Computing

Paper 9691/11
Written Paper

General Comments

There was some evidence of rote learning by candidates on some topics. As a result, questions that required an application of knowledge were less well answered. Many questions now link different areas of the syllabus and require careful thought before answering. There is also some evidence of candidates rote learning previous exam questions and mark schemes and applying answers from previous papers to similar, but different questions.

If a candidate answers a question on an additional page, they should be reminded to indicate clearly to the examiner where their revised answer is to be found. If answers are crossed out, the new answers must be very clear so that examiners can easily read the text and award candidates the appropriate mark.

Comments on specific questions.

Question 1

(a) This subject is part of the system life cycle. Candidates confused this with other parts of the system life cycle and answered accordingly.

(b) (i) Describing the difference between parallel and pilot changeover methods was something that was well answered as a basic definition of each process, but the question asked for a description that required, for full marks, something more than this basic definition. The word description was a clue on how to answer this question.

(ii) Continuing the theme of parallel and pilot changeover, the answers to the advantages of each method was as subject that was clearly well understood, especially for parallel changeover.

(c) Candidates were given the names of three kinds of system maintenance. They could often describe them, sometimes very precisely but they were also asked to offer an example from the system in the question that was not well answered. Most often, general examples regarding data processing were given that were not appropriate to the scenario of the question.

Question 2

(a) The question asked the candidates to push items onto a drawn stack, to pop some and then add more items. Pushing the items was clearly better known that popping them, as many candidates treated the stack as a queue and removed the first items originally added and then moved the other items down.

(b) The same sequence of inputs and outputs was given for a queue but candidates achieved fewer marks here as most of the candidates moved items along the queue after removing previous items. The operation of queues is understood less well than the operation of the stack in part **(a)**.

Question 3

(a) This was a structured question asking candidates to ink storage media to types of storage by drawing lines between boxes. There were many correct answers but there were few candidates with full marks.

(b) (i) This question about ROM and RAM has been asked before using different scenarios and was answered extremely well. It was common to see full marks. There were some incorrect answers in the form of a 'hard disk' given as a type of memory in a flying model aircraft.

(ii) This question was not answered well. Many candidates did not understand the question or, more likely, saw the words “user interface” and gave stock answers that did not relate to the scenario in question.

Question 4

The operation of the point-of-sale stock control system produced a large range in the number of marks awarded. There were many perfect answers but the marks awarded did tend to cluster towards the bottom of the range. Candidates need to improve their knowledge in this area.

Question 5

(a) The parts of this question involved computer interfaces and is presented rather differently from the usual. The answer to this part was as much common sense as computing and candidates scored well.

(b) (i) Candidates were far less sure what “refresh” meant. Many of the descriptions were very vague concentrating what was seen on the screen rather than the process that caused the updating.

(ii) The reason the graphic needed to be updated was much better answered as candidates realised that when flying, planes change their position rapidly.

(c) The essential features of a control screen for this scenario was, often answered in generic terms. It was even unusual to see the features that were expected and the explanations were even rarer. Many candidates gave answers about the data the control screen was displaying rather than the features of the screen itself. This question also produced many answers that referred to scenarios from previous papers.

(d) (i) The question asked candidates to put the data, given in a table, against the appropriate icon of the flight in a diagram of the flight control area. This form of question was very different to those asked in previous years, but most candidates rose to the challenge and gave very good answers.

(ii) The follow up question asked how additional data could be displayed when required on this screen. Many answers did not appreciate that this was a real time system that was constantly changing and answered with ideas about form based or menu based interfaces.

Question 6

(a) This question asked candidates to produce a truth table for a small logic circuit. It produced the usual range of answers from perfect to zero. This is an area of the syllabus where many still need to improve their understanding.

(b) (i) Converting from binary to denary is an area that is well known and most answered correctly. However many candidates showed their working. Many candidates incorrectly used the numbers over the grid as the values for the binary digits within the grid rather than the correct binary values of 64, 32, 16, 8. 4, 2, 1, working from left to right.

(ii) Converting the other way from denary to binary still produces many more incorrect answers than correct ones. Candidates need to improve their understanding in this area.

(c) (i) Half duplex is often answered as full duplex because the candidates do not put the final part of the answer “*at one time*” and serial transmission also requires more than just data sent one bit at a time. It also requires "'along a single channel". This question has been asked many times previously.

(ii) A protocol is well understood by candidates and many produced positive answers.

(ii) Why we need a protocol is far less well understood and the answers often confused this with error checking rather than the rules that have to be agreed before data can be transmitted.

(d) This question gave the candidates a table of bits arranged in a grid and asked them to find the any errors in the data transmitted using even parity.

(i) (ii) (iii) All three parts asked for the row or column that was in error. This was was often well answered as all that was required was for candidates to count the number of on (one) bits and find which has an odd number. Why the data does not require re-transmitting is far less well understood. The grid with appropriate row and column being identified, showed where the error was and being a binary system, the bit here happens to be all that was required to flip it to its alternative value.

(e) This question asked the candidates to create a logic circuit to represent a simple Boolean equation. It did not produce many full mark answers. There were very many single input AND and OR gates causing marks to be lost entirely.

Question 7

Candidates were given a list of data items entered into an online sales website and the various parts of the question is based around validation and verification techniques.

(a) (i) This part revolves around validation and most candidates clearly knew what kinds of data can be easily validated and more importantly, what kinds of data input can be validated and by which method.

(ii) In this part many candidates confused verification with validation. The further section of this question asked for a data item suitable for verification, which was usually given correctly, but the reason why it was suitable was far less well understood. The reason often given was not about the data, but the results of the verification check.

(iii) This part was to identify which particular data item could be validated via a drop down list and the reason for choosing this. Most candidates gave date of birth as a correct example but again fewer knew the reason behind this; that there were limited options for day, month and year that is coded in a drop down list.

(b) **T**his question asks candidates to name software types and then give reasons for their choice, for software that could be used to develop such an online website. The items were correctly named but the follow up reasons were far less well known.

COMPUTING

Paper 9691/12

Written Paper

General Comments

There was some evidence of rote learning by candidates on some topics. As a result, questions that required an application of knowledge were less well answered. Many questions now link different areas of the syllabus and require careful thought when answering. There is also some evidence of candidates rote learning previous exam questions and mark schemes and applying answers from previous papers to similar, but different questions.

If a candidate writes the answer to a question on an additional page they must indicate clearly to the examiner where their revised answer is to be found. If answers are crossed out, the new answers must be very clear so that Examiners can easily read the text and award candidates the appropriate mark.

Comments on Specific Questions.

Question 1

(a) The question asked the candidates to push items onto a drawn stack, to pop some and then add more items. Pushing the items was clearly better known that popping them, as many candidates treated the stack as a queue and removed the first items originally added and then moved the other items down.

(b) The same sequence of inputs and outputs was asked for a queue, and here, the marks given were far fewer as most of the candidates moved items along the queue after removing previous items. The operation of queues was understood less well than the operation of the stack in part **(a)**

Question 2

(a) Candidates were asked to define the terms buffer and interrupt. Many candidates clearly defined the buffer but far fewer gave the complete definition for an interrupt. It is more than a signal to the processor; it clearly has to come from somewhere or something. This was missing in most answers.

(b) This part asked how buffers and interrupts work when sending data to be printed. The many answers provided gave the answer to a question belonging to a previous paper and as such were not in the context of this question. Candidates lost marks by not referring to a print buffer. Many candidates also appeared to think that whilst the processor was filling the buffer, it could also carry on doing other tasks. Finally, when the buffer is empty, many candidates made the mistake of stating that it was the buffer that sent the interrupt to the processor. Candidates often answered in general terms using computer rather than processor or that memory is moved to the buffer, to give just two examples.

Question 3

This matching of computing terms to their description question proved to be less challenging for the candidates to answer as there were no additional (distraction) boxes on the right hand side of the question. It was also made somewhat simpler due to the terms being so distinct from each other. However, the question did find the full range of marks from 0 – 5.

Question 4

(a) This question was really about modular division and candidates who realised this gained full marks but others more commonly were awarded zero. It was not uncommon to see candidates treating the given table as another stack and placing the items into it accordingly. These candidates appear not to have properly read the question.

(b) (i) Candidates were asked to describe when a second record, with a key field ending in the same value as the second one in the previous question is to be stored in the file. There was much confusion in the answer between files and records, with answers stating the file (or even worse **it**) was over written rather than a particular record being over-written. Candidates did not often state what would happen to the file contents, most often naming what this action was called.

(ii) The follow up question asked how this "clash" could be prevented. There were many very good answers that gained full marks, however, quite a large number of candidates could name the method to prevent a clash but did NOT go on to describe how it operated. Once again reading the question and taking on board the word describe is crucial in being able to gain full marks.

Question 5

(a) This question has appeared in different forms on previously but this did not mean that answers gained more marks this time. Answers were often general and not reflecting the example given in the question. Many candidates did not read the question in detail, which referred to 4 separate control rooms that were 20 years old. Many answers gave efficiency as the reason to improve the system or to remove "bugs" in the system, rather than what was being looked for in terms of not being able to maintain the equipment or software and more importantly the reason why that was not possible.

(b) (i) This question was about how you might change from the old to the new system. Many simply named the method, often incorrectly as parallel, but then did not offer a description of that method. This was true for candidates who gave an appropriate method, which was usually "direct". Candidates who offered alternative correct answers often described a different method to that named. Candidates stating Pilot or Phased methods often used imprecise terms when describing the method of changeover.

(ii) This question asked for an inappropriate method. Once again it was common to see this named but there was not a follow up reason why it was not the appropriate method. Parallel was often named but the reason why two real time systems could not both be operating together was not given. Most candidates seemed to think that data loss was more important than the danger inherent in the system. The candidates appeared to be linking the question to a different scenario.

(c) Candidates were given the names of three kinds of system maintenance. They could often describe them, sometimes very precisely but they were also asked to offer an example from the system in the question that was not well answered. Most often, general examples regarding data processing were given that were not appropriate to the scenario of the question.

Question 6

(a) This question mostly generated completely correct answers. A large number of candidates appeared to believe that an operating system is held on an external hard drive and that a backup is always on an internal drive.

(b) (i) Naming a storage medium that was solid state produced the usual plethora of "USB" with no additional comments provided. Generally, this was well answered by the majority of the candidates.

(ii) Solid-state memory being cheap, portable or small is not a real benefit of using such a device. An A level examination requires rather more. Candidates did offer 'robust' as a good reason but few explained why it was robust. Fast transfer time was frequently offered as an answer but it is the latency, or lack or latency that is the real factor here.

Question 7

(a) (i) Candidates were asked to circle a type of printer and then give a feature and a drawback. Many candidates did not mark in any way either alternative, which made it impossible to say what their feature or drawback referred. It was more common to see the feature than the drawback. Candidates choosing the laser printer usually gained the feature point but offered vague or general drawbacks such as expensive. Candidates did not say whether it was expensive buying the printer or running it and it required more detail.

(ii) A similar kind of question asking for features and drawbacks for either a 3D printer or a graph plotter. The former offered better answers, especially the feature, which was also given for the plotter. For both, the drawback given was just the general, “expensive”.

(b) This question was answered well. The candidates were given a list of descriptions and asked to name the appropriate **input** devices. However, it was not unusual to see an output device named.

Question 8

(a) (i) This question required the candidates to work out the truth table for a logic circuit. The answers offered were of a better quality than in previous papers with far more gaining full marks

(ii) This question was different to that asked in previous papers. It asked "what could replace the whole circuit?" There were very many incorrect answers that mentioned complex groups of gates even from candidate who received full marks on the previous question.

(b) A logic circuit was provided, and the candidates asked to write a Boolean expression to represent this circuit. Answers were usually either completely correct or completely incorrect. Many candidates were not able to analyse a simple logic circuit.

Question 9

(a) A question that proved difficult for candidates to gain full marks, though many obtained two marks. Many candidates answered the question using a completely different scenario taken from a previous question paper and so gained very little credit. Answers were rather stereotyped mainly from the use of video/animation in the presentation and the ability to be seen by a larger audience.

(b) This question was presented in a novel manner and did really make the candidates think, which in turn produced many very good answers. It also had the opposite effect for some in that they appeared less able to justify the choices made about the type of control they selected for GUI control. A number of the candidates did not appear to know the names of the GUI controls (widgets), which made the question difficult to answer.

Question 10

(a) A straightforward question converting binary numbers to denary and a skill that is well known and well-practised as the majority gained full marks on this.

(b) Doing the reverse i.e. converting from denary to binary notation is less well-practised or perhaps it is just that it offers more scope for mistakes to occur in the calculation as far fewer gained full marks here.

(c) This question proved to be a real problem for candidates. All sorts of invalid sensors were suggested that simply could not cope with a mass of runners crossing the start line of a race. Devices such as pressure sensors or bar code readers simply would not work in this scenario. The answer must relate to the scenario of the question.

(d) This question was another that many found difficult to answer. The idea of sensors sending data / signals to the processor was very common, but once again, the type of sensor was not appropriate to the scenario. Many candidates also talked about analogue to digital conversion but did not state that the signal from the sensor was analogue in the first place. Many stated that it was the sensor that directly started and stopped the timing device, which is clearly not the case.

COMPUTING

Paper 9691/13

Written Paper

General Comments

There is still some evidence rote learning by candidates on some topics. As a result, questions that required an application of knowledge were less well answered. Many questions now link different areas of the syllabus and require careful thought when answering. There is also some evidence of candidates rote learning previous exam questions and mark schemes and applying answers from previous papers to similar, but different questions.

If a candidate answers a question on an additional page, they must indicate clearly to the examiner where their revised answer is to be found. If answers are crossed out, the new answers must be very clear so that examiners can easily read the text and award candidates the appropriate mark.

Comments on Specific Questions.

Question 1

(a) (i) (ii) (iii) The question asks for an example of magnetic, optical and solid state storage, followed by a description of how the data is stored. Most candidates could name the type of device for each type but not how the data was stored on the device. For solid-state devices, many candidates simply state "USB" without any additional information.

(b) Candidates were asked for advantages of solid state as compared to magnetic storage devices. Many candidates provided insufficient answers such as "cheaper" or "faster". The idea that it is more robust is well known but it is unclear if candidates know why it is more robust.

Question 2

This was a diagram type question asking candidates to link binary calculations of a variety of kinds to their answers. There were more answers than questions, which caused some confusion, but generally, it was well answered with the majority getting full marks. The upper two question boxes caused the most confusion.

Question 3

(a) (i) Answers to this question appeared to be vague, generic and unrelated to the scenario. Candidates need to increase their understanding of software types and their uses.

(ii) This question asked for a device that would be suitable for the CAD design task. Many answers stated a type of software which is clearly not a device. On many occasions, where a device was named, it was a mouse which is not a specialist item that would make better use of CAD software.

(b) (i) (ii) This was a similar question about spreadsheet software and the features of the software are well known.

(c) (i) (ii) Candidates were asked about presentation software features and also another device suitable for use with the software. The features are well known by the majority, but the additional device had far too many software examples rather than a device. Even when a device was named, it was often only part of an answer with screen being the most common. Many answers did not refer to the scenario in which the question was set.

Question 4

(a) Candidates were given a set of Boolean statements and asked to create a logic gate diagram to match the statements. This produced some excellent answers and it was very common to see full marks awarded, showing that candidates have taken on board comments made in previous reports.

(b) Candidates asked to complete the truth table from the Boolean statements. A small number of candidates made no attempt at this answer, but equally, the level of marks awarded was far higher than those awarded in previous years.

Question 5

(a) Candidates were presented with incomplete diagrams of three kinds of named network. They were asked to show how the computers were connected. Most did not link the bus network correctly, drawing lines through each of the computers rather than from each to a single connection. The ring network was most often correct and the star network produced a wide variety of incorrect answers, with many not realising a hub connection was required for full marks.

(b) (i) (ii) (iii) All three parts asked for a pair of benefits for each of the three named network types. The star network produced the more complete answers closely followed by the bus network. Many candidates provided generic answers that could apply to all and any of the three kinds of network such as allow data sharing or sharing of peripherals.

Question 6

(a) (b) The scenario here was set up to test the candidates' ability to convert from binary to denary and denary to binary. The conversion from binary to denary produced far more correct answers than the opposite conversion method. Many candidates incorrectly provided the category rather than the channel number when converting from binary to denary.

(c) Candidates were asked to state what happens when a binary value higher than the permitted range was entered through the device. This involved a numeric conversion and then use of that conversion. The majority of the candidates provided the expected answer.

(d) In each of the above questions a bit was always left as blank at the left hand end of the diagram. This was always for the parity bit. Candidates were asked to state what the parity bit for a particular binary sequence would be if using even parity. Many gave the full binary number not just the expected single bit answer and as such did not properly answer the question.

(e) This question asked for descriptions of both serial and simplex data transmission. Overall, this was well known but a good number negated their answer for simplex by adding the phrase "at a time". For serial transmission many candidates stated only half the answer i.e. bits sent one at a time, omitting the "along a single channel" or the equivalent.

Question 7

(a) Answers to this question were often general and did not reflect the example given in the question i.e. that of a control system for a power station. Many answers gave efficiency as the reason to improve the system or to remove "bugs" in the system, rather than what was being sought, in terms of not being able to maintain the equipment or software and more importantly the reason why that was not possible.

(b) This question was more of an information-handling question with candidates given four descriptions of methods of changeover and asked to name each from the descriptions. Most candidates correctly named direct and parallel changeover, but many managed to confuse pilot and phased changeover. Some candidates did not read the question properly or missed the point as they stated four stages of the system life cycle.

Question 8

Each part of this question showed an incorrect answer given by someone in response to a question and asked to state why it was wrong. The majority of all five answers were correct.

(i) The question stated a wrong description of batch and most correctly named it as real time processing. Some candidates chose to describe what batch processing was rather than why it was a wrong statement.

(ii) This part was about verification which had been given as validation. Some candidates chose to describe a validation method rather than stating what the correct form of data checking was.

(iii) The majority of candidates answered this part correctly. Candidates knew a queue is a FIFO structure though some chose to name it as a LILO structure, which is just as correct but not the normal way of describing a queue.

(iv) The difference between ROM and RAM were firmly embedded in the minds of the candidates,

(v) The idea of full duplex transmission is also well known but some candidates do penalise themselves by failing to add “at the same time or simultaneously” at the end of their answer and so confuse it with half duplex.

Question 9

(a) The scenario here is a bicycle manufacturer and candidates were asked to label a diagram to show where a particular bicycle was in the process of manufacture. This was a straightforward process of data handling from the given data and as such, candidates answered it with few problems.

(b) This was an interface question with a difference that required candidates to think about the processes that happen within an interface so that data is only displayed when required. The answers showed that being able to think around a problem is a skill that still needs developing in future.

(c) The final part was an extremely testing question about how the computer system knew where the particular bicycle was in the manufacturing process. This required candidates to mention the need for sensors as well as naming an appropriate type of sensor. The need for sensors was often stated but an appropriate type of sensor was often generic. The type of sensor was often not related to the scenario or would simply not work in the situation described. Many candidates did not describe a robotic manufacturing system, but gave answers involving total human interaction with the manufacturing process. The type of software named was often not required for this scenario, for example, painting software as part of an art package is clearly not what is expected in this case.

COMPUTING

Paper 9691/21
Written Paper

Key messages

To succeed in this paper it is essential that candidates have practical experience of programming using a high-level procedural language. It is recommended that candidates choose one of the following: Pascal, Visual Basic (console mode), and Python.

Programming and pseudocode questions from past examination papers provide an ideal starting point for practical work.

General comments

There are many candidates who do not appear to have any programming experience.

Comments on specific questions

Question 1

This question covered the string handling functions ASCII and CHAR listed in the syllabus. The definitions of these functions were given in the question stem.

(a) A minority of candidates provided correct answers to the given function calls. The question provided the fact that ASCII('A') returns 65. Therefore, ASCII('B') returns 66. The function definition clearly stated that if the function is not properly formed, an error is generated. Few candidates gave this as an answer to ASCII('AB'). 'AB' is clearly not a character but a string and therefore is not a valid argument for the ASCII function. Some candidates were able to state that CHAR(67) returns 'C', having been provided with the clue that CHAR(65) returns 'A'.

(b) Only the most able candidates were able to state that the 15th letter of the alphabet could be calculated with the formula CHAR(ASCII('A') + 14).

(c) (i) A minority of candidates were able to explain that two uppercase letters can be arranged in alphabetical order because the letters A to Z have increasing ASCII codes and the character with the smaller value is the first character and the character with the larger value is the second character.

(ii) Only the better candidates successfully explained that to arrange two words in alphabetical order, the ASCII codes of the characters are compared in turn from the start of each word until two characters are different. The lower code determines the first word. If two words are the same when one ends, this is the first word.

(iii) Credit was given to candidates who responded with program code rather than pseudocode, but very few candidates showed understanding on how to declare a function.

Question 2

This question covered the string handling functions LEFT, RIGHT and MID listed in the syllabus. The definition of the function NOW() was given in the question stem.

(i) Many candidates were able to give the correct result of the function call NOW() on the 1st July 2015.

(ii) Most candidates made a good attempt at completing the flowchart to calculate the age in years from a given date of birth.

(iii) This part question required candidates to justify their choice of test data. The requirement that only valid dates in the form DDMMYYYY were to be used was missed by the majority of candidates. Working through the flowchart should have provided the insight that dates were required where the birth month was before the current month, after the current month or equal to the current month with the birth day before, after or equal to the current day.

Question 3

This question included the use of a one-dimensional array.

(a) A minority of candidates were able to declare and initialise a one-dimensional integer array in their chosen programming language. The initial value suggested for the array elements rarely was zero, the only sensible value when the array is to be used to keep a count of the frequency of each letter in a message.

(b) The more able candidates were completed the partial pseudocode successfully. Incrementing the correct frequency total in the Letters array appeared challenging. Candidates were expected to use their knowledge of ASCII codes being consecutive for the letters of the alphabet. The calculation `ASCII(NextLetter) - ASCII('A')` provides the index of the array element to be incremented.

The more able candidates successfully explained that the file-handling function EOF() checks whether it reached a marker immediately after the last character of the file and returns TRUE or FALSE.

(c) This was a challenging question for candidates. It required them to write a function to perform a serial search of a 1D array. The function was to return the index of the highest value found. The calculation `CHAR(Index + 65)` would have returned the most frequent letter of the message. The calculation `ASCII(MostFrequentLetter) - ASCII('E')` would give the difference between the most frequent letter and the letter E.

(d) (i) The dry-run of the given pseudocode was successfully completed by many candidates.

(ii) Many candidates understood that they were in fact decoding an encrypted message.

(iii) A minority of candidates could list features such as comments and keywords in capital letters that were used in the pseudocode to make it easier to understand.

(iv) Desirable features, (such as meaningful variable names and indentation) that should also be used when writing pseudocode, were mentioned by very few candidates.

(e) Syntax errors and logic errors were not well understood. Candidates rarely gave a suitable description of when each type of error could be detected and how.

(f) This question part involved a random number generator and a 2-dimensional array. The more able candidates made a good attempt at completing the partial pseudocode. A minority of candidates showed an understanding that checking the correctness of the program code should consist of inspecting the contents of the LetterGrid array after execution of the given program statements to check that every letter is present exactly once in the second column.

COMPUTING

Paper 9691/22
Written Paper

Key messages

To succeed in this paper it is essential that candidates have practical experience of programming using a high-level procedural language. It is recommended that candidates choose one of the following: Pascal, Visual Basic (console mode), and Python.

Programming and pseudocode questions from past examination papers provide an ideal starting point for practical work.

General comments

Many candidates clearly show they have experience of programming in a high-level language. There are a significant number of candidates who do not appear to distinguish pseudocode and the programming language being used.

Some candidates use the ← symbol (assignment) when an equality symbol is required. Candidates need to understand the difference between variables and literals when writing code. Frequently variables are used in code with quotes around them.

Comments on specific questions

Question 1

(a) (i) This was generally well answered. Some candidates had counted from 0 (although an example was given in the question) and therefore gave 'R' as the answer.

(ii) Most candidates were able to recognise that this would generate an error.

(b) The candidates who used the correct variable 'TodaysDate' were able to give the correct values in the function to extract the day, month and year.

Question 2

(a) Many candidates completed the trace table correctly. Some candidates missed out the last value in column x and therefore did not subtract the rogue value from Result. Most candidates correctly stated the expected result. Many candidates recognised that -1 was being subtracted from the expected result, but they did not know the reason why. Some thought it was due to the while statement (while x<> -1). A wide range of incorrect answers were given. Some just described what was shown in the trace table. Most candidates realised this was a logic error.

(b) A range of correct solutions were given. Common acceptable (but not the most efficient) solutions included:

- swapping the 'INPUT x' line with 'Result ← Result + x'
- using an IF statement to prevent the rogue value being added to the total
- adding 1 to the final value of Result or initialising Result to 1.

Some candidates replaced the WHILE loop with a REPEAT-UNTIL loop but did not realise that the rogue value would still be added to the total if the input line was not moved.

Question 3

(a) Most correct answers gave " " as the value to represent an empty cell. Other single characters were given as acceptable answers. However, '0'/ 'O' for an empty cell was not appropriate. It was not always clear whether candidates were suggesting zero (incorrect as it is an integer and characters needed to be stored in the array) or the character 'O' (also incorrect as it is one of the marker values used for the game).

Many candidates were able to correctly declare and initialise the array. Some of those using Python or C, used dimensions 0 - 2, not recognising that the row and column needed to be referenced 1 - 3. Candidates had to realise that the array data type needed to match the value assigned.

(b) (i) This part question was well answered. Most candidates recognised that the first and third rows were valid. A common error was not to recognise that the last row, column given (2,2) was already occupied.

(ii) Candidates with experience of programming functions, correctly checked that the row and column were within range. Many candidates were unable to produce the correct logic statement. A common error was to include an ELSE statement after checking whether the row was in the correct range so it would only check for correct column range if the row was incorrect. The same error was frequently repeated again when checking whether a cell is empty.

(c) (i) Many candidates correctly identified the use of functions and procedures as an indication of top-down design.

(ii) Candidates need to realise that top-down design makes it easier to solve the problem. It does not necessarily make it easy to solve the problem.

(iii) Assignment statements were recognised by many candidates and many achieved the mark for procedure call, possibly helped by the word CALL being given in the code. A few candidates were able to recognise the functions used.

(iv) This part was generally well answered, with the most frequent correct answers being 'indentation' and 'meaningful variables'.

(v) This part was generally not well answered. A minority of candidates could correctly identify which identifiers represented procedures and which represented functions. Candidates needed to refer to the pseudocode listed at the beginning of **part (c)**. The function data type is the data type of the return value.

(d) Some candidates could provide a correct structure for a procedure in their chosen programming language. Many candidates correctly wrote the code for swapping the values of X and O.

(e) This part of the question was well answered overall. Candidates need to be able to recognise where iteration started and the conditional statement ended. The more able candidates completed the UNTIL condition correctly.

(f) Some candidates were able to convert the flowchart to program code in their chosen programming language. Many needed to produce a correct structure for a procedure. For example, those using VB, commonly wrote the word 'procedure' rather than 'sub'. Candidates need to know the constructs in their chosen programming language. Coding the FOR loop correctly was challenging for many. Converting the OUTPUT statement was frequently omitted.

(g) Many candidates provided for input of row and column number, but many did not display a grid. Screen design should consider the overall functionality of the screen. The more able candidates used the display given in **part (f)**.

(h) The most common correct answers given were black box and white box testing. The common incorrect answer was alpha / beta testing.

COMPUTING

Paper 9691/23
Written Paper

Key messages

To succeed in this paper it is essential that candidates have practical experience of programming using a high-level procedural language. It is recommended that candidates choose one of the following: Pascal, Visual Basic (console mode), and Python.

Programming and pseudocode questions from past examination papers provide an ideal starting point for practical work.

General comments

Many candidates clearly show they have experience of programming in a high-level language. Candidates need to know that pseudocode statements are different to programming language statements.

Some candidates use the assignment symbol ← when an equality symbol is required. Candidates need to know the difference between variables and literals when writing code. Frequently variables are used in code with quotes around them.

Comments on specific questions

Question 1

(a) Candidates generally interpreted the function definitions correctly. Some candidates needed to realise that MID("RED", 3, 2) is not valid and would therefore generate an error.

(b) The more able candidates provided elegant solutions to this string handling question. Many candidates needed to initialise the empty string.

Question 2

(a) The majority of candidates completed the pseudocode correctly. Many candidates correctly identified the use of functions and procedures as an indication of top-down design. Candidates needed to realise that top-down design makes it easier to solve the problem. It does not necessarily make it easy to solve the problem. Assignment statements were recognised by many candidates. Few candidates were able to recognise where functions were used. Some candidates incorrectly listed the function identifier as a variable identifier.

(b) The more able candidates realised that storing the index value in each of the Board elements that were not the start of a slide or ladder would make programming the game easier. Other acceptable values were 0 or -1. The question showed the Board array containing some integers. A small number of candidates were able to deduce that this required the declaration of an integer array. Some candidates did not use the value suggested in **part (i)** as the initial value in **part (iii)**. Many candidates were able to correctly declare and initialise the array in their chosen programming language. Some of those using Python or C, gave dimensions 0 - 29, but the board squares were numbered from 1 to 30.

(c) The more able candidates provided a solution that would work even if there were no slides or ladders in the board design. One possible solution is:

```
INPUT a, b
WHILE NOT (a = 0 AND b = 0)
   Board[a] ← b
   INPUT a, b
ENDWHILE
```

(d) Most candidates made a good attempt at completing the pseudocode function. The more able candidates gave completely correct answers. A common error was to confuse the two variables 'MovesSoFar' and 'PlayerPosition'.

(e) This part question showed that candidates need to practise their programming skills. A minority of candidates demonstrated knowledge of how to open a file in their chosen programming language. Candidates need to know that outputting to a file is different to outputting to the screen (console).

(f) The more able candidates realised the benefit of using a named constant for the size of the board. If the constant identifier is used wherever the algorithm requires the number of squares of the board, such as the loop for initialising the Board array, the only change required is the value of the constant at the beginning of the program.

Question 3

(a) The majority of candidates completed the trace table correctly and identified the algorithm as a sorting routine. Many candidates correctly stated that after only 2 iterations of the outer loop no more changes were made to the contents of the array. A few candidates were able to explain why this algorithm was inefficient. The more able candidates correctly completed the pseudocode to produce the standard bubblesort algorithm.

(b) The majority of candidates identified indentation as the main feature that made the pseudocode easier to understand. Most candidates suggested annotation as another desirable feature that should have been used.

Question 4

(a) Many candidates found it difficult to convert the flowchart to program code in their chosen programming language. Some candidates were able to produce a correct structure for a function. Candidates needed to know the constructs in their chosen programming language. Coding the MOD operator correctly was challenging for many candidates. Converting the RETURN statement was frequently omitted.

(b) Many candidates provided suitable test data and expected results. The justifications were sometimes insufficient. Precisely which year was given was not as important as the fact that the test data needed to include a year that is:

- divisible by 400
- divisible by 100, but not 400
- divisible by 4 but not 100
- not divisible by 4

(c) The most common correct answer given was black box testing. A common error was to list white box testing, which was given in the question stem of **part (b)**.

COMPUTING

Paper 9691/31
Written Paper

General

There was evidence of an improvement in the standard of candidate responses for certain syllabus topics over previous years. The process of normalisation appears to be well understood and candidates were able to apply the general principle of Third Normal Form to the table designs given. Application of the theory was also required when candidates were asked to re-design the data model and some excellent well expressed answers were seen.

Another syllabus area which required the application of basic knowledge was answered less well. The stack data structure is well understood by candidates and the definition and completion of the pop and push algorithms was well answered. However part **(b)(i)** required the candidate to apply this basic understanding of how a stack is implemented to the practical task of the management of subroutine return addresses. Candidates are expected to be familiar with practical applications of the data structures in the syllabus: linked list, binary tree, stack and queue.

Accuracy is a key skill for the computer scientist. In **Question 3** part **(b)** the class names were given in the question rubric. Candidates should therefore use these exact names in the construction of their class diagram. Any identifier variations did not gain credit.

Question 1

In part **(a)(i)**, a minority of candidates provided the correct answer. Candidates were required to elaborate further when stating "a repeated group". The answers given in **(a)(ii)** testified to the fact that the candidate was not clear what was being repeated. Candidates need to express their answer which makes it clear that it was the group of attributes: class name, class level and class leader, which was being repeated for a single member number. Some candidates needed to show more understanding by describing particular data values, for example, the ClassLeader value of DAV being repeated.

Parts **(b)(i)** and **(b)(ii)** were well answered. Most candidates gave the correct number of rows in **(b)(iii)**. In part **(b)(iv)** a majority stated the correct one-to-many relationship. However, many-to-many was a popular, but incorrect, alternative answer given. Part **(b)(v)** is another example where the standard of response seen has noticeably improved with the correct description of the MemberNo primary key in the MEMBER table linking to a foreign key in MEMBERCLASSES well expressed.

A small number of candidates correctly identified the compound key required for the MEMBERCLASSES table for part **(c)(i)**. For parts **(ii)** and **(iii)** knowledge of partial dependencies was exhibited by many and identifying the need for a CLASS table was often successful. Some candidates incorrectly suggested the additional table should be for the class leader. Part **(d)** was answered well by many candidates but the distribution of attributes in the MEMBER and FEE tables and appropriate primary keys sometimes proved challenging.

Question 2

Most candidates knew the meaning of the vertical character in BNF rules. This was also the case with identifying and explaining recursion in part **(b)**. Candidates must appreciate when the term recursion is used with procedures and functions in a high-level language, it has a different meaning.

In part **(c)** candidates found little difficulty in identifying valid and invalid packets. A small number of candidates gained the second mark by giving a clear listing of the rules used to arrive at the answer. For example, only the most able candidates could correctly identify that rules 1 and 2 needed to be used three times in part **(iii)**. A minority of candidates understood that the amended rules in part **(iv)** meant that there were two types of packet. The majority of candidates seemed to think that the new rules meant that a string

could be a combination of letters and hashes and amended their rules accordingly. Resourceful candidates realised that a definition of the hash character was required, then a recursive 'hash string' similar to the given rule for <string>.

Question 3

A minority of candidates provided fully correct answers to part **(a)** with candidates mostly scoring a few marks only. Few correct answers of 'property' for the final term were seen.

Candidates were usually more successful with part **(b)**, but only the most able candidates correctly showed inheritance between the classes on the class diagram. The majority scored well on identifying the properties for each class. Candidates should appreciate that a 'double precision' data type for a currency value is inappropriate.

Question 4

Candidates found few problems in describing the operation of a stack, but only a very small number of candidates correctly completed the diagram in part **(b)**. Entries placed on the stack by candidates showed a lack of understanding of the process of handling the return addresses for procedure calls.

Completion of the missing pseudocode for parts **(b)(ii)** and **(c)** was much better answered and full marks for each procedure were not uncommon.

Question 5

In the answers to parts **(a)** and **(b)**,the hexadecimal value was less likely to be correct. In part **(b)**, –127 was an incorrect answer that was common.

Despite being asked on previous papers, answers in part **(c)** were often either vague or simply incorrect; "Less space, less memory, fewer bytes, easier to understand, possible to represent larger numbers". The answer expected was a statement that the hexadecimal representation will use fewer digits. Some candidates expanded on this by stating that a group of four binary digits will be condensed to a single hexadecimal digit.

For part **(d)**, successful completion of the addition was usually correct, even if the earlier translation of denary to two's complement was unsuccessful. Overflow and its recognition was understood by many candidates although some candidates treated the summed byte as an unsigned integer and therefore incorrectly stated the addition actually gave 131.

Part **(e)(i)** was well answered with candidates successfully converting the 16-bit pattern to a denary number. For part **(e)(ii)** "normalisation" often appeared as the explanation. Candidates need to understand that normalisation is an issue for real numbers, not a BCD representation. Candidates should understand that that zero is a valid BCD digit and therefore the pattern "0000" is permitted.

Question 6

In part **(a)** the correct answer was given by very few candidates. There were a multitude of different, incorrect answers with DFD a popular choice. Candidates should understand the difference between the different types of chart, especially a systems flowchart and a program flowchart.

Full marks in part **(b)** were rare but the overwhelming majority of candidates scored some marks. Part **(c)** was generally well answered.

Question 7

In part **(a)**, answers often showed a lack of understanding of "media". Where correct media were identified, descriptions were often inadequate or not relevant.

The diagrams given for part **(b)** needed to be of a higher quality. The computer C4 rarely had its printer attached. Routers and modems often connected to only one shop and there was little recognition that Shop C's LAN employed a bus topology. There should have been two attainable marks for showing the cable terminators required on a bus network and the attachment of the file server to the cable. If a modem or router was drawn it often connected to 'nowhere' and did not gain credit.

In part **(c)** candidates should understand that intranet content is provided from a web server. The use of a browser was more widely known. Answers to part **(iii)** often focused on the need for authorised access. Some candidates seemed to miss the fact that it was an intranet and based their answers on the benefits of a LAN with inappropriate answers such as the sharing of hardware resources.

COMPUTING

Paper 9691/32
Written Paper

General

There was evidence of an improvement in the standard of candidate responses for certain syllabus topics over previous years. The process of normalisation appears to be well understood and candidates were able to apply the general principle of Third Normal Form to the table designs given. Application of the theory was also required when candidates were asked to re-design the data model and some excellent well expressed answers were seen.

Another syllabus area which required the application of basic knowledge was answered less well. The stack data structure is well understood by candidates and the definition and completion of the pop and push algorithms was well answered. However part **(b)(i)** required the candidate to apply this basic understanding of how a stack is implemented to the practical task of the management of subroutine return addresses. Candidates are expected to be familiar with practical applications of the data structures in the syllabus: linked list, binary tree, stack and queue.

Accuracy is a key skill for the computer scientist. In **Question 3** part **(b)** the class names were given in the question rubric. Candidates should therefore use these exact names in the construction of their class diagram. Any identifier variations did not gain credit.

Question 1

In part **(a)(i)**, a minority of candidates provided the correct answer. Candidates were required to elaborate further when stating "a repeated group". The answers given in **(a)(ii)** testified to the fact that the candidate was not clear what was being repeated. Candidates need to express their answer which makes it clear that it was the group of attributes: class name, class level and class leader, which was being repeated for a single member number. Some candidates needed to show more understanding by describing particular data values, for example, the ClassLeader value of DAV being repeated.

Parts **(b)(i)** and **(b)(ii)** were well answered. Most candidates gave the correct number of rows in **(b)(iii)**. In part **(b)(iv)** a majority stated the correct one-to-many relationship. However, many-to-many was a popular, but incorrect, alternative answer given. Part **(b)(v)** is another example where the standard of response seen has noticeably improved with the correct description of the MemberNo primary key in the MEMBER table linking to a foreign key in MEMBERCLASSES well expressed.

A small number of candidates correctly identified the compound key required for the MEMBERCLASSES table for part **(c)(i)**. For parts **(ii)** and **(iii)** knowledge of partial dependencies was exhibited by many and identifying the need for a CLASS table was often successful. Some candidates incorrectly suggested the additional table should be for the class leader. Part **(d)** was answered well by many candidates but the distribution of attributes in the MEMBER and FEE tables and appropriate primary keys sometimes proved challenging.

Question 2

Most candidates knew the meaning of the vertical character in BNF rules. This was also the case with identifying and explaining recursion in part **(b)**. Candidates must appreciate when the term recursion is used with procedures and functions in a high-level language, it has a different meaning.

In part **(c)** candidates found little difficulty in identifying valid and invalid packets. A small number of candidates gained the second mark by giving a clear listing of the rules used to arrive at the answer. For example, only the most able candidates could correctly identify that rules 1 and 2 needed to be used three times in part **(iii)**. A minority of candidates understood that the amended rules in part **(iv)** meant that there were two types of packet. The majority of candidates seemed to think that the new rules meant that a string

could be a combination of letters and hashes and amended their rules accordingly. Resourceful candidates realised that a definition of the hash character was required, then a recursive 'hash string' similar to the given rule for <string>.

Question 3

A minority of candidates provided fully correct answers to part **(a)** with candidates mostly scoring a few marks only. Few correct answers of 'property' for the final term were seen.

Candidates were usually more successful with part **(b)**, but only the most able candidates correctly showed inheritance between the classes on the class diagram. The majority scored well on identifying the properties for each class. Candidates should appreciate that a 'double precision' data type for a currency value is inappropriate.

Question 4

Candidates found few problems in describing the operation of a stack, but only a very small number of candidates correctly completed the diagram in part **(b)**. Entries placed on the stack by candidates showed a lack of understanding of the process of handling the return addresses for procedure calls.

Completion of the missing pseudocode for parts **(b)(ii)** and **(c)** was much better answered and full marks for each procedure were not uncommon.

Question 5

In the answers to parts **(a)** and **(b)**,the hexadecimal value was less likely to be correct. In part **(b)**, –127 was an incorrect answer that was common.

Despite being asked on previous papers, answers in part **(c)** were often either vague or simply incorrect; "Less space, less memory, fewer bytes, easier to understand, possible to represent larger numbers". The answer expected was a statement that the hexadecimal representation will use fewer digits. Some candidates expanded on this by stating that a group of four binary digits will be condensed to a single hexadecimal digit.

For part **(d)**, successful completion of the addition was usually correct, even if the earlier translation of denary to two's complement was unsuccessful. Overflow and its recognition was understood by many candidates although some candidates treated the summed byte as an unsigned integer and therefore incorrectly stated the addition actually gave 131.

Part **(e)(i)** was well answered with candidates successfully converting the 16-bit pattern to a denary number. For part **(e)(ii)**, "normalisation" often appeared as the explanation. Candidates need to understand that normalisation is an issue for real numbers, not a BCD representation. Candidates should understand that that zero is a valid BCD digit and therefore the pattern "0000" is permitted.

Question 6

In part **(a)**, the correct answer was given by a small number of candidates. There were a multitude of different, incorrect answers with DFD a popular choice. Candidates should understand the difference between the different types of chart, especially a systems flowchart and a program flowchart.

Full marks in part **(b)** were rare but the overwhelming majority of candidates scored some marks. Part **(c)** was generally well answered.

Question 7

In part **(a)**, answers often showed a lack of understanding of "media". Where correct media were identified, descriptions were often inadequate or not relevant.

The diagrams given for part **(b)** needed to be of a higher quality. The computer C4 rarely had its printer attached. Routers and modems often connected to only one shop and there was little recognition that Shop C's LAN employed a bus topology. There should have been two attainable marks for showing the cable terminators required on a bus network and the attachment of the file server to the cable. If a modem or router was drawn it often connected to 'nowhere' and did not gain credit.

In part **(c)**, candidates should understand that intranet content is provided from a web server. The use of a browser was more widely known. Answers to part **(iii)** often focused on the need for authorised access. Some candidates seemed to miss the fact that it was an intranet and based their answers on the benefits of a LAN with inappropriate answers such as the sharing of hardware resources.

COMPUTING

Paper 9691/33
Written Paper

General

There were signs of improvement in the standard of candidate responses for certain syllabus topics over previous years. The process of normalisation appears to be well understood and candidates were able to apply the general principle of Third Normal Form to the table designs given. Application of the theory was also required when candidates were asked to re-design the data model and some excellent well expressed answers were seen.

Completion of some pseudocode algorithm has been regularly asked for this paper and the standard of responses seen for the three stack routines in **Question 4** were of a high standard.

The stack data structure is well understood by candidates and the definition and completion of the pop and push algorithms was well answered.

Accuracy is a key skill for the computer scientist. In **Question 3** part **(a)** the five class names were given in the question rubric. Candidates should therefore use these exact names in the construction of their class diagram. Any class name identifier variations did not gain credit.

Question 1

In part **(a)(i)**, a minority gave a correct answer. Many candidates needed to further elaborate on the statement "a repeated group". The answers given in **(a)(ii)** suggested that that come candidates were not clear on what was being repeated. Candidates need to express their answer which makes it clear that it was the group of attributes, in this case, title, genre, release date and review date which was being repeated for a single reviewer.

Parts **(b)(i)** and **(b)(ii)** was well answered and anything less than full marks was rare. Most candidates gave the correct number of rows in **(b)(iii)**. In part **(b)(iv)** many candidates did not state the degree of relationship based on the order in the which the tables were given in the rubric (the relationship was many-to-one). Some candidates gained the mark by including the table names in their one-to-many description. Part **(b)(v)** is another example where the standard of candidate response seen has noticeably improved with the correct description of the ReviewerID primary key in the REVIEWER table linking to a foreign key in REVIEW well expressed.

In part **(c)(i)** most candidates identified Title as the primary key for the REVIEW table. For part **(ii)**, knowledge of the dependency between non-key attributes was well understood. A general explanation was expected for the first mark followed by a statement of which two non-key attributes were dependant. It was insufficient for the second mark to state 'Genre and Fee are dependent". The mark was secured for the statement "GendreFee is dependent on Genre". Part **(ii)** was well answered with recognition that the fee rates needed to be stored in a new third table.

Question 2

Candidates need to have some practical experience that drawing a syntax diagram is an alternative tool for expressing a set of BNF rules. Part **(a)** was not well answered by most candidates.

Explanations for the term 'recursive rule' were generally good for part **(b)**. Candidates must understand that the term recursion has different meaning when used with procedures and functions in a high-level language. Some candidates could not build on a good explanation for part **(i)** and then secure the mark for part **(ii)**, applying the definition to the given set of rules.

In part **(c)**, candidates found little difficulty in identifying valid and invalid product codes, but few answers to gain the second mark gave a clear listing of the rules used to arrive at their answer. For example, only the strongest candidates could correctly identify that in part **(iii)** rule 1 needed to be used three times.

Question 3

Candidates were successful with part **(b)**, with many candidates securing most of the available marks. Only the best candidates correctly showed inheritance between the classes on the class diagram. The majority of candidates scored well on identifying the properties for each class. Candidates should understand that a 'double precision' data type for a currency value such as the 'off-the-shelf' retail price was inappropriate.

The stronger candidates were able (as the stem for all parts of **(c)** required) to support their general explanation of OOP terms with reference back to a pseudocode statement from the class definition. A common error was to suggest that the ProjectID identifier was being used for an instance of the class.

Question 4

Candidates found few problems in describing the operation of a stack.

Completion of the missing pseudocode for parts **(b)** and **(c)(ii)** was well answered and full marks for each procedure were common. Similarly candidates were able to write the Pop procedure with no pointers as to its construction.

Question 5

In the answers to part **(a)**, the hexadecimal value was less likely to be correct.

For part **(b)**, successful completion of the addition was usually correct, even if the earlier translation of denary to two's complement was unsuccessful. Overflow and its recognition were understood by many candidates. Some candidates stated that the final representation was for –128 which could not be correct for the addition of two positive integers.

Part **(c)(i)** was well answered with candidates successfully converting the 16-bit BCD pattern to a denary number. For part **(ii)**, "normalisation" often appeared as the explanation. Candidates need to understand that normalisation is an issue for real numbers, not a BCD representation. Candidates should also understand that that zero is a valid BCD digit and therefore the pattern "0000" is permitted.

Question 6

In part **(a)**, the correct answer was given by a small number of candidates. There were a multitude of different and incorrect answers, with DFD a popular choice. Candidates should understand the difference between the different types of chart, especially a systems flowchart and a program flowchart.

Full marks in part **(b)** were rare but the overwhelming majority of candidates scored some marks. Candidates need to be able to transfer their understanding of the processes of program creation, interpretation, compilation and the translation of an assembly language program to a pictorial representation of the processes. The candidate's practical experience of program development may well be using an Integrated Development Environment (IDE). They should appreciate that its basic construction is the use of a text editor, error reporting, the translation process and the production of files.

Question 7

The diagrams given for part **(a)** needed to be of a higher quality. As stated in the rubric of the question, this was to be a bus network. There should have been two attainable marks for showing a single cable run with a cable terminator at each end. Candidates should understand that the provision of a print server requires a computer connected to the network cable which has a printer attached to the computer. Other hardware which would have gained credit included a file server, router, modem or a firewall, with a connection to the Internet.

For part **(b)**, there were few answers which secured the three available marks. The most popular answers were from candidates who realised that each user of the network must have a network account and so user names and passwords need to be managed by the network OS. The other popular answer was the management of the files on a shared file server.

In part **(c)**, candidates should understand that intranet content is provided from a web server and that content is then viewed using a web browser. Answers often focused on the need for authorised access. Some candidates seemed to miss the fact that it was an intranet and based their answers on the benefits of a LAN with inappropriate answers such as the sharing of hardware resources.

COMPUTING

Paper 9691/04

Project

General comments

This report provides general feedback on the overall quality of project work for GCE Advanced Level 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.

The projects submitted covered a wide variety of topics with better candidates showing evidence of researching a problem beyond their School or college life.

In order to have the full range of marks available to the candidate, the computing project must involve a third party client whose requirements are considered and clearly documented at all stages of the system development. Centres are reminded that the project work is designed to test the candidates' understanding of the systems life cycle. The requirements are clearly set out in syllabus ***section 4***, 'The Guidance on Marking the Computing Project' ***section 7.2*** acts as a useful checklist, for 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 A Level textbooks available for project work, which do not cover the full requirements of the CIE syllabus. Candidates who prepare their work only using these text books and not the syllabus for guidance often miss out vital sections of their reports; or complete unnecessary work for example feasibility studies and cost benefit analysis.

Centres must not allow their candidates to produce reports that match the requirements of the previous A Level Computing syllabus. This can mean that the work produced does not meet the requirements of some sub-sections, Nature of solution and Systems maintenance documentation. For other sub-sections, Installation and Evaluate the client's and users' response to the system, extra work is included that is not required by the current syllabus.

Project Reports and Presentation

As usual, the presentation of most of the reports was to a very high standard, with reports word-processed and properly bound. Candidates should ensure that only material essential to the report is included so that they only submit one volume of work. Candidates are reminded that only authentic letters from clients and/or users must be used to provide evidence for the Evaluation, Implementation, Investigation and Analysis sections. These letters could be scanned in to the project report but must not be re-typed/typed out by the candidates.

It is strongly recommended that the structure of the candidate's report follows that of the mark scheme set out in the current syllabus. Essential evidence should not be relegated to appendices. This allows both teachers at the Centres and Moderators to easily check that work for all sections has been included. It is also essential that the pages of the report are clearly numbered by the candidate.

Project assessment and marking

Nearly all Centres used the marking grid on pages 45-48 of the current syllabus to provide a breakdown of marks showing the marks given for each sub-section of the report. In order to aid the process of moderation, the completed grid should include references to the appropriate pages in the candidates' reports where evidence for each section can be found. Teachers should comment as to why they awarded the marks for

each section. Moderators have noticed that where there is a good commentary provided by a teacher the marking is usually very close to the agreed standard.

Section 3

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) Quality of report.

Most candidates set out their reports in the appropriate sections and made good use of illustrations including diagrams and screenshots. Less able candidates sometimes did not include page numbers in their reports, this meant that teachers could not clearly identify to the Moderator where evidence was to be found and those candidates were unable to cross reference items within their report.

(b) Definition Investigation and Analysis

(i) Definition - nature of the problem

This is a brief introduction for anyone who is unfamiliar with the organisation and the area under investigation. Most candidates described the organisation and many identified the methods used; more able candidates described the methods used, the origin of the data and indicated the form of this data.

(ii) Investigation and Analysis

In order to gain good marks candidates must clearly document client and user involvement in their investigation. Candidates need to consider carefully the evidence obtained from interviews, observation of the existing system and study of documents currently in use and then ask follow up questions to fill in any gaps in the knowledge obtained about the current system or requirements needed for the new system. Alternative approaches need to be discussed in depth as they would be applied to the candidate's proposed system.

The detailed requirements specification produced must be based on the information collected and include what the client needs the system to produce. Feasibility studies and cost benefit analysis are not required.

(c) Design

(i) Nature of the solution

The requirements specification set out in the analysis needs to be discussed with the client and a set of measurable objectives agreed. These objectives will then form the basis for the project evaluation.

Most candidates provided designs that included proposed data structures, layouts for input screens and reports required, better candidates used pseudocode and/or flowcharts to provide a detailed description of the processes to be implemented.

In order to obtain marks in the top two bands for this sub-section, candidates need to obtain evidence that their client has seen and commented on the design work, and then show what has changed as a result of these comments. Evidence from the solution is not required here. Gantt charts are also not required.

(ii) Intended benefits

In order to obtain good marks for this sub-section, candidates should describe the benefits of their intended system, not just provide a list of general statements that could apply to any system.

(iii) Limits of the scope of solution

Candidates should describe the limitations of their intended system including an estimate of the size of any files required, not just provide a list of general statements that could apply to any system. File sizing estimates should be based on information provided by the client.

Full marks for the design section cannot be awarded without candidates clearly supplying evidence for **(i)**, **(ii)** and **(iii)**.

(d) Software Development, Programming Testing and Installation

(i) Development

Evidence of development should include program listings of code written by the candidate, data structures used and evidence of tailoring of software packages. For top marks, the solution should have no logical flaws, match the design specification in **(c)(i)** and be annotated by the candidate. If evidence from implementation is included as part of the design then the development cannot be checked against the design specification.

(i) Programming

It is important that the programming code in this sub-section is written by the candidate and not produced as a result of tailoring a software package. Marks should only be awarded to code that has been written by the candidate.

Candidates need to show that they can apply the programming skills developed at AS level in Paper 2 to a real situation. This includes technical programming competence and ensuring that their program could be maintained by writing self-documented code.

(iii) 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, together with expected results for all tests. For top marks to be awarded, the test plan should clearly identify that all parts of the system have been tested. Many candidates only tested the validation and navigation aspects of their system, and omitted to test that their system did what it is supposed to do, for example production of reports. This omission meant candidates were unable to gain marks in the highest band for this sub-section.

(iv) Installation

Most candidates provided an implementation plan containing details of user testing, user training and system changeover.

For good marks to be awarded written evidence from the client and/or user(s) must be included in order to show that the system has been seen, used and tested, and the candidate's plans have been agreed.

Centres are reminded that appropriateness of structure and exploitation of available facilities are not required for this sub-section of the report.

(e) Documentation

(i) Systems Maintenance Documentation

This sub-section of the report is a Systems Maintenance document. Many candidates incorrectly included Technical Documentation. Please see the current syllabus for details of what should be included in this sub-section.

For top marks to be awarded the candidate must how explain adaptive maintenance could be undertaken for their system.

(i) User Guide

This section was completed to a good standard by most candidates. Centres are reminded that for full marks the candidate must include an index and a glossary only for the terms used in their User Guide. Glossaries that include items not mentioned in the user guide would be confusing for anyone reading the guide. For top marks, the User Guide needs to be complete and include details of how to install the new system, backup routines and a guide to common errors. Also good on-screen help should exist where this is a sensible option.

(f) Evaluation

Centres are reminded in order to gain high marks candidates need to provide a detailed evaluation that includes the content set out in the guidance for marking projects section of the syllabus.

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

Candidates need to consider each objective set out in **(c)(i)** and explain how their project work met the objective or explain why the objective was not met. Candidates should also indicate where the evidence, probably from testing or feedback from the users of the system, could be found in their report to support these conclusions.

(ii) Evaluate the client's and users' response to the system

A response must be provided directly from the client and user(s) showing that they have used the system, not just reported by the candidate. The candidate should then evaluate their client's and users' responses.

For evidence in this section to be awarded any marks, the candidate must include original letters, preferably on headed notepaper, signed by the client and not typed and/or composed by the candidate.

Centres are reminded that possible extensions and the good and bad points of their final system are not required for this sub-section of the report.