UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced/Advanced Subsidiary Level

MARK SCHEME for the May/June 2006 question paper

9691 COMPUTING

9691/03 **Paper 3 (Written)**

Maximum raw mark 90

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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1 **(a)** - the computer only understands binary
- HLL is written in language close to human language
- translator needed to turn one into the other
(1 per -, max 2) **[2]**

(b) - interpreter translates one line of code and runs it
- before translating the next line
- original code is always present
- compiler translates entire code
- before allowing it to be run
- creates object code
(1 per -, max 4) **[4]**

(c) **(i)** - translator program maintains a dictionary of reserved words
- if the reserved word used is not in this dictionary then an error has been made
- message may be given which suggests one close to spelling provided

(ii) - variable names must follow the rules of the language
- translator tries the rules against the names used and reports any errors
- contents of variables must be of a specific type
- error created by the attempted use of anything else.
(1 per -, max 4) **[4]**

2 **(a)** **(i)** - designed for use by a technician
- shows how the system was put together/works
- so that a technician can alter the system
- correct the system when necessary
(1 per -, max 2) **[2]**

(ii) - designed for the non computer literate user of the system
- provides training guides to teach the checkout operators
- provides simple instructions for use
- what to do when something goes wrong
(1 per -, max 2) **[2]**

(b) **(i)** - needed to correct bugs found in the system once it is working
- e.g. There is no warning given that the till roll is about to end.

(ii) - changes to the system because external things have changed
- e.g. the sales tax rate changes

(iii) - changes which enhance/improve the performance of the system
- e.g. a flagging system at the tills to speed up the processing of bar codes **[6]**

3 - to test out new parts without building them
- saves time in development
- to test safety features in crashes
- saves money in development
- to test safety features
- saves risk of injury to humans
- to give immediate readout of costings
- as modifications are made the costs are shown immediately/no need for further work

(1 per -, pairs marked on reasons, max 6) **[6]**

4 - message is stored until recipient ready to read it/can be stored for long period if desired
- representative will not want to be interrupted during a sale
- messages can be duplicated/each message can be sent to a number of recipients at a time
- may want to send a message about a new product/offer to representatives in a particular area
- messages can be forwarded/without the need for copying them
- message may be received from one department and need passing on to another
- messages can be encrypted
- stops a rival firm learning trade secrets
- positive responses can be given to show that a message has been delivered
- can act as proof that an employee actually received an instruction
- attachments can be used
- to send brochures to team about new product

(1 per -, max 4 pairs, max 8) **[8]**

5 - value in PC is…
- copied into MAR
- value in PC is incremented
- data in the address referred to in MAR is…
- copied into MDR
- data in MDR is copied into CIR
- contents in CIR are split into operation code and address
- operation code is decoded as unconditional jump
- value in address part of instruction is copied into PC
- reset restarts the cycle.

(1 per -, max 7) **[7]**

6 **(a)** **(i)** - data and the permitted operations on that data are defined together (class)
- objects in classes can pass messages from one to another
- classes can share some characteristics (inheritance, derivation)
(1 per -, max 2) **[2]**

(ii) - programs are expressed as a number of rules (relationships)
- and a set of facts
- program specifies what must be done, not how to do it.
(1 per -, max 2) **[2]**

(b) **(i)** - address in instruction is
- the address of the address of the data
suitable diagram worth two marks.
- used to access areas of memory that are not accessible using the space available for the address in the instruction code **[3]**

(ii) - address in instruction is added to
- a value held in a special register called the index register
suitable diagram worth two marks
- allows a set of contiguous data (array) to be
accessed without altering instruction **[3]**

7 - different workers at the centre need access to different information
- doctor needs access to medical histories
- receptionist needs access to general information
- access can be of different types/RO and RW
- dependent on seniority/need to amend data
- some data is particularly sensitive and needs to be properly protected
- access controlled by passwords
- physical control of what can be seen through different machines and…
- specific times during the day/week when it is available to see/amend
- access rights determined by
- passwords/which machine used/user IDs…
- lead to different HCIs giving different views of the data
- sensitive files encrypted
- human right of privacy
- could be serious consequences (loss of job)
if information became known
(1 per -, max 6) **[6]**

8 **(a)** - dynamic data structure can alter size dependent upon the number of items … static data structure remains a fixed size throughout its use.

- dynamic: list/tree
- static: array **[…]**

(b) **(i)** - advantage is that the programming is simpler/can be used as a validation check on number of students

- disadvantage is that large amounts of storage taken up even if there are few students/college roll can never exceed 1000/takes a long time to find a name. **[2]**

(ii) must be a serial search. Whatever form candidate chooses.

Mark points:

- set COUNTER to 0/1
- compare Array(COUNTER) with X
- if equal then report found and value of COUNTER, End
- if Array(COUNTER) is empty then report error, not found
- else increment COUNTER
- if Counter > 999/1000 then report error, not found
- else repeat from second point

(1 per -, max 5) **[5]**

(iii) - when student leaves then all students greater in the alphabet have to be moved up one place in the array

- when a new student arrives, the correct location in the array needs to be found and
- the remaining students moved down one place

(1 per -, max 2)

- a binary search (cut) may be used
- involving looking at the centre value in the remaining part of the array at each pass
- and then cutting number of items to be searched in half
- Speeds up any searches that have to be made (because of reduced number of comparisons)
- This is a fairly stable population so probably worth ordering.

(1 per -, max 2)

(max 4) **[4]**

9 **(a)** **(i)** - used when there is not enough memory available
- part of the storage is allocated to act as memory
- this block is then imported to memory when it is needed
- especially used when a piece of software is so big that it will not fit into memory

(1 per -, max 2) **[2]**

(ii) - the division of memory into fixed size units
- logical pages can then be assigned to any physical page in memory
- records of the contents of each page in memory are kept in an index

(1 per-, max 2) **[2]**

(iii) - the division of software into logical parts which are of different sizes
- individual segments can be present in memory without the need for the whole program to be there
- an index is required to store the beginning, size and contents of each segment
- leads to fractionalisation of the memory

(1 per -, max 2) **[2]**

(b) **(i)** - temporary storage of
- input or output data
- on some form of backing storage

(1 per -, max 2) **[2]**

(ii) - jobs are stored on backing store
- with reference to the job and its location stored on a spool/print queue
- the jobs in the spool queue can be prioritized and…
- the job reference can enter the queue at a position according to its priority

(1 per -, max 3) **[3]**

10 - standardisation necessary so that computer systems can talk to each other
- hardware standards like common access ports mean communication possible
- common file formats
- common communications media like
- ISDN and
- common communication protocols like
- http
- use of layered protocols to
- allow manufacturers to design for a particular layer
- standardisation of software (Use of Office by 90% of computer users)
- standard character sets

(1 per -, max 8) **[8]**

[Total: 90]