CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN ADVANCED PROFICIENCY EXAMINATION MAY/JUNE 2006

COMPUTER SCIENCE

COMPUTER SCIENCE

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

MAY/JUNE 2006

INTRODUCTION

This is the sixth year of open examinations for Unit 1 and the fifth year for Unit 2. There were three examination papers in both units, namely, Paper 01, Paper 02, and Paper 03. In each unit, Paper 01 and Paper 02 were examined externally by CXC while Paper 03, the Internal Assessment, was examined internally by teachers and moderated by CXC.

In each unit, Paper 01 consisted of short-answer questions that were designed to test candidates' breadth of coverage of the syllabus. On the other hand, Paper 02 consisted of essay-type questions that were designed to test their depth of understanding of the syllabus. Thus, candidates were expected to show deeper insight and understanding of the topics examined in Paper 02.

In each unit, Paper 01 consisted of three sections, each one corresponding to a module of the syllabus. There were five compulsory questions within each section, and each question carried 10 marks. The maximum amount of marks that could be obtained in Paper 01 was therefore 150.

Similarly, Paper 02 of each unit consisted of three sections, each one corresponding to a module of the syllabus. There were two questions within each section, and each question carried 30 marks. Candidates were expected to answer one question from each section. The maximum amount of marks that could be obtained in Paper 02 was therefore 90.

The individual contributions of Paper 01, Paper 02, and Paper 03 to the final grade remained 50 per cent, 30 per cent, and 20 per cent, respectively.

GENERAL COMMENTS

In general, performance on both units of the syllabus has continued to improve. In Unit 1, more than half of the candidates are now obtaining grades I to III. In Unit 2, more than 40 per cent of the candidates are now obtaining grades I to III. However, the performance on the School Based Assessment should have been better. Better performances on the SBA should lead to better overall performances on both units as well as better performances on the theory papers. Candidates need to maximize the opportunity to get higher marks on the SBA.

Even though the performance in Unit 2 has improved, there is still concern about the level of programming ability being demonstrated in Sections B and C of both written papers. Candidates continue to find it extremely difficult to write even simple programs, in both the imperative and object-oriented programming languages. Teachers are encouraged to have several programming labs and exercises done with the candidates.

As recommended last year, candidates are encouraged, as part of their examination technique, to read questions carefully before answering, and to respond with sufficient detail that is commensurate with the marks indicated in the question.

GENERAL COMMENTS

UNIT 1

In general, performance on both units of the syllabus has continued to improve. In Unit 1, more than half of the candidates are now obtaining grades I to III. In Unit 2, more than 40 per cent of the candidates are now obtaining grades I to III. However, the performance on the School Based Assessment should have been better. Better performances on the SBA should lead to better overall performances on both units as well as better performances on the theory papers. Candidates need to maximize the opportunity to get higher marks on the SBA.

Even though the performance in Unit 2 has improved, there is still concern about the level of programming ability being demonstrated in Sections B and C of both written papers. Candidates continue to find it extremely difficult to write even simple programs, in both the imperative and object-oriented programming languages. Teachers are encouraged to have several programming labs and exercises done with the candidates.

As recommended last year, candidates are encouraged, as part of their examination technique, to read questions carefully before answering, and to respond with sufficient detail that is commensurate with the marks indicated in the question.

DETAILED COMMENTS

UNIT 1

PAPER 01

SECTION A – Components of Computer Systems

Question 1

This question tested how a UPS could help protect a computer (part (a)), the concept of port connectivity (part (b)) and the use of satellites as a transmission medium (part (c)). Several candidates obtained full marks in this question. However, many candidates ignored the marks available for part (a) and just wrote one point. A good response for part (a) would have mentioned that a UPS gives users time to close applications and save their work. Part (b) was generally well answered with many candidates saying that port connectivity had to do with advances in port design and cable types. For part (c), some candidates failed to mention that satellite signals propagated to space and then to earth.

Question 2

This question tested candidates' knowledge of the instruction set of a computer, client/server software and peer-to-peer networks. Some candidates thought that the instruction set was the programming language statements of a particular language e.g. Pascal. For part b(iii), some candidates did not know that the client

makes a request which the server attempts to service in the specific applications chosen. For part 2(a), a good response was 'the instruction set of a computer refers to the complete set of instructions which are hard-wired into the micro-processor and which defines the set of instructions the computer will understand and be able to execute'.

Question 3

Question 3 looked at features of disk management software, memory management in an operating system, multitasking and multiprocessing. Responses for this question were generally good and many candidates scored full marks. Weaker candidates mixed up 'multitasking' and 'multiprocessing' in part (c).

Question 4

This question required the candidates to know about features provided by network operating system software as well as two utilities typically present in system software. The question attracted some of the best responses in the examination. Candidates displayed a sound knowledge of most features provided by network operating system software. Weaker candidates could explain either none or only one of the utilities typically present in system software.

Question 5

In this question, candidates had to compare extranets to the Internet, explain the term 'capacity of a storage device', explain 'access speed of a storage device' and explain 'portability'. Except for parts a(i) and a(ii), most of the other parts were generally handled well. In part (a), some candidates confused 'intranet' with 'extranet'. Part b(i) which referred to the capacity of a storage device was well answered, with some candidates giving values of actual device capacities e.g. 100 MB.

SECTION B – Application of Computers

Question 6

In this question, candidates had to demonstrate knowledge of expert systems, data warehouses and data mining. This question was generally poorly done. In Part (a), most candidates did not know what an expert system was. An expert system stores knowledge of a limited domain in the form of rules and makes inferences based on those rules, similar to a human expert. Also, many could not describe data warehouses. However, Part b(ii) was answered better than Part (b)(i).

Question 7

This question examined monitoring and control systems, user interfaces and suitability of a computer application for an organization. Most candidates were not familiar with monitoring and control systems as tested in Part (a). Monitoring and control systems use computer technology to track/monitor processes and take certain courses of action if problems occur. They are typically present in many industrial applications. Parts (b) and (c) were well-answered.

Question 8

This question tested candidates' knowledge of data security, system back-up and real time updating of files. Most candidates answered Part (a) fairly well; however some did not describe, but rather just listed,

the main points. There are logical and physical approaches to data security. In the logical approach, programs can have password protected access. In the physical approach, computers can be placed in enclosed/protected areas. In Part (b), many candidates explained system back up but did not give an example. An example could be a secretary backing-up her word-processing files on a file server at the end of the day. Part (c) was done well by most candidates.

Question 9

This question started by asking how firewalls and encryption could protect an organization's data from unauthorized access. The other parts required a suggestion of ways in which computers could affect a financial organization and the distinctions between batch and on-line processing. Responses for this question were generally of a poor quality although some candidates scored full marks. Part (a) was generally answered fairly well. One candidate stated that firewalls 'helped protect an organization's data from unauthorized access'. However, this was already stated in the question and gained no marks. Part (c) contained important types of processing used in information technology but many did not know the meaning of the terms. Batch processing is where transactions are gathered together into a collection and are used to update master files at a later time. Online processing is where transactions are executed and changes are made to master files almost immediately.

Question 10

This question examined telecommuting and the ways in which computers help us entertain ourselves and facilitate communication. In Part (a), many candidates mixed up telecommuting and teleconferencing. Telecommuting is where employees can work from one location and communicate their work to the main office at another location using computer and telecommunication technologies. Parts (b) and (c) were well-answered.

SECTION C – Computer-based Problem Solving

Question 11

Part (a) of this question asked for similarities and differences between information stored on CD-ROM and in a digital library. Part (b) pertained to sources of information relevant to monitoring the progress of a hurricane. Part (a) was generally well answered with many candidates scoring full marks. For Part b(i), approximately half of the responses stated that newspapers were a good source due to the fact that it was updated regularly. However, it should be noted that newspapers are not updated regularly enough to monitor a hurricane. Parts (b)(ii) and b(iii) were generally well answered.

Question 12

This question was about information and characteristics of information sources related to making a financial decision. The businessman got his initial information from an anonymous email. Part (a) was not answered very well as candidates did not incorporate certain key words in their responses which should have related to information characteristics.
For Part (b), many candidates *listed* sources rather than *listing* and *explaining* them.

Question 13

This question looked at data sources and their characteristics. This question was a fairly simple question, but many candidates answered it poorly. Questionnaires were a good source of information in this case. Part (b) attracted some fairly good responses.

Question 14

For this question, candidates had to distinguish between DVD and CD ROMs as information sources. Part (b) asked about sources of information based on a scenario. Overall, this question was answered well and some candidates scored full marks. Part (a) was well answered. In Part (b)(i), some candidates used sources that were not relevant to Francis' situation. Three good sources of information for Francis were newspapers, magazines and the Internet.

Question 15

This question was based on software tools appropriate for different tasks performed by a toy store at Christmas. For Part (a), most candidates did not give a very suitable response and hardly anyone obtained full marks. Spreadsheet was a good response for Part (a). In Part (b), most candidates were able to identify the software tool, but there were hardly any reasonable responses for precautions which should be taken. One precaution was to keep back-up hard-copies of the presentation.

PAPER 02

SECTION A – Components of Computer Systems

Question 1

Part (a) required candidates to differentiate between several pairs of computer terms. Part (b) examined how an operating system could execute three processes at the same time. Part (c) tested candidates' knowledge of the data requirements and communication requirements of a package.

a) Generally, candidates did not differentiate between the two terms given. Many candidates defined each term separately without highlighting what made them different. For Part (a) (iii), a good response was 'cache memory is much faster than RAM and also more expensive'.

b) Clearly, most candidates knew that the operating system could handle and execute many processes at the same time. However, only brief explanations of how this was done were given by most candidates. A good response should have contained a discussion of round-robin allocation of time-slices, preemption of processes, interrupts and saving and reloading of process states.

c) Some candidates seemed confused in Part (i) and spoke about qualities of information. They did not read the scenario carefully and answer based on the situation presented. Many also spoke about "database attributes". More focus should have been placed on the fact that different departments were involved.

Question 2

Part (a) of this question presented a diagram and candidates were asked to identify the network topology illustrated. Part (b) asked for two advantages of fibre-optic cable over coaxial cable, Part (c) asked about the OSI model for computer communication and Part (d) looked at data transmission in bus and ring networks. Overall, this question was answered very well in most instances. For Part (c), some candidates did not focus on the key functions of the various layers of the OSI model. For example, the main role of the network layer is to route packets although there are other subordinate functions.

SECTION B – Application of Computers

Question 3

Part (a) required candidates to use examples to distinguish between data loss and data corruption. Part (b) examined levels of management and the associated information systems. Part (c) asked about precautions to minimize data loss in the event of a hurricane. Overall, the question was generally well answered although it was not a popular question. In Part (b)(ii), many candidates knew of the different types of information systems but had problems relating them to the levels of decision making. Parts (a), (b)(i) and b(iii) were fairly well done as were Parts 3(c)(i) and 3(c)(ii). Some weak responses for 3(c)(ii) were UPS, surge protectors and covering computers with plastic bags. One precaution was 'to move data to a safe storage location in the building: the safe storage location could be a sturdy cabinet that was waterproof and located in a sturdy room'.

Question 4

This question looked at techniques to deter unauthorized access to a web based system, software piracy, ways in which an organization could benefit from automation and three ways in which computer applications have affected the job market. The question was very popular. Parts (a) and (b) were satisfactorily done.

Many responses for Parts (c) and (d) were similar. For Part (c), some responses were too simple and involved expressions like "more work done", "less salaries to pay out" etcetera. There was a clear indication that some candidates misinterpreted Part (d). Also, positive and negative ways in which computers affect the job market should have been considered for

Part (d). For example, new jobs have been created, for example,. software developer and computer applications have caused displacement of a number of clerical employees in some organizations.

SECTION C – Computer-based Problem Solving

Question 5

Part (a) of this question presented a scenario and candidates had to describe three other sources of information to confirm information found on a web site. A discussion of evaluative criteria for acceptance or rejection of information was then required. Part (b) asked for the benefits to an organization of using the Internet as an information source and part (c) required a discussion of three characteristics of information sources. Part a(i) was fairly well answered. Good responses for part a(i) included valid information from other related sources, Web sites, experts in the financial sectors, articles in reviewed magazines, newspaper articles and television programmes. Part a(ii) was badly done. Very few candidates were able to identify all

three evaluative criteria correctly. Most candidates did not correctly relate their explanations to the stated criteria. Many candidates did not focus on "using the Internet as an information source", but rather discussed the use of the Internet as a way to promote their business. Candidates should pay attention to what the question is specifically asking and read questions carefully. Part (c) was not well done. Many candidates were not clear about the definition for each term and hence were not able to obtain all three marks for each concept.

Question 6

The majority of the candidates attempted this question which was based on a University scenario that required the use of software tools for different tasks. Part a(i) was generally well-answered. A minority of candidates did not obtain the mark due to lack of familiarity with the names of appropriate software tools. For example, some cited Microsoft ® Excel as an example of a database software tool. Part a(ii) was fairly well answered although many candidates failed to explain their answers sufficiently in order to obtain full marks. Candidates need to pay attention to specific technical terms as it relates to the particular software tool. Parts b(i) (ii) had similar problems to Parts a (i) and a (ii). In Part (c), a minority of candidates obtained all six marks. Most candidates did not include in their response, the 'retrieval of information from the database and spread sheet programs', into the presentation. Many of them simply stated that Microsoft ® PowerPoint could be used. Part (d) was not well-answered. Many candidates cited word-processors as opposed to desktop publishing software as the most appropriate tool for producing the newsletter and brochures. Many of them were not able to effectively explain the reasons for their selection.

UNIT 2

PAPER 01

Section A – Software and Software Development

Question 1

This question tested candidates' knowledge and understanding of the waterfall model, which is one of the most widely known models of a software development process. There were good answers to Part (a). However, many candidates did not properly explain that a software development process is a set of activities and associated results which lead to the production of a software product, saying instead that it is a sequence of steps. In Part (b), some candidates did not specify the names of the stages of the waterfall model or specified the names incorrectly. Poor explanations were sometimes given for the activities that take place in the three stages, especially for the design stage. Part (c) was generally answered well, though some candidates indicated that a weakness of the waterfall model is that it is time consuming and costly, instead of mentioning the inflexibility inherent in the model.

Question 2

This question tested candidates' knowledge and understanding of two information gathering techniques that can be used during requirements analysis, namely, interviews and questionnaires. It also required candidates to determine which one was more appropriate for the scenario given. There were good answers to all three parts of this question and valid reasons were given for choosing one technique over the other in the situation given. However, there were cases where candidates stated that interviews allowed one to have face-to-face or direct encounter with stakeholders but did not indicate why this was valuable to the

information gathering process. Some candidates also failed to state that responses to interview questions are documented and that responses to questions in a questionnaire are collected and analyzed.

Question 3

This question tested candidates' knowledge and understanding of Computer Aided Software Engineering (CASE) tools. The question was generally answered well by candidates though some did not answer the question at all. However, in Part (a), some candidates failed to mention that CASE tools are software products. Some failed to mention that it is used to support or automate different aspects of the software development process. In Part (b), some candidates did not identify the stages of the software process where CASE tools can be used. Few candidates mentioned pertinent terms such as "graphical system models" and "technical and user documentation". In Part (c), some candidates incorrectly stated that one disadvantage of a CASE tool is that software developers would become less skilled by using the tool.

Question 4

This question tested candidates' knowledge and understanding of architectural design which is an important design process activity. This question was poorly answered by most candidates, indicating inadequate preparation or understanding of this aspect of the syllabus. In Part (a), few candidates were able to explain that system structuring in the breaking down of the system into subsystems and some even confused this term with the software development life cycle. In Part (b), many candidates stated that modular decomposition is the breaking down of the system. However, this is partially correct; modular decomposition is the decomposition of sub-systems into modules. In Part (c), candidates were unable to distinguish between a sub-system and a module. Some of them incorrectly stated that a sub-system performs a single task. The responses to Part (d) were generally poor and candidates failed to mention that outputs include graphical representations of system models and diagrams showing the system structuring and modular decomposition.

Question 5

This question tested candidates' knowledge of user interface design guidelines and guidelines for designing reports. There were fairly good responses to Part (a) of this question. However, guidelines such as "user familiarity", "consistency", and "user guidance and feedback" were rarely mentioned. Also, instead of stating "recoverability" as the ability to gracefully recover from errors, candidates used a less appropriate term, "robustness". The responses to Part (b) were not satisfactory. Guidelines for report design such as using meaningful titles, presenting relevant information, and balancing the layout of the information were generally not described. Instead, candidates described the information that the reports should contain and how they should be prepared.

Section B – Programming Languages

Question 6

This question tested candidates' understanding of various object-oriented concepts and their ability to represent a class in a diagram. Candidates were required to explain the concept of inheritance and to describe how message passing takes place among objects. Part (a) was answered well by most candidates though data types for the instance variables and the "()" after method names were often omitted. In Part (b), candidates seemed to understand how message passing took place but did not clearly explain the process. Some incorrectly indicated that the *Customer* object would call the *Account* object using its

withdraw() method as follows: *A.withdraw()*. Some candidates missed the point of the question completely and talked about the physical process of going to the bank to withdraw/deposit money using ATMs and bank slips. Part (c) was not answered well by most candidates and no response gained full marks. It should be noted that inheritance is when a class assumes the instance variables and methods of another class, perhaps adding its own instance variables and methods.

Question 7

This question tested candidates' knowledge and understanding of several fundamental object-oriented concepts. The answers to Part (a) were generally correct though some of the candidates were unable to properly distinguish between an object and a class. A class is like a template that describes the behaviour and attributes of a set of similar objects while an object is an instance of a particular class. Part (b) was not answered well and many candidates did not explain that encapsulation is the technique of hiding the internal implementation details of an object from external objects. For Part (c) few candidates explained that public instance variables can be accessed directly by external objects. Thus, if these variables change in the future, all the external objects would have to be changed since they were not shielded from the changes by encapsulation.

Question 8

This question tested candidates' knowledge and understanding of programming languages and the use of compilers and interpreters. Part (a) was answered well and most candidates were able to classify programming languages in terms of level such as high-level versus low-level. Some gave examples in cases where they could not identify specific terms and these were accepted. In Part (b), most candidates only gained half the marks since they only stated one reason, namely that compiled code executes faster than interpreted code. Another reason is that compiled code can be distributed and executed without need for the compiler, unlike interpreted code which always requires the presence of the interpreter. Part (c) was generally answered well though some candidates lost marks by missing out one or more criteria for selecting a programming language.

Question 9

This question tested candidates' ability to trace through an algorithm and to determine the output that it generates. The majority of candidates gained only partial marks for this question since they only had part of the output correct. Many candidates had no idea how to trace through the algorithm and simply rewrote the algorithm in their responses. However, a few candidates gained full marks by correctly drawing the shape that would be generated by the algorithm. The following is the expected output of the algorithm:

```
**********
*        *
*        *
*        *
**********
```

Please note that full marks were awarded for alternative output based on a different valid interpretation of one of the functions given.

Question 10

This question tested candidates' ability to write algorithms using bounded and unbounded iteration. Part (a) was answered well by many candidates. However, many candidates only obtained partial marks for Part (b). Several candidates attempted to use the modulus function but used it incorrectly. Generally, the responses by candidates in this question indicate that they are unable to write simple algorithms using the basic programming control structures of sequence, selection, and repetition. Numerous responses indicate that candidates do not know how to write a *while* loop or how to specify the conditions of a *while* loop or an *if* statement. Candidates have difficulty in integrating the different programming structures into a working algorithm. They also need to appreciate the difference between a *for* loop and a *while* loop.

SECTION C – Program Development

Question 11

This question tested candidates' knowledge of graphical user interface objects and their ability to choose appropriate user interface objects to solve a given problem. The question was answered well by most candidates, many of them getting full marks. While there were a few candidates who designed the dialog box with inappropriate graphical user interface objects, the majority designed the dialog box consisting of the following objects:

- Fonts that were used to create labels and the window title
- Text field to enter the first number, labelled with a label object
- Text field to enter the second number, labelled with a label object
- Text field to display the larger of the two numbers, labelled with a label object
- A Button that causes the program to display the larger of the two numbers
- A Window to contain all the other objects

Question 12

This question was designed to test candidates' knowledge and understanding of the queue abstract data type (ADT). The queue ADT removes elements from the top of the queue using a *dequeue()* operation while elements are added to the end of the queue using an *enqueue(Object)* operation. The question was generally answered badly by most candidates with Part (a) and Part (b) being answered better than Part (c) and Part (d). Since new elements are added to the end of the queue, clearly 10 is the answer for Part (a). Two ADT operations for a queue are *enqueue (Object)* and *dequeue()*. An algorithm to remove the elements of *Q1* and place them in *Q2* is given below:

```
while not Q1.isEmpty() do
     set element to Q1.dequeue()
     Q2.enqueue(element)
end while
```

In the future candidates are encouraged to gain practice in writing algorithms that employ ADTs such as queues, stacks, and linked lists.

Question 13

This question was designed to test candidates' ability to write the source code for a class in an object-oriented programming language. It required candidates to declare three instance variables of different data types and to code two methods with simple functionality. Candidates were also expected to write a constructor for the class given. The majority of candidates performed very badly in this question indicating that most of them are not getting adequate exposure to practical object-oriented programming. Nevertheless, a few candidates performed quite well and obtained high marks in this question. A number of candidates mixed and matched language features from different programming languages. In the future, candidates should indicate which language they are using and use only the features of this language in their responses.

Question 14

This question tested candidates' knowledge of tools that can be used to simplify the process of creating computer programs. The tracer was given as an example. Other tools include editor, stepper, linker, and debugger. Most candidates answered this question reasonably well. However, some candidates identified software engineering tools although from the example of the tracer, it was clear that programming tools were required.

Question 15

This question was designed to test candidates' knowledge and understanding of the stack abstract data type (ADT). Candidates were required to find the sum of every other element in a stack using only stack ADT operations. Like Question 12 involving the queue ADT, most candidates answered this question very poorly. However, there were a few rare responses that specified a correct algorithm such as the following:

```
set sum to 0
while not S.isEmpty() do
     set element to S.pop()
     add element to sum
     if not S.isEmpty() then
          S.pop()
     end if
end while
```

A few candidates attempted to define the stack ADT operations in their responses to this question. However, the question required candidates to *use* the ADT operations to solve the problem given. It was also clear that many candidates had great difficulty in writing algorithms involving the fundamental programming constructs of sequence, selection, and iteration. If candidates do not master these concepts, it will be impossible for them to perform well in the questions involving the writing of algorithms or programming code.

PAPER 02

Section A – Software and Software Development

Question 1

This question was designed to test candidates' in-depth knowledge and understanding of two software process models, evolutionary development and the reuse-oriented approach. The question also tested

candidates' ability to draw a level-0 data flow diagram from a given narrative. The question was answered fairly satisfactorily by most candidates; however, there is considerable room for improvement in answering this type of question. For example, in the data flow diagram, symbols were often mixed up, indicating that candidates did not fully understand the notation used in data flow diagrams or they lacked experience in applying the notation. The numbers of the processes were often omitted and the data flows were generally incorrect especially with respect to their direction or description of data.

In Parts (b) and (c), candidates demonstrated a good understanding of the evolutionary approach and the reuse-oriented approach for developing software. However, the weaknesses of the evolutionary approach were not properly discussed in Part (b). Similarly, in Part (c), the discussion of the reuse-oriented approach was often not as thorough as was expected. Candidates are reminded that in answering the questions of Paper 2, they are expected to give detailed responses to questions having keywords such as "discuss" or "describe".

Question 2

This question was designed to test candidates' in-depth knowledge and understanding of tools that are typically used in the analysis phase of software development. In particular, it focused on entity-relationship modeling and the use of data dictionaries to formally define data in an organization. Part (a)(i) of the question was fairly well answered by most candidates who attempted this question. Few candidates described the attributes of entities as being a component of the model and some incorrectly stated that the cardinality of relationships is a main component of the model. Part (a)(ii) was poorly done by most candidates. Sources of information to draw an entity-relationship model include computer displays, reports, data flow diagrams, and business documents such as forms. The performance in Part (a)(iii) was fair. Most candidates were able to identify at least three entities from the scenario given. Relationships between entities were generally drawn correctly with a straight line connecting the entities; however, in some cases, no name was given to the relationship.

Part (b) was generally well done by most candidates. They correctly explained that a data dictionary is like a database or repository of data that is important to the organization (that is, a database of metadata). Many candidates obtained full marks for correctly describing the contents of an entry in the data dictionary.

Question 3

This question was designed to test candidates' knowledge and understanding of programming languages and the steps of the object-oriented process. It also tested candidates' ability to write and use recursive functions. Part (a) was badly done by most candidates. Most of them were unable to write the function properly with the necessary arguments or call the function with the right parameters and capture the value returned. They were also unable to return the value of -1 if the search was unsuccessful. Candidates need to improve their skills in defining and calling functions with the appropriate parameters. They also need to understand how to design a recursive function.

Parts (b) and (c) were generally well done. However, in Part (b), there were candidates who described the stages of the general software process instead of the specific stages of the object-oriented process. Also, even though good answers were given for the maintainability aspect of Part (c), many candidates failed to mention that the ripple effect of errors is minimized in a maintainable program and that new changes would not usually cause existing code to malfunction.

Question 4

This question was designed to test candidates' knowledge of various aspects of programming languages. It also tested candidates' ability to write procedural algorithms involving repetition statements (such as *for* loops) and simple data structures such as arrays. The majority of candidates who answered this question omitted Parts (a) and (b), indicating their inability to write algorithms to solve a given problem. Those who attempted Parts (a) and (b) incorrectly specified the *for* loop. They were also unable to iterate through the array (by using the loop index variable) to move or swap the elements. Part (c) was bookwork and was fairly well done by most candidates. However, in Part (d), a large number of candidates described the software development life cycle instead of describing the hierarchical decomposition of programs into modules and the use of the fundamental control structures of sequence, selection, and iteration. Finally, in Part (e), it was expected that candidates would describe the use of the compiler or interpreter to translate a program and the subsequent execution of the compiled or interpreted code on the computer.

Question 5

This question required candidates to identify the graphical user interface (GUI) objects that would be used in a simple program as well as to identify the GUI events that the program needs to anticipate and explain how these events would be handled when they occur. In Part (a), candidates were able to identify the GUI objects that would be used, but many of them had difficulty explaining the purpose of the different GUI objects. In Part (b), several candidates were unable to draw an appropriate GUI with a pleasing layout that one would expect from a modern GUI application. A few candidates even drew several GUI objects without placing them on a window. In Part (c), many candidates were unable to describe two events that the program should anticipate. One event that the program should anticipate is the user clicking on a "Calculate" (or similar) button when he/she is ready to perform the interest calculation. Another event is the user pressing the "Return" or "Enter" key in one of the text fields.

In general, Parts (d) and (e) were badly done and many candidates did not answer Part (f) at all. The code written in these Parts was of a very poor quality, highlighting candidates' inability to write code for fairly straightforward problems. In Part (d), most candidates were unable to write the code to populate *L* with the required numbers. In Part (e), many candidates did not retrieve the data entered by the user in the text fields before doing the calculation of simple interest. For example, in Java, a *getText()* method would be called to obtain the data entered in the different text fields and this data would then be converted to the required type such as *int* or *double* before calculating the simple interest. In Part (f), after calculating the monthly installment, a *setText()* method (in Java) would be used to put the value calculated in the relevant text field.

Question 6

This question tested candidates' ability to write code for an object-oriented program. Candidates were required to write the code for a *Product* class with given instance variables and methods. They were also required to write code to create instances of the *Product* class and to store these instances in an appropriate data structure such as an *ArrayList* or *Vector* (in Java). Many candidates were unable to correctly write the code for the *Product* class. Some candidates did not know how to write an accessor, a method that simply returns the value of an instance variable. Many candidates were unable to correctly reference the *Product* objects created in Part (b) and put them into the data structure specified. An iterator would then be used to access the *Product* objects in the data structure. By invoking the *reorder()* method on each *Product*, it can be known whether a certain product has to be reordered. In Part (c), candidates were expected to describe how the technique of inheritance could be used to create a subclass of the *Product*

class. This subclass would automatically inherit the instance variables and methods of *Product*. Inheritance allows additional instance variables to be declared and it also allows the *reorder()* method to be implemented differently in the subclass.

PAPER 03

INTERNAL ASSESSMENT

GENERAL COMMENTS

The quality of the Internal Assessments for Unit I in the 2006 examinations was much better than last year. In Unit 2, most candidates made at least a fair attempt at the Internal Assessment. A few schools used the old syllabus and this presented some problems.

Generally, most candidates chose appropriate topics for the Internal Assessment. The topics chosen were relevant to the level of the candidates and the specific objectives of the respective syllabuses.

One centre submitted samples that were based on the same scenario for a batch of candidates. Teachers should note that each candidate should generally use a different scenario from others for their projects.

DETAILED COMMENTS

Unit 1

Many candidates did not identify a problem in the 'Problem Identification/Situational Analysis' section but rather in the 'Description of the current system and procedures' section. Candidates are asked to desist from including information meant for one section in another section. Teachers should carefully apply the marking scheme when marking candidates' internal assessment reports. They were many instances where full marks were awarded to sections that were not present in the report, for example, some candidates omitted the 'Problem Identification/Situational Analysis' section and still obtained full marks in that section.

<u>Description of the purpose of the study</u>

In this area, many candidates did not address the purpose of the study properly especially with regard to the guidelines given in the syllabus, for. example, response times, volume of data to be stored and processed, and tolerance levels. Descriptions of tolerance levels were particularly weak.

<u>Solution Process</u>

Many candidates used data collection such as interviews and questionnaires but most did not analyze the responses from the questionnaires.

Analysis of Solution

- Hardware Specification: Many candidates stated instead of describing the systems specifications, for example, instead of describing hardware components, some candidates simply provided a listing and many teachers awarded full marks.

- Software Specification: Many candidates simply listed examples of various types of software and provided no descriptions. Network layout diagrams were generally missing.
- Evaluation of Solution: Some candidates attempted to justify their choice of networking components/ hardware/software absolutely rather than relative to other possibilities. In the case of networking, a good response was that a bus network is generally cheaper to set up than a star. Justification of compatibility of network, hardware and software was virtually non-existent.
- Presentation: Diagrams were fairly ok.

Organizational Impact

- Enhancements: Much research was not done on other software that existed on the market. Too many candidates used Microsoft Access® for databases rather than software with a "proven" track-record for the specific functions required.
- Negative Impact: Fairly well-done
- Identification of strategies for addressing issues: While some candidates were able to address this area fairly well, the 'public relations' and 'advertising' sections were either misunderstood or not attempted at all.
- Justification: Some candidates seemed to have been oblivious to the fact that they needed to justify strategies used in the section above.
- Presentation: Many candidates did either an inadequate executive summary or none at all. Quite a few failed to produce a proper contents page and some manually numbered the pages with a pen.
- Communication of information: Candidates need to proof-read their work since there were grammatical errors in many reports.

RECOMMENDATION

Internal Assessment reports should be typed in black ink using a suitable font with double line spacing.

Unit 2

Most parts of the project had at least fair attempts. The 'System Models' section was not properly done. It should be noted that the 'System Models' section of the internal assessment is an important area in Computer Science. This section shows candidates' ability to apply rules to a given situation to create models for analysis. In many cases the rules for drawing entity-relationship diagrams and data flow diagrams were violated. Many context diagrams included data stores, which is a major error. Some candidates mixed up level 1 and context data flow diagrams. It is also clear that some candidates have not been using the recommended texts from the syllabus. Projects were generally well-presented except for a few cases where the overall project presentation could be improved by the use of double spacing and the use of black (not colored) ink for text. In most cases, candidates were unable to give appropriate responses for the non-functional requirements of the project. This information can be found in books such as the Software Engineering text by I. Sommerville.

RECOMMENDATION

Teachers need to provide more guidance for candidates as they work through the SBA. For example, teachers can teach the material for the various parts of the SBA and then see how the candidates apply