

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

Cambridge International Diploma in Computing

MARK SCHEME for the June 2004 question papers

9691/5216/5217/5218 COMPUTING

9691/01	Paper 1 (Written Paper 1), maximum raw mark 90
9691/02	Paper 2 (Practical Tasks), maximum raw mark 60
9691/03	Paper 3 (Written Paper 3), maximum raw mark 90

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do 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*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

Grade thresholds taken for Syllabus 9691 (Computing) in the June 2004 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 1	90	66	62	35
Component 2	60	53	51	39
Component 3	90	59	55	31
Component 4	60	45	37	23

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

June 2004

A AND AS LEVEL
CAMBRIDGE INTERNATIONAL DIPLOMA

MARK SCHEME

MAXIMUM MARK: 90

SYLLABUS/COMPONENT: 9691/01, 5216

COMPUTING
Written Paper 1

Page 1	Mark Scheme	Syllabus
	COMPUTING – JUNE 2004	9691

- 1**
- (a)**
- (i)** Controls responses to external requests/controls hardware/makes system work
- (ii)** Program that allows the user to do something useful. A sensible example is acceptable (1)
- (b)**
- (i)**
- Batch not time sensitive (2)
 - Real-time must provide immediate outcome
- (ii)**
- On-line user or peripheral in communication with processor (2)
 - Off-line user is not in communication with processor/device not controlled by processor
- (c)**
- Real-time (3)
 - On-line
 - Because user commands must be acted on immediately
- 2**
- (a)**
- Program
 - Part of OS
 - Designed to carry out a common task (1 per point, max 2) (2)
- (b)**
- Data transfer programs
 - To control movement of data to and from storage
 - File handling programs
 - To store/sort/retrieve/delete files
 - Hardware drivers
 - To control communication with peripherals
 - Automatic back up
 - To automatically make copies of files to protect the data
 - Anti-virus software
 - To protect files from attack by viruses
 - Formatting
 - To prepare media for storing files
 - Compression
 - To reduce size of files (while maintaining integrity of data)
 - Defragmentation
 - To tidy up files on the disk
 - Disk scanner
 - To find errors on surface of disk (2 per type, max 2 types, max 4) (4)

Page 2	Mark Scheme	Syllabus
	COMPUTING – JUNE 2004	9691

- 3 (a) (i)** Testing all possible routes through the program logic/Testing knowing the code/Test the algorithm. Note: not dry run on its own
- (ii)** Test that the outcome is as expected for a given input/Testing not knowing the code
- (iii)** Testing by programmer/in-house
- (iv)** Testing by public/end users/potential users/unconnected with writing **(4)**
- (b) (i)** Error in grammar/rules of language
e.g. Misspelled reserved word/wrong statement construction
- (ii)** Error in construction of program/order of statements/wrong method of solution/wrong interpretation of algorithm
e.g. Jump instruction to wrong point in program
- (iii)** Program commands inappropriate arithmetic **(6)**
e.g. Division by zero
- (c)**
- Individual modules may be linked incorrectly
 - Clash of variables across modules
 - Parameter values of wrong type
- (1 per point, max 2) **(2)**
- 4 (a) (i)** Those symbols that the computer (software) can recognise **(1)**
- (ii)**
- As binary codes
 - ASCII/EBCDIC
 - Using 7,8,15,16 bits
 - The number of bits = 1 byte
- (1 per point, max 2) **(2)**
- (b) (i)**
- Character/text/string/alpha
 - Date or datetime or integer (long)
 - Currency/Real/Integer
 - Boolean
 - Integer
- (5)**
- (ii)**
- 10-30
 - 2-8
 - 2-4
 - 1-2
 - 2 or 4
- Total 17-48 bytes (1)
- X10000 (1) Ψ 170000 - 480000 bytes
- + 10% (1) Ψ 187000 - 518000 bytes
- (/1024) (1) Ψ 187 - 518 Kbytes (1) **(5)**

Page 3	Mark Scheme	Syllabus
	COMPUTING – JUNE 2004	9691

- 5 (a) (i) Communication is only one way
- (ii) Communication is two-way and can be at the same time
- (iii) Communication is two-way, but only one way at a time (3)
- (b) (i) - Processor transfers data from primary memory to fill buffer
 - Data sent from buffer to secondary storage while...
 - Processor continues with other tasks
 - When buffer empty interrupt sent to processor
 - Processor (may) interrupts current job
 - (Deals with) request to fill buffer
 Mark for mention of priority of interrupt
 (1 per point, max 5) (5)
- (ii) - Half duplex
 - Data needs to go to buffer and interrupt to processor but at different times.
 (1 per point, max 2) (2)
- 6 (a) - Limited number of workers allowed access to records
 - These workers specifically named
 - Access to workers is strictly password controlled
 - Overseeing body to impose standards
 - Only certain machines can access the data/restrictions on machines
 - Data encrypted (not coded)
 (1 per point, max 3) (3)
- (b) - RSI because of keyboard use
 - Use ergonomic keyboard/take regular breaks
 - Muscle/back strain
 - Use well-designed chairs/keyboards/and well positioned
 - Eyestrain/pregnancy
 - Use glasses/anti-glare screens/look away regularly/use radiation monitors
 - Poorly designed environment/trailing wires
 - Use a purpose built area/ensure wires are properly concealed
 (1 per point, max 6) (6)

Page 4	Mark Scheme	Syllabus
	COMPUTING – JUNE 2004	9691

- 7
- Digital camera used to capture image/photograph of employee
 - Image downloaded (into graphics software) directly/image scanned (into graphics software)
 - Image can be edited/cropped/resized
 - Data compressed
 - And stored as a series of bytes
 - On hard drive
 - Pointer to the image is stored in each record
- Mark available for description of storage e.g. bitmap/jpeg
(1 per point, max 4)
- (4)
- 8
- Is the solution technically possible?
 - If the equipment does not exist to carry out the task then it does not matter how good it would be, it cannot happen/similar for software
 - Is the solution economic to produce?
 - If the cost of automation is so great that the firm could not recoup the cost then it is not feasible
 - Is the solution economic to run?
 - If the running costs are higher than at present then there is little point in changing
 - Effect on workforce
 - If the human cost (mass redundancy) is so great there are serious social implications that are not acceptable
 - Is the workforce skilled enough?
 - If there are no skilled people to operate the machines it cannot work
 - Will the customer notice a difference?
 - Price/quality/reliability, if no then why bother?
 - Is the introduction going to be beneficial to the company
 - Will profits increase?
 - Legal
 - DPA covered, etc.
 - How long will it take?
 - If it takes too long the factory may have to shut
- (2 per pair, max 8)
- (8)

Page 5	Mark Scheme	Syllabus
	COMPUTING – JUNE 2004	9691

- 9 (a) (i) - Contrasting colours for background and text or text becomes difficult to read
 - Colour (red) to highlight items more important than others
 - Needs to be used sparingly
 - Use of corporate colour scheme
 - Care with red/green because of colour blind people
- (ii) - Layout should follow normal reading pattern for eye because natural and less chance of errors being made or things missed out
 - Limit the volume of information because otherwise a screen becomes daunting
 - Layout should be similar on all pieces of software so that user gets used to the layout
- (iii) - Content should be similar across pieces of software
 - To enable user to be trained easily
 - Content must be relevant or user will begin to ignore
 - Content type must be correct e.g. if highlighted in red it really must be urgent
 - Take account of different users
 - Help should be available
 (1 per point, max 9) (9)
- (b) - Application is specialised
 - Probably unique
 - Generic applications software is designed to be adaptable to many systems
 - This system will not fit a generalised model
 - Needs to match the other software in use
 (1 per point, max 2) (2)
- 10 (a) - Day-to-day management information/what stock needs re-ordering
 - Strategic information/if we do 'this' then 'that' will happen
 Accept any 2 of Operational, Knowledge, Management and Strategic (2)
 (1 per point, max 2)
- (b) - Graphs
 - Ideal for showing trends
 - Reports in text form
 - Gives exact details/figures
 - Reports in tabular form
 - Arranges exact details to make them simpler to interpret
 - Interactive presentation on screen
 - Allows the manager to tailor the output required
 - Sound
 - Can inform while the manager is doing something else (6)
 (2 per type, max 3 types, max 6)
- Total (90)**

June 2004

A AND AS LEVEL
CAMBRIDGE INTERNATIONAL DIPLOMA

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9691/02, 5217

COMPUTING
Practical Tasks

Page 1	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

Practical Tasks Assessment Form

Centre Number		Centre Name	
Candidate Number		Candidate Name	

The mark points indicated on the mark scheme are listed below. Indicate with a tick where each mark has been awarded. Please ensure that you attach this mark sheet to each candidate's work.

		✓
Question 1(a)(i)		
Maximum 6 Marks		
	Student ID - a unique field	
	Numeric type	
	Student name to be able to contact the student	
	Text / alphanumeric / string type	
	Form / class / tutor group in order to find student	
	Text / alphanumeric / string type	
	Gender to see if reading depends on gender	
	Character	
	Sub-Total 1(a)(i)	
Question 1(a)(ii)		
Maximum 1 Mark		
	Student ID	
	Sub-Total 1(a)(ii)	
Question 1(b)(i)		
Maximum 8 Marks		
	Book ID - a unique field	
	Numeric type	
	Title – to know the book	
	Text/Character/String type	
	Author(s) to know who wrote the book	
	Text/Character/String type	
	Publisher to know who published the book	
	Text/Character/String type	
	ISBN for ordering purposes	
	Text/Character/String type	
	Sub-Total 1(b)(i)	
Question 1(b)(ii)		
Maximum 1 Mark		
	Book ID	
	Sub-Total 1(b)(ii)	

Page 2	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

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		✓
Question 1(c)		
Maximum 7 Marks		
	Student table has at least 20 entries	
	All StudentIDs are different	
	Book table has at least 15 entries	
	Every BookID is different	
	StudentBook table has at least 1 book for each student	
	StudentBook table has at least 1 student for each book	
	There is at least one student that has borrowed more than one book	
	There is at least one book that has been borrowed by more than one student	
	All StudentIDs in StudentBook table exist in Student table	
	All BookIDs in StudentBook table exist in Book table	
	Sub-Total 1(c)	
Question 1(d)		
Maximum 3 Marks		
	The user can only enter a valid Book ID	
	The report has a clear and meaningful heading	
	The report gives details of the Book	
	The report gives details of all the students that bought the book together with the dates	
	Sub-Total 1(d)	
Question 1(e)		
Maximum 3 Marks		
	The user can only enter a valid Student ID	
	The report has a clear and meaningful heading	
	The report gives details of the Student	
	The report gives details of all the books that the student has borrowed together with the dates	
	Sub-Total 1(e)	

Question 2	
Maximum 10 Marks	

Top	P	S(1)	S(2)	Finished	Output
0	1				
1		1			
	2				
2			2		
	0			FALSE	
	2				
1					BEAR
	4				
2			4		
	0			(FALSE)	
	4				
1					CAT
	0			(FALSE)	
	1				
0					DOG
	3				
1		3			
	5				
2			5		
	0			(FALSE)	
	5				
1					GIRAFFE
	0			(FALSE)	
	3				
0					HORSE
	0			TRUE	

Give ½ mark per row, after the first SIX, in the table. Round the total up to the nearest whole number.

The items in parentheses are optional.

Page 4	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

		✓
Question 3(a)		
Maximum 5 Marks		
	There are buttons for each Roman numeral	
	The buttons are arranged in numeric order	
	There is a clear all button	
	There is a display showing the Roman number entered	
	There is a display showing the Arabic equivalent	
	The calculator has an on/off button	
	Sub-Total 3(a)	
Question 3(b)(i)		
Maximum 5 Marks		
	<i>For annotation of code give:</i>	
	2 marks if it is fully annotated	
	1 mark for some annotation	
	0 marks if there is no annotation or very little	
	<i>For the code give 1 mark each to a maximum of 3:</i>	
	The Roman number display is updated as each numeral is entered	
	The Arabic number display is updated as each numeral is entered	
	The user is prevented from entering an invalid Roman numeral	
	The clear button clears both displays	
	The on/off button works correctly	
	The user can enter up to 21 characters	
	Sub-Total 3(b)(i)	
Question 3(b)(ii)		
Maximum 6 Marks		
	Give 1 mark for each test to a maximum of 6. The example column should be treated as examples and other valid examples are acceptable.	

Test Data	Example	Expected Output
Data in range 1 to 7000	MMMCLVI	Accepted 3156
Use of all the letters	MDCLXVI	Accepted 1666
Boundary value	MMMMMMM	Accepted 7000
Too large	MMMMMMMI	Rejected Output cleared
Single character	C	Accepted 100
Letters not in order	MCCDVI	Can't be entered
Testing for too many Is, Xs, Cs	XIIII	Can't be entered
Testing for too many Vs, Ls, Ds	MMDD	Can't be entered
Test maximum number of characters	MMMMMMDCCC CLXXXVIII	Accepted

	Sub-Total 3(b)(ii)	
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Page 5	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

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		✓
Question 3(b)(iii)		
Maximum 5 Marks		
	<i>Give 1 mark for each of the following tests, providing they show the data entered and the result, to a maximum of 5. (Screen dumps are acceptable.)</i>	
	Test Data	
	Data in range 1 to 7000	
	Use of all the letters	
	Boundary value	
	Too large	
	Single character	
	Letters not in order	
	Testing for too many Is, Xs, Cs	
	Testing for too many Vs, Ls, Ds	
	Testing for 21 characters	
	Sub-Total 3(b)(iii)	
	Total (max 60)	

June 2004

A AND AS LEVEL
CAMBRIDGE INTERNATIONAL DIPLOMA

MARK SCHEME

MAXIMUM MARK: 90

SYLLABUS/COMPONENT: 9691/03, 5218

COMPUTING
Written Paper 3

Page 1	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

Question 1

- (a) (i) Unique attribute (or set of attributes) used to identify the record or tuple.
(ii) A different attribute that allows the data to be accessed in a different order.
(iii) The primary key of another file/table/relation that is used to link files/tables/relations together. (3)
- (b) (i) Different users require different information
Information is sensitive/confidential and should only be available to those who need it
Secretary may need contact information
College nurse may need medical information
Subject tutors may need academic information
Personal tutor needs social information
Principal can see all (but medical information)
Students allowed RO access to their own record
Technician allowed to alter structure but not to see data
(1 per point, max 4) (4)
- (ii) Passwords arranged as ...
hierarchy...
to verify user ID
User ID identifies areas available to user
Particular machines allow different access
Physical precautions like locking doors/keyboards
Encryption of information
Physical identifiers (fingerprints, iris recognition)
NB: Rights not assigned to passwords
(1 per point, max 4) (4)

Question 2

- (i) Quality of life improved
Can work around other commitments
More time can be spent with family because no time wasted commuting
Loses social interaction
Can feel isolated at work (if things go wrong)
Distractions of family/TV upsetting work schedule
May need training in use of technologies
- (ii) No need for large/expensive centralised office space/lower utility bills
Happier workforce/less happy workforce (with reason)
World wide workforce
Greater security issues
Less easy to monitor what workers are doing
Difficult to make sudden decisions about work
Training and capital costs
Group working can become difficult
- (iii) Less traffic
implies less need for infrastructure
less pollution
Closer knit families implies fewer problems from young
Communications may mean closer monitoring of individuals by state
Simpler to provide work for disabled
(1 per point max 9) (9)

Page 2	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

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Question 3

- (a) Program is stored in memory along with data
 programs and data are indistinguishable
 Uses a single processor
 Sequential carrying out of instructions
 (1 per point, max 3) (3)
- (b) (i) Contains the address of the next instruction to be carried out
 Controls the sequence of instructions
- (ii) Holds the instruction while it is being executed
 Contains both function and address/operand
- (iii) Holds the address of the instruction/data that is next to be used
 (Must have first mark point before any credit)
- (iv) Contents of any address that has been accessed are placed in here first before being used
 May be an instruction or a piece of data
 OR:
 Holds data/instructions
 When being passed between memory and CPU/acts as a buffer between memory and CPU
- (v) Stores results of calculations/does the arithmetic
 All input to and output from processor pass through the accumulator
 (1 per point, max 2 per dot, max 10) (10)

Question 4

- (Tokens) are analysed to check for grammatical correctness (form valid sentences)
 (Code)/reserved word checked against rules
 Invalid number of brackets found
 Determine priorities of arithmetic operators in an expression
 Produce intermediate code
 Diagnostic error messages are reported
 Label checks
 Flow of control checks
 Declaration checks
 (1 per point, max 5) (5)

Page 3	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

Question 5

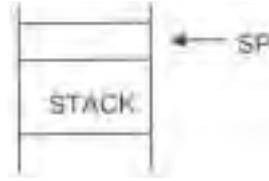
- (a) Maximise the use of the computer system
 Be fair to all users
 Provide a reasonable response time to all users
 Prevent system failure due to overloading
 Provide consistency to users
 (1 per point, max 3) (3)
- (b) First come/first served
 First to enter ready Q is first to enter running state
 Favours long jobs
 Shortest job first
 Jobs in ready Q are in order, shortest job first
 Means that jobs are seen to be completed but favours shorter jobs
 Round Robin
 Each job given time slice
 When time slice over, job goes to back of ready Q
 Shortest remaining time
 The job that requires the least job to complete is done first
 Long jobs may never be started
 Multi-level feedback queues
 Queues with different priorities
 Jobs can change Q dependent on amount of time already given
 (2 per type, max 2 types, max 4) (4)
- (c) (Each job given separate priority according to:)
 importance of job/type of job
 amount of time already waited
 size of job
 amount of peripheral time
 (I/O job high priority)
 Amount of processor time already given
 Necessary response time
 (1 per point, max 5) (5)

Question 6

- (a) (i) 01100110
- (ii) 01110101 (2)
- (b) (i) 11011011 (1 per nibble) (2)
- (ii) $-128 + 91 = -37$ (2)
- (iii) The original numbers are positive
 The answer is negative
 There has been an overflow from the positive part of the byte to the negative.
 (1 per point, max 2) (2)
 Note: Follow through in part (b) on wrong answers in part (a) of 10011010
 and 10001011
 They give the answer 00100101 (for 2 marks)
 Which gives the answer 37 (for 2 marks)
 Which gives: Originals are negative
 Answer is positive
 Overflow out of byte (any two of the three for final 2 marks)

Page 4	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

- (c) (i) Check for stack full
insert new value at
ARRAY(SP)
Increment SP



- (ii) Decrement SP
Check for empty stack
Read value
At ARRAY(SP)
(Allow any consistent use of SP) (1 per point, max 6)

(6)

Question 7

- (a) $\langle \text{VARIABLE NAME} \rangle ::= \langle \text{ALPHA} \rangle | \langle \text{ALPHA} \rangle \langle \text{DIGIT} \rangle \langle \text{DIGIT} \rangle | \langle \text{ALPHA} \rangle \langle \text{ALPHA} \rangle$
(1 per alternative, 1 for correct use of notation, max 4)

(4)

- (b) $\langle \text{VARIABLE NAME} \rangle ::= \langle X \rangle | \langle Y \rangle$
 $\langle X \rangle ::= \langle \text{ALPHA} \rangle | \langle \text{ALPHA} \rangle \langle X \rangle$
 $\langle Y \rangle ::= \langle \text{ALPHA} \rangle \langle \text{NZD} \rangle \langle \text{DIGIT} \rangle$
 $\langle \text{NZD} \rangle ::= 1|2|3|4|5|6|7|8|9$

(2 for definition of X, 1 for definition of Y, 1 for definition of NZD, 1 for two options for variable name, max 4)

(4)

Question 8

- (i) A device that allows many terminals all to use the same communications line at different times
- (ii) Connects different types of network together
Software at a node (on the network)
Which directs messages down different routes
According to their desired destination
- (iii) Links two LANs (which may or may not be similar)
uses address information in packets
Has the ability to learn the layouts of the networks
Can control access from one part of the network to the other.
- (iv) Necessary if communication link is analogue
Converts digital signals to analogue for transmission.
(1 per point, max 8)

(8)

Page 5	Mark Scheme	Syllabus
	A AND AS LEVEL – JUNE 2004	9691

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Question 9

- (a) A standard approach to analysis and design
 Training is available in the methods used
 Designed to assist in the management of large scale software projects
 Teams can be used on different aspects of task
 Identifies clearly defined stages/modules
 Standard documentation throughout
 A new manager could take over if necessary
 Maintenance is made easier
 (1 per point, max 4) (4)

- (b) Software tool to draw Gantt charts
 Standard Gantt templates
 Duration of tasks inserted/edited
 Parallel tasks automatically identified
 Resource loads automatically identified
 Project progress can be continually superimposed and monitored
 Software tool to draw Critical Path Analysis diagrams/PERT
 Network can be validated automatically
 Critical path established
 Changes implemented easily
 What ifs can be considered
 Gives duration of the project
 Note: Not CASE, documentation tools or program generators
 (1 per point, max 3 per type, max 6) (6)

Total (90)