardware and software on which the system can be implemented should also have been included.

(ii) User

For full marks the candidate needs to include an index and a glossary, the guide needs to be complete including details of backup routines and common errors. Also, good on-screen help should exist where this is a sensible option.

(h) Evaluation

This section is very poorly completed by many candidates, with many trying to attempt an evaluation without evidence provided from their end users. End user involvement is clearly required in (i) and (ii) of this section. There are detailed guidelines, for this and all sections, clearly set out in the guidance for marking projects section of the syllabus.

(i) Discussion of the degree of success in meeting the original objectives

Very few candidates considered each objective in turn and indicated how the project met the objective or explained why the objective was not met. Even fewer candidates included use of user defined, typical test data as part of this discussion.

(ii) Evaluate the users' response to the system

Many candidates did not provide clearly recorded evidence from their end user, this is essential. Candidates need to obtain the user's response to how the system developed meets the agreed specification and evaluate this response as to the satisfaction with the system developed.

(iii) Desirable extensions

Some candidates identified limitations and possible extensions but sometimes forgot to identify the good and bad points of the final system.