COMPUTING

Paper 9691/11
Written Paper

General comments

Although this was a new paper format, the standard of candidate's work was broadly similar to previous years.

Candidates and Centres are reminded that written papers are now scanned in and marked on computer screens by Examiners. Consequently, if a candidate writes the answer to a question on an additional page they must indicate VERY CLEARLY to the Examiner where their revised answer is to be found. If answers are "scrubbed out", the new answers must be very clear so that Examiners can easily read the text and award candidates the appropriate mark.

It was evident that a significant number of candidates are learning certain topics "parrot fashion". Questions which required an application of knowledge were overall less well answered. As this subject moves to a syllabus where more understanding and application of the syllabus topics rather than just simply learning definitions is required, candidates will need to change how they approach computing topics. This is a challenge which many Centres and candidates, of course, will enjoy.

Comments on specific questions

Question 1

(a) This was generally answered well but several candidates were giving very vague answers such as: "parts you can see or touch" which is an unacceptable answer at this level. The definitions of software were slightly better overall. *Hardware is the electronic parts of a computer system while software are the programs that run on the hardware.*

(b) This question caused few problems; however, a surprising number of candidates confused input and output and gave keyboard and barcode readers/scanners as examples of output devices.

(c) Frequently the answers given here referred to output **devices** and NOT **types** of output (e.g. sound/beep, receipt/hard copy) as was required. This was caused by careless reading of the question by a number of candidates.

(d) In part **(i)**, the examples of the use of DTP were generally satisfactory. However, the features of DTP were less well answered with some all too common very vague and general answers, such as: "can edit the data", "can save and print out the leaflet". In part **(ii)** many candidates confused presentation software with multimedia. Whilst good presentations do make use of multimedia, more general features would include: *use of slide transitions, hyperlinks to (for example) videos, use of animation and other multimedia features.*

Question 2

(a) Many candidates gave very general answers that did not really explain the role of the manager or the systems analyst e.g. "the manager and systems analyst must work together to find out what the problem is and to resolve it" – such answers do not really say anything of value. The important point here is that the manager must provide the knowledge and requirements of the business as they are the expert in how the business works whereas the analyst provides the knowledge of what is possible.

(b) The majority of candidates missed the point here and gave similar vague answers to those in part **(a)** e.g. “ask people/workers to see how well it works”, “check with the manager to see if he is happy”. A good answer would mention typical evaluation techniques such as black box testing, alpha testing, and so on.

Question 3

(a) This was reasonably well answered with reference to ASCII being by far the most common correct example. However, other acceptable factors such as *characters recognised by the computer, use of 8-bit (1 byte) codes etc.* were covered by many candidates.

(b) This was not as well answered as part **(a)**. Many candidates wrongly referred to it as being another form of ASCII. There were very few who offered examples (which would have been the best way to describe how integers are represented) and very few made any reference to 2’s complement to store negative integers. There were many very general answers such as “integers do not contain decimal points or fractions”, “an example of an integer is 147” – none of these types of answers gained any marks.

Question 4

(a) Candidates who took the advice given in the question to draw a diagram did considerably better than those who relied on text only.

(b) Many candidates understood the meaning of *hashing*; but seemed to struggle somewhat in part **(ii)** when trying to explain the concept of *clashes* and how the system deals with this. A significant number wrongly suggested that “clashes occur when 2 members have the same name and this clash could be overcome by writing a better hash algorithm”. Candidates need to understand that 2 different IDs can hash to the same value. When this happens there are different possible solutions, on of which is to read records sequentially from the hashed address until the correct ID is found.

Question 5

(a) The description of the *control unit* gave mostly 1 mark - usually for referring to the fetching of each instruction. Many answers were too general such as “the control unit fetches and decodes instructions” which omitted several key parts of the overall function of the control unit.

In the *memory unit* section, many candidates just described how RAM works (several also referred to ROM) and missed the key issues such as *stores programs/date* ***currently in use,*** *stores parts of the operating system* ***currently in use***.

The description of the ALU was slightly better but again “throw away” answers were again all too common such as “it does all the calculations and makes all the decisions” which indicated a total lack of understanding of how this unit works. As its name suggests it carries out arithmetic and logical operations.

(b) In general, this was well answered. Many candidates gained 3 or more marks here for answers which explained that a buffer is a temporary storage area and data is transferred from primary memory to hard disk via the buffer. When the buffer is full the processor can carry on with other tasks while the buffer is emptied. When the buffer is empty an interrupt is sent to the processor requesting more data to be sent to the buffer. There were some common errors such as “the hard disk sends an interrupt to the primary memory”, “buffers allow the hard disk to get on with other tasks” – all of which indicated some confusion among a number of candidates.

Question 6

This question proved to be very easy to a number of candidates. Several scored the maximum marks (of 6) and very few got fewer than half marks here. The only relatively common error was to see candidates adding up the 1s and giving an output of 0, 1, 1, 2.

Question 7

This question also proved to be fairly straight forward with many gaining 3 or more marks. Common errors where marks were lost included: "need to be careful of colour-blind people" (but gave no reason WHY this was an issue) and "text should follow the normal reading pattern of a human" (but did not indicate anywhere WHAT this normal reading pattern was).

Question 8

(a) It was very common to see "LAN works over short distances and WAN works over long distances" – a little too vague. Better answers explained that LANs are networks covering a single site, while WANs are networks connecting geographically remote nodes. It was also fairly common to see candidates misunderstand the term WAN and described a **wireless network** of computers. Generally, candidates do not seem to understand the concept of networks very well and misuse of a number of hardware terms was clearly evident (e.g. routers, hubs, switches, etc. were all very confused).

(b) Generally well answered but several candidates confused *parallel data transmission* with *parallel implementation*.

(c) This was well answered by many. A common error was "it was odd/not even" (with no reference to WHY).

Question 9

(a) This was reasonably well answered by many candidates. It is important that candidates understand that a single user operating system will only allow one user at a time to use the computer, but different users can use the computer at different times as each approved user will be identified by a user ID.

(b) The term *multi-user* caused considerable confusion here. Many candidates described networks, chat rooms, facebook, etc. Correct answers referred to several users using the same computer at the same time and the operating system will give each user a time slice of processor time in quick rotation.

COMPUTING

Paper 9691/12
Written Paper

General comments

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(c) Frequently the answers given here referred to output **devices** and NOT **types** of output (e.g. sound/beep, receipt/hard copy) as was required. This was caused by careless reading of the question by a number of candidates.

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(c) This was well answered by many. A common error was "it was odd/not even" (with no reference to WHY).

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(a) This was reasonably well answered by many candidates. It is important that candidates understand that a single user operating system will only allow one user at a time to use the computer, but different users can use the computer at different times as each approved user will be identified by a user ID.

(b) The term *multi-user* caused considerable confusion here. Many candidates described networks, chat rooms, facebook, etc. Correct answers referred to several users using the same computer at the same time and the operating system will give each user a time slice of processor time in quick rotation.

COMPUTING

Paper 9691/13
Written Paper

General comments

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A significant number of candidates are learning certain topics "parrot fashion". Questions which required an application of knowledge were overall less well answered. As this subject moves to a syllabus where more understanding and application of the syllabus topics rather than just simply learning definitions is required, candidates will need to change how they approach computing topics. This is a challenge which many Centres and candidates, of course, will enjoy.

Comments on specific questions

Question 1

(a) This was generally answered.

(b) Most candidates showed understanding of the term *storage device.*

(c) Most candidates answered this question well. However, a number clearly misread the question and gave examples of output *devices* rather than *types* of output.

(d) In part **(i)**, the examples of the use of DTP were generally satisfactory. However, the features of DTP were less well answered with some all too common very vague and general answers, such as: "can edit the data", "can save and print out the leaflet". In part **(ii)** the examples of the use of word processors were generally correct; however, as with DTP, the features given were just general and were not related to the use/application as requested in the question. The third part – use of spreadsheets - was slightly better with candidates showing a little more knowledge of this type of software.

Question 2

(a) Many candidates gave very general answers that did not really explain the role of the manager or the systems analyst e.g. "the manager and systems analyst must work together to find out what the problem is and to resolve it" – such answers do not really say anything of value. The important point here is that the manager must provide the knowledge and requirements of the business as they are the expert in how the business works whereas the analyst provides the knowledge of what is possible.

(b) The majority of candidates gave very poor, vague answers here e.g. "to check the new system works" or "to make sure it is easy to use". Candidates need to be aware that testing is important to the analyst to ensure that there is evidence that all objectives have been met or they may not get paid. Testing is also important to the manager to ensure that all objectives have been met or the system may prove unsatisfactory in the future.

Question 3

(a) This was reasonably well answered with reference to ASCII being by far the most common correct example. However, other acceptable factors such as *characters recognised by the computer, use of 8-bit (1 byte) codes etc.* were all covered by many candidates.

(b) This was not as well answered as part **(a)**. Many candidates referred to it as being another form of ASCII. There were very few who offered examples (which would have been the best way to describe how integers are represented) and very few made any reference to 2's complement to store negative integers. There were many very general answers such as "integers do not contain decimal points or fractions", "an example of an integer is 147" – none of these types of answers gained any marks.

(c) No real problems here although weaker candidates simply described what is *meant* by a Boolean value rather than that it could be stored as a single bit or byte..

Question 4

(a) This question was reasonably well answered with a large number of candidates gaining the mark for stating that new loan details are added to the end of the file.

(b) In part **(i)** a diagram would have been helpful in trying to describe how indexes would be used. Many answers were extremely vague e.g. "index is used to find the member file" – such responses do not answer the question adequately. Very few candidates knew how to answer part **(ii)**. Again a diagram showing how a check is made on index values to determine where the new ID number could be added would have been helpful.

Question 5

(a) Part **(i)** was generally well answered; however, a significant number of candidates thought permanent was the same as volatile (and temporary = non-volatile). These candidates generally confused the role of RAM and ROM. This manifested itself in parts **(ii)** and **(iii)** where they again confused what would be stored on ROM and RAM. However, as with part **(i)**, the second and third parts did not really cause the majority of candidates many problems.

(b) In general, this was well answered. Many candidates gained 3 or more marks here for answers which explained that a buffer is a temporary storage area and data is transferred from primary memory to hard disk via the buffer. When the buffer is full the processor can carry on with other tasks while the buffer is emptied. When the buffer is empty an interrupt is sent to the processor requesting more data to be sent to the buffer. There were some common errors such as "the hard disk sends an interrupt to the primary memory", "buffers allow the hard disk to get on with other tasks" – all of which indicated some confusion among a number of candidates.

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Question 7

This question also proved to be fairly straight forward with many gaining 3 or more marks. Common errors where marks were lost included: "need to be careful of colour-blind people" (but gave no reason WHY this was an issue) and "text should follow the normal reading pattern of a human" (but did not indicate anywhere WHAT this normal reading pattern was).

Question 8

(a) It was very common to see "LAN works over short distances and WAN works over long distances" – a little too vague. Better answers explained that LANs are networks covering a single site, while WANs are networks connecting geographically remote nodes. It was also fairly common to see candidates misunderstand the term WAN and described a **wireless network** of computers. Generally, candidates do not seem to understand the concept of networks very well and misuse of a number of hardware terms was clearly evident (e.g. routers, hubs, switches, etc. were all very confused).

(b) This was generally well answered with many candidates gaining more than half marks.

(c) This was well answered by many. However, it was all too common to see "the bits are added up and the sum checked at the other end" – this indicated a general lack of understanding of how check sums work: The bytes are sent as a block; the bytes are added up before transmission (ignoring the carry out of the byte); the result is sent with the data and compared with the result of the same calculation carried out after transmission.

Question 9

(a) This was reasonably well answered by many candidates showing understanding that multi-user operating systems allow many users to all use one computer, whereas a network operating system links many computers to share data and resources

(b) Again fairly well answered with many candidates showing they understood how batch processing worked.

COMPUTING

Paper 9691/21
Written Paper

General comments

This was the first time this paper had been examined, as it replaced the Practical Programming Project.

Candidates should have covered all the syllabus aspects whilst engaged in designing, writing and testing a piece of work similar to a programming project.

In the syllabus the paper is titled 'Practical Programming Techniques'. A proportion of the candidates could not write any programming code in a high-level language. Several could not name a high-level language.

On the other hand, nearly every candidate could correctly use a trace table and knew about finding the value of a factorial using recursion. The candidates who scored highly were the ones who could write blocks of code.

Comments on specific questions

Question 1

(a) This was well answered. The greatest anomaly was the candidates who gave the Boolean field more than one byte, sometimes much more. The question does not ask for a range in the size estimate. Answers within a sensible range were marked correct.

(b) Again mainly well answered. The main reason for not gaining all the marks was using 1000 as the value for a kilobyte.

(c) A small proportion of candidates could define the fields correctly in their chosen language, but very few could give a record header and a way of ending the definition. The answers implied that few candidates had defined a record when programming.

This was the first instance of candidates being asked to state what programming language they were using. Algorithm and pseudocode were frequent wrong choices. Others did not know the name of the language they were using. Some candidates chose one language and tried to give an answer in a different one.

(d) About half of the candidates wrote that validation was about getting a correct value entered, rather than a reasonable one; this lead to some strange tests in the second part. There are many possible correct answers.

(e) This was mainly correctly answered, particularly the first part. Some candidates used JobId > 1, rather than JobId >= 1, and many candidates did not keep the 2 conditions for Paid separate.

(f) Most candidates could answer this question to some extent. Many found it straightforward and gave examples of valid, boundary (both) and invalid values. Others repeated the type of value they were giving.

Question 2

(a) Both tables were correctly filled in. Nearly all candidates could perform this task.

(b) This was very similar to **Question 1(e)**, but about half the candidates who were correct in 1**(e)** did not write this correctly. Many wrote 'A' OR 'a' rather than 2 separate conditions.

(c) All parts of this question were well answered by most candidates.

(d) Most candidates knew that the ASCII code took some kind of numerical form, but had difficulty explaining how this numerical form is used for comparison.

In part **(iii)** many candidates realised that you have to work along letter by letter. Few candidates mentioned what the outcome would be if one word ended before the other.

Question 3

(a) Usually correctly answered, though some candidates wanted to put the individual letters as the initialising elements.

(b) A majority of candidates gained some marks here. Simple manipulations of 2-dimensional arrays are part of the syllabus. The main weakness was in not being able to declare the array. Most candidates could enter the initialising value to each element.

(c) This was the most challenging question on the paper. There are several different ways to answer it, often depending on the language being used.

Question 4

(a) The 2 parts here were the best answered questions on the paper.

(b) About a quarter of the candidates recognised that the function would repeat forever, or some similarly expressed problem.

(c) Many candidates organised the function to have a FOR loop, but did not change the form of the recursive call. Those who did get it correct are to be congratulated.

COMPUTING

Paper 9691/22
Written Paper

General comments

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In the syllabus the paper is titled 'Practical Programming Techniques'. A proportion of the candidates could not write any programming code in a high-level language. Several could not name a high-level language.

On the other hand, nearly every candidate could correctly use a trace table and knew about finding the value of a factorial using recursion. The candidates who scored highly were the ones who could write blocks of code.

Comments on specific questions

Question 1

(a) This was well answered. The greatest anomaly was the candidates who gave the Boolean field more than one byte, sometimes much more. The question does not ask for a range in the size estimate. Answers within a sensible range were marked correct.

(b) Again mainly well answered. The main reason for not gaining all the marks was using 1000 as the value for a kilobyte.

(c) A small proportion of candidates could define the fields correctly in their chosen language, but very few could give a record header and a way of ending the definition. The answers implied that few candidates had defined a record when programming.

This was the first instance of candidates being asked to state what programming language they were using. Algorithm and pseudocode were frequent wrong choices. Others did not know the name of the language they were using. Some candidates chose one language and tried to give an answer in a different one.

(d) About half of the candidates wrote that validation was about getting a correct value entered, rather than a reasonable one; this lead to some strange tests in the second part. There are many possible correct answers.

(e) This was mainly correctly answered, particularly the first part. Some candidates used JobId > 1, rather than JobId >= 1, and many candidates did not keep the 2 conditions for Paid separate.

(f) Most candidates could answer this question to some extent. Many found it straightforward and gave examples of valid, boundary (both) and invalid values. Others repeated the type of value they were giving.

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Question 4

(a) The 2 parts here were the best answered questions on the paper.

(b) About a quarter of the candidates recognised that the function would repeat forever, or some similarly expressed problem.

(c) Many candidates organised the function to have a FOR loop, but did not change the form of the recursive call. Those who did get it correct are to be congratulated.

COMPUTING

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Written Paper

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In the syllabus the paper is titled 'Practical Programming Techniques'. A proportion of the candidates could not write any programming code in a high-level language. Several could not name a high-level language.

On the other hand nearly every candidate could correctly use a trace table and knew about finding the value of a factorial using recursion. The candidates who scored highly were the ones who could write blocks of code.

Comments on specific questions

Question 1

(a) All candidates gained some marks in this part. The requirements were detailed in the question, but some of the designs were very sparse and some did not use the space sensibly.

Some layouts were excellent.

(b) Most of the trace tables were completed correctly.

(c) This was well answered. The greatest anomaly was the candidates who gave the Boolean field more than one byte, sometimes much more. The question does not ask for a range in the size estimate. Answers within a sensible range were marked correct.

(d) This was generally answered correctly.

(e) Most candidates knew what they had to do to make a more secure password. The strange thing then was that so many ignored the rules that they had just stipulated.

For example, in **(i)** the candidate had written 'Random, as random as possible, using letters, characters and numbers', and then in **(ii)** given a password of 'Computer_Studies'

(f) Again, most candidates tried to answer this question, but very few got the syntax of the language they were using correct. Candidates had some idea of the overall form of the construct, but little of the detail. None of the languages specified by candidates uses an assignment within the select, case or switch structure. Most candidates did. Those using C++ got into the greatest muddle.

Question 2

(a) Most candidates could give some form of null character. When it came to the second part, candidates could either declare the array or perform the assignment within a loop. They could rarely do both.

(b) There were many good attempts at this problem. The usual approach was to search the whole array, not stopping when the track name was found. Candidates went straight for a FOR loop when one of the other loops was required.

(c) This was usually well answered. It was not obvious why a Boolean field needed a large number of bytes, which was a common feature.

Question 3

(a) Nearly always correct, just a few candidates decided to add some extra modules.

(b) Just as **(a)**, nearly all correct.

(c) This question asked about programming techniques. Many candidates answered well, though a number gave design techniques as their answer.

(d) Nearly all candidates got into the sense of this question and gave a variety of answers with good references to the scenario.

(e) Most candidates had some idea of local variables and scope. A good response was 'By declaring the use of local variables. Local variables can be declared independently in different subroutines. They only have scope within that subroutine.' The same candidate wrote in part **(ii)** 'Program modules can be integrated into library routines and reused each time the module is needed without needing to check the variable names and rewriting the code each time.'

Candidates had to be sure of their knowledge to be able to be accurate in what they wrote.

Question 4

(a) Both parts were answered correctly by nearly all candidates.

(b) Relatively few candidates could see that the function would not end. It looks as though they could recognise the factorial function, but not fully how recursion works.

(c) Some candidates wrote a FOR loop to produce iteration, but continued to use a recursive call within that loop. The candidates that wrote a correct answer are to be congratulated.

COMPUTING

Paper 9691/31
Written Paper

General comments

There was no evidence that candidates had problems in attempting all the questions in the time available. If there is a single 'message' to take away from this paper it is the worryingly poor answers which were seen for **Question 8 b (ii)**. Very few candidates wrote anything which would be considered an algorithm and candidates need to make sure they come into the examination able to write an algorithm description in either some form of Structured English or pseudocode or represent the algorithm with a flowchart.

Comments on specific questions

Question 1

The standard of answers here was very varied. Some candidates did not appreciate what was meant by a bus and instead described special purpose registers. Other candidates were able to name the three main ones – data bus, address bus and control bus – but could not follow this up with a clear description for the second mark. Examples considered insufficient included "the data bus carried data" or "the address bus carries addresses".

Question 2

(a) There were several ways in which the candidates could score the two marks. Answers expected were that they are both low-level languages and there is a one-to-one correspondence between the instructions of each language.

(b) This was poorly answered. Some detail was expected here with a description of operation codes being looked up from a table to find the corresponding machine code and an explanation of how address labels would be processed during the assembly process.

(c) (i) Candidates appeared to understand this but answers were often poorly expressed; candidates might consider a diagram to help explain.

(ii) A wide variety with the standard of answers seen. There were some excellent answers; others mentioned the use of the Index Register but were then unable to describe how its contents are used.

(iii) Poorly answered. Answers often did little more that try and 'work it out' from the key word relative.

Question 3

The standard of answer was generally good with candidates able to describe the various forms of copper cabling, fibre optic and wireless. Better answers did as the question asked and made a clear statement about their comparative data transfer rates and ranges.

A few candidates scored zero as they did not pick up on the key words in the question of 'transmission media' and so gave instead a description of various networks which did not include the media used. Similarly, some candidates saw the word 'media' and followed this with a description of CD-ROMS, CD-Rs, etc.

Question 4

(a) This should have been an easy mark but candidates were often unable to give a definition which conveyed the idea of feedback – that each output must be produced fast enough that it will affect the next input.

(b) There were some poor answers to this question which demonstrated a complete lack of understanding of what exactly is the role of a sensor and actuator. Answers often contained statements such as "the sensors switch on the air-conditioning motor". What was required was the idea that temperature sensors continually send data measurements to the processor. The processor then makes a decision, which could result in the processor sending a signal to the actuator.

(c) Well answered; although often a correct application was not followed up with a clear explanation of why this was real-time. Computer/video gaming and booking reservation systems were the most popular answers seen.

Question 5

(a) Many candidates did not appreciate what is spooling and described in more general terms the issues associated with the speed mismatch between the processor and its peripheral devices. Candidates did realise that spooling involved the use of temporary storage but the use of this was unclear.

(b) (i) What was expected here was the suggestion that print jobs will be sent to the printer faster than the printer is able to output them, that it is crucial that printouts are kept separate from each other and that printouts must not get lost.

(ii) This was answered better than the previous two parts. Answers did describe the need for a queue which might or might not use priorities. The better candidate described the queue as containing a reference to each print job and not the print file itself.

Question 6

(i) It was clear from answers seen the candidates who had some practical experience of using SQL from a DBMS software. Those candidates earned – together with part **(ii)** – full marks.

(ii) Answers expected were that there are commands for the maintenance of the data in the database (insert, delete and amend) and for the production of queries.

Question 7

Answers were generally poor and some candidates were clearly confused as to what was required and, instead of simply computing the denary value, went into a narrative description of the bit pattern. Often in parts **(i)** and **(ii)** the minus sign was omitted.

Question 8

(a) (i) It was important here that candidates expressed themselves clearly. An answer which stated "a static data structure does not change" (which would score zero) is a very different answer to "the size of a static data structure cannot be changed". The second mark was awarded for an answer which stated that a dynamic structure's size was matched to the number of data items.

(ii) Good answers for the advantage included stating that the array allows for direct access to any element so that algorithms for tasks such as searching for an item are more straightforward. The most popular disadvantage was that a static structure could result in the wastage of memory space.

(b) (i) Very few answers gave a table containing two columns showing the data value and the array subscript pointer; most answers showed the conceptual linked list which resulted. The nodes were either drawn in arrival order (considered a better answer) or alphabetical order but either approach was able to score the full five marks. However, it was disappointing to see many diagrams where: there was no 'Start' pointer; where the pointers had no arrowheads, where the supposed last item seemingly pointed to another item labelled 'End' or similar; where there was no indication of a 'Free space' list of locations.

(ii) See the comments under the General introduction. Many candidates described how a named new item e.g. JIM would be inserted into the list of items given in part **(i)**. This does not constitute an algorithm.

Question 9

(a) Well answered by the majority of candidates. Candidates appreciated that reverse Polish does not require the use of brackets or any use of rules of precedence.

(b) A wide variety of answers seen. The resourceful candidate drew a number of stacks and was able to show the step-by-step changes to its contents. Credit was given to the candidate who was not able to illustrate the use of a stack but did show the correct final infix for the given expression.

Question 10

(i) Answers for all parts of this question generally demonstrated a sound understanding of relational database design. The majority of answers scored maximum marks.

(ii) Some candidates were ahead of themselves and correctly stated this was a 'many-to-many' relationship but then drew the diagram including a third intermediate entity.

(iii) Well answered. Candidates stated that it was not possible to implement a many-to-many relationship and that a link table was needed which would then require a new one-to-many and many-to-one relationship. However candidates were often unable to gain the final mark by stating how these new relationships would be formed by the use of foreign keys.

Question 11

(a) The difference between interpreted and compiled code was generally well understood and there were many ways in which the three marks could be scored. Common incorrect statements seen included vague statements such as - "the compiler is faster" – "the interpreter produces executable code" – "the compiler error messages are not very helpful".

(b) (i) Very few candidates were able to score two marks. The idea that the MAR will receive the contents of the Program Counter were common, but few answers were able to state that for an instruction such as a 'jump' instruction the MAR would have copied to it the operand part of the Current Instruction Register contents.

(ii) This was very poorly answered. The straightforward mark was for stating that the MDR is loaded with a value from some main memory location. Again candidates did not appreciate that the MDR will be needed following the decoding of an instruction such as 'Store' when the contents of the ALU are loaded to MDR.

Question 12

Well answered with candidates often able to present a full discussion of the issues and their solution. Encryption, digital signatures, passwords, anti-virus software, firewalls and the setting up of permissions for the use of particular software/data by certain users only were all popular answers. Credit was also given to candidates who were able to describe that the general computing principles addressed here were those of authentication and authorisation.

COMPUTING

Paper 9691/32
Written Paper

General comments

There was no evidence that candidates had problems in attempting all the questions in the time available. If there is a single 'message' to take away from this paper it is the worryingly poor answers which were seen for **Question 8 b (ii)**. Very few candidates wrote anything which would be considered an algorithm and candidates need to make sure they come into the examination able to write an algorithm description in either some form of Structured English or pseudocode or represent the algorithm with a flowchart.

Comments on specific questions

Question 1

The standard of answers here was very varied. Some candidates did not appreciate what was meant by a bus and instead described special purpose registers. Other candidates were able to name the three main ones – data bus, address bus and control bus – but could not follow this up with a clear description for the second mark. Examples considered insufficient included "the data bus carried data" or "the address bus carries addresses".

Question 2

(a) There were several ways in which the candidates could score the two marks. Answers expected were that they are both low-level languages and there is a one-to-one correspondence between the instructions of each language.

(b) This was poorly answered. Some detail was expected here with a description of operation codes being looked up from a table to find the corresponding machine code and an explanation of how address labels would be processed during the assembly process.

(c) (i) Candidates appeared to understand this but answers were often poorly expressed; candidates might consider a diagram to help explain.

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(a) This should have been an easy mark but candidates were often unable to give a definition which conveyed the idea of feedback – that each output must be produced fast enough that it will affect the next input.

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seemingly pointed to another item labelled 'End' or similar; where there was no indication of a 'Free space' list of locations.

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(i) Answers for all parts of this question generally demonstrated a sound understanding of relational database design. The majority of answers scored maximum marks.

(ii) Some candidates were ahead of themselves and correctly stated this was a 'many-to-many' relationship but then drew the diagram including a third intermediate entity.

(iii) Well answered. Candidates stated that it was not possible to implement a many-to-many relationship and that a link table was needed which would then require a new one-to-many and many-to-one relationship. However candidates were often unable to gain the final mark by stating how these new relationships would be formed by the use of foreign keys.

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Well answered with candidates often able to present a full discussion of the issues and their solution. Encryption, digital signatures, passwords, anti-virus software, firewalls and the setting up of permissions for the use of particular software/data by certain users only were all popular answers. Credit was also given to candidates who were able to describe that the general computing principles addressed here were those of authentication and authorisation.

COMPUTING

Paper 9691/33
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General comments

There was no evidence that candidates had problems in attempting all the questions in the time available. If there is a single 'message' to take away from this paper it is the worryingly poor answers which were seen for **Question 8 b (ii)**. Very few candidates wrote anything which would be considered an algorithm and candidates need to make sure they come into the examination able to write an algorithm description in either some form of Structured English or pseudocode or represent the algorithm with a flowchart.

Comments on specific questions

Question 1

Most candidates scored on this question. Key points which were rarely seen were the concept that an array processor would require the use of several ALUs and that a maths processor is effectively an additional processor which works alongside the main processor.

Question 2

(a) Candidates with practical experience of writing and compiling separate program modules would be familiar with the role of a linker. Candidates generally scored well on this question appreciating that the key role of the loader would be to resolve any potential address conflicts.

(b) (i) Candidates appeared to understand this but answers were often poorly expressed; candidates might consider a diagram to help explain indirect addressing.

(ii) A wide variety with the standard of answers seen. There were some excellent answers; others mentioned the use of the Index Register but were then unable to describe how its contents are used in forming the address to be used.

Question 3

Well answered with candidates often able to present a full discussion of the issues and their solution. Encryption, digital signatures, passwords, anti-virus software, firewalls and the setting up of permissions for the use of particular software/data by certain users only were all popular answers. Credit was also given to candidates who were able to describe that the general computing principles addressed here were those of authentication and authorisation.

Question 4

(a) This should have been an easy two marks but candidates were often unable to give a definition which conveyed the idea of feedback – that each output must be produced fast enough to affect the next input.

(b) There were some very poor answers to this question. It was often not clear what type of sensor was being used and answers often described the sensor doing something such as activating the actuator. What was expected was the concept of a data signal being received by a processor and then acted upon.

Question 5

(a) Most candidates were able to describe that virtual memory involves an area of the secondary storage being used as main memory.

(b) Some candidates latched on to the word "segment" and so incorrectly proceeded to describe a modular approach to program development. The question clearly stated "to manage the memory" and answers therefore required a description of the available memory being divided into fixed or variable size partitions and the way that programs would be scheduled from the pool of waiting programs and a suggestion of strategies which could maximise the available memory resource. Very few candidates followed the suggestion of illustrating this with a supporting diagram.

Question 6

(i) It was clear from answers seen those candidates who had some practical experience of using SQL from a DBMS software. Those candidates earned – together with part **(ii)** – full marks.

(ii) Answers expected were that there are commands for the maintenance of the data in the database (insert, delete and amend) and for the production of queries.

Question 7

(a) Generally well answered with a variety of different methods used to compute the binary.

(b) Again well answered. The request in the question stem "Show your working" was intended to suggest that the carries be shown at each stage of the addition. Candidates often did not do this but were still able to secure full marks for a correct final answer.

Question 8

(a) (i) It was important here that candidates expressed themselves clearly. An answer which stated "a static data structure does not change" (which would score zero) is a very different answer to "the size of a static data structure cannot be changed". The second mark was awarded for an answer which stated that a dynamic structure's size was matched to the number of data items.

(ii) Most answers gained one mark only stating that the linked list will only use memory required matched to the number of items in the stack at any one time, or stating that an array could effectively waste space.

(b) (i) Most candidates scored the maximum marks.

(ii) See the comments under the General introduction. Many candidates described how a named new item e.g. JIM would be inserted into the binary tree data given in part **(i)**. This does not constitute an algorithm.

(iii) Most candidates were clear that a node which had descendants would be the problem case when deleted but were often unable to clearly express this. Few answers stated that deleting a leaf node would require only a pointer change to one of the nodes and have no other effect on the tree. Strategies which gained credit were: the above description of a leaf node; a complete reorganisation of the tree; or better, the reading of the descendant nodes to say a file and then reading them one after the other and using the existing 'insert to tree' routine.

Question 9

(a) Well answered by the majority of candidates. Candidates appreciated that reverse Polish does not require the use of brackets or any use of rules of precedence.

(b) (i) (ii) Generally well answered. Candidates were able to draw the tree and then use this to compute the infix expression.

Question 10

(i) Answers to all parts of this question generally demonstrated a sound understanding of relational database design. The majority of answers scored maximum marks. Some candidates incorrectly stated the relationship as 'one-to-many'.

(ii) Some candidates were ahead of themselves and correctly stated this was a 'many-to-many' relationship but then drew the diagram including a third intermediate entity.

(iii) Well answered. Candidates stated that it was not possible to implement a many-to-many relationship and that a link table was needed which would then require a new one-to-many and many-to-one relationship. However candidates were often unable to gain the final mark by stating how these new relationships would be formed by the use of foreign keys.

Question 11

(a) The difference between interpreted and compiled code was generally well understood and there were many ways in which full marks could be scored. Common incorrect statements seen included vague statements such as - "the compiler is faster" – "the interpreter produces executable code" – "the compiler error messages are not very helpful".

(b) Very few candidates were able to score full marks. The idea that the Program Counter is continually incremented was understood. Few answers were able to state that for an instruction such as a 'jump' instruction the PC would have copied to it the operand part of the Current Instruction Register contents.

Question 12

Well answered with candidates able to describe both the hardware components and communications media which would be used. Candidates sometimes described a component e.g. a router, but did not follow this with a description of the general role of a router or, what its specific role would be in the context of the given scenario. Candidates need to appreciate that in a question which states "Discuss ..." more is expected than just a list of components or media.

COMPUTING

Paper 9691/04
Project

Key message

Reports should not consist of more than 250 pages. Teachers should encourage candidates to choose evidence carefully. When producing databases, candidates should build these from scratch and not use templates provided by the software. Technical documentation should show tables, forms, queries and reports in design view and only program code **written by the candidate** should be listed. Technical documentation should not contain any pages automatically produced from software such as Microsoft Access Database Documenter.

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 again 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 system 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 both teachers and candidates, setting out the expected contents of each section.

Centres are reminded that this guidance and the marking scheme have changed in 2011. Please use the up-to-date A Level Computing Syllabus for guidance on the project.

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. Candidates who prepare their work only using text books and not the syllabus for guidance may miss out vital sections of their reports; or complete unnecessary work e.g. feasibility studies and costings.

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. However, candidates should ensure that only material essential to the report is included so that there is only one volume of work submitted per candidate. Candidates are reminded that only authentic letters from end users must be used to provide evidence for the Evaluation, Implementation, Investigation and Analysis sections; these letters must not be 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 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 essential that the pages of the report are clearly and consecutively numbered by the candidate.

From 2011 there are 3 marks available for the quality of reporting, see page 36 of the 2011 syllabus.

Project assessment and marking

It was pleasing to see that most Centres used the marking grid on pages 48-51 of the syllabus to provide a breakdown of marks showing the marks given for each sub-section of the syllabus. However, the completed grid should also include references to the appropriate pages in the candidates' reports where evidence for each section can be found.

***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.

(b) Definition Investigation and Analysis

(i) Definition - nature of the problem

Most candidates described the organisation and the methods used but only the better candidates identified the origins and form of the data.

(ii) Investigation and Analysis

In order to gain good marks candidates must clearly document client and user involvement and clearly state agreed outcomes. Candidates need to consider carefully the evidence obtained from interviews, observation of the existing system and user documents, and then ask follow up questions to fill in any gaps in the knowledge obtained about the current system or requirements for the new system. Also alternative approaches need to be discussed in depth and also applied to the candidate's proposed system. A detailed requirements specification should be produced based on the information collected, this must include the specific requirements of the system to be produced and not just concentrate on hardware and software.

This sub-section of the report remains the same as in previous years. However Centres are reminded that a distinction has been made between the 'client', who requires the new system and the day-to-day 'users' of the system. In many cases the client may also be a user of the system.

(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. Evidence from the solution is not required here

(ii) Intended benefits

Candidates should describe the benefits of their intended system, not just 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 a list of general statements that could apply to any system.

Full marks for this section cannot be awarded without candidates clearly supplying evidence for **(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.

(ii) Programming

The program listing of code **written by the candidate** should be self-documenting showing the following:

- Meaningful identifier names
- Indentation and formatting to show the control structures used
- Use of the programming language's commenting features so that the logic of the solution can be followed
- Technical competence (see 2.4 for features expected)

Automatically produced code is not creditworthy.

(iii) Testing

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. The test plan should clearly show 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 the system did what it is supposed to do, thus not being able to gain marks in the highest band for this section.

(iv) Installation

It was pleasing to see more candidates providing a detailed installation plan that contained details of user testing, user training and system changeover for their system. However, for good marks to be awarded, there should be evidence to show that the system has been seen and used and these plans have been agreed with the client.

(e) Documentation

(i) Systems Maintenance Documentation

The standard of work provided for this section was high, but only the very best candidates were able to obtain top marks by fully annotating their documentation.

(ii) User Documentation

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, and the guide needs to be complete including 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 again reminded that, in order to gain high marks, candidates need to provide a detailed evaluation that included the content set out in the guidance for marking projects section of the syllabus. Many candidates provided scant evidence for this section; if this is the case then there are few marks that can be awarded.

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

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

Candidates need to consider each objective set 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

Centres are reminded that this response needs to be clearly provided 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 creditworthy, any original letters included must be on headed notepaper, signed by the client and not typed and/or composed by the candidate. Questionnaires, emails and interviews must be authenticated if used for client and/or user feedback.