GCE MARKING SCHEME

COMPUTING
AS/Advanced

SUMMER 2013

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCE COMPUTING. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

COMPUTING - CG3

MARK SCHEME

SUMMER 2013

CG3 Summer 2003 -

01 A data structure is a group / set / collection of related data items / elements 1

02 Example could be subprogram return addresses (also undo / back, etc) 1

Why: idea of winding back nesting of subprograms 1
NOT LIFO or last in first out alone

(*Alternatively recursion values / reverse polish calculations - accepted not expected*)

03 Example could be a keyboard buffer, download buffer 1

NOT a printer queue

[**Note:** other computer applications are possible but it must be a computer application, so **not** e.g. queue of patients at doctor's but could be a computerised version of this]

Why: In each case, because the natural / desirable processing order is first in first out (or eg item waiting longest should be dealt with next) 1
NOT FIFO or first in first out alone

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04 Protocols are necessary to specify data formats, etc, to enable devices to communicate with each other 1

Examples: 1
- linking a printer to a computer
- linking mobile phones by Bluetooth
- using ftp/http/smtp/voip/pop3 to transfer data between devices

05 Serial transmission:
Data sent bit-by-bit along the same data line 1

Advantage: any one of:
- requires only two wires (**condone** one wire) compared with 8 or 16 in parallel 1
- serial can travel longer distances than parallel
- simpler interface / circuit board

Parallel transmission:
All bits in a byte (or idea of 8 or 16) are sent simultaneously along separate data lines 1

Advantage: transmission is faster than serial transmission 1

06 Because many input devices (eg microphone, sensor producing continuously varying voltage etc) produce an analogue signal 1

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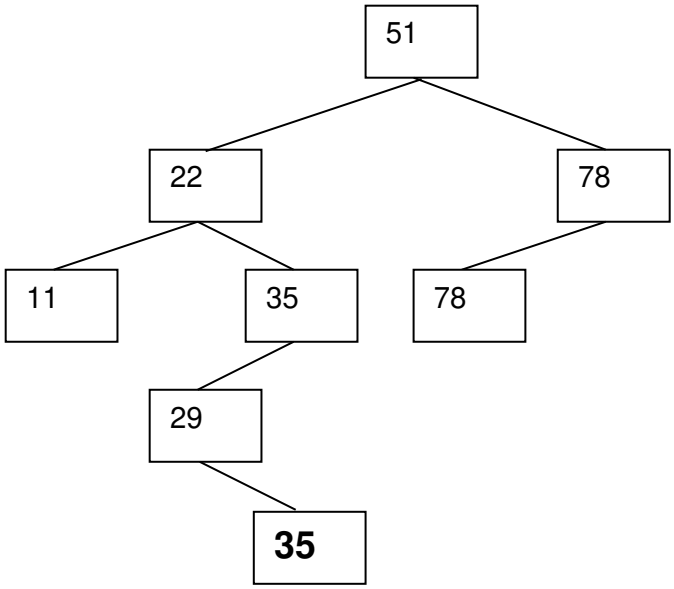
07 Binary tree 1

08 51 1

09 Advantage: faster to search/add a value 1

Disadvantage: more complex to program / process 1

10 1



11 Moves from root/51 to 78 to 78. Then looks for left branch. None there, so 67 not in tree 1

Produces suitable message / output / error report 1

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12 Biometric(s) 1

Staff/ authorised persons could have their retinal scan taken originally then stored on file 1

When entry attempted, a new scan is taken and compared with those on file 1

If a match is found, entry is permitted 1

Concern: any one of: 1

- People may not wish personal record to be kept / feel it infringes their freedom
- People may be concerned about possible eye damage (repeated flash photography etc)

An example of an extended answer worth five marks is:

Biometric.

Staff and authorised persons could have their retinal scan taken originally then stored on a computer file. When an entry to the building attempted, a new scan is taken and compared with those on file. If a match is found, entry is permitted

Staff members may be concerned about possible eye damage through the repeated use of flash photography.

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13 Computer prompts for input into specific fields on a screen dialogue form 1
Advantage: any one of: 1
- Cursor may move automatically to next input field
- Intuitive to fill in - echoes familiar paper form / good for surveys etc
- Allows change to be made while screen still visible
- May include validation – only some entries allowed

14 A touchpad can more easily be fitted into a small device like a laptop computer or PDA / does not require extended flat space to move the mouse over / allows multiple gestures, hand swipes etc 1

Not just smaller / cheaper / faster / more precise / health issues / better for disabled user

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15 Any two of:
- check for correspondence between the designed system and the specification 1+1
- confirm that the most appropriate techniques have been used
- confirm that the user interface is appropriate

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16 Even if correct when entered, age will not remain correct / data will lose integrity 1

Date-of-birth is preferable 1

17 Different views: any two of
- allow database users to <u>read / write to / amend / delete</u> only part of DB 1+1
- allow database users to access only <u>certain records / certain fields</u>
- may link tables together so user's view is as if only one table

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18 Any eight of: 8x1
- Is a method of benefitting from the speed of a CPU compared with slower peripherals
- More than one job is in memory at same time
- More than one job is processed (apparently) at same time
- Time-slice is the amount of time allocated to each job by the operating system
- Scheduling allocates time-slices to the jobs
- Polling is the sequential checking of jobs so that each gets its appropriate share of time
- Partitioning is a division of computer's memory for different jobs
- One job is halted if eg waiting for a peripheral device – other jobs can now be processed
- Paging jobs in and out makes better use of memory
- This promotes efficient use of CPU
- It is achieved by use of interrupts

An example of an extended answer worth eight marks is:
A multiprogramming computer system is one where more than one job is held in the computer's main memory at the same time and can be processed in the computer's central processing unit (CPU) at (apparently) the same time. Multiprogramming is used to ensure the most efficient use of the CPU and prevent the CPU being idle while waiting for a slower peripheral. One job is halted if waiting for a peripheral device so other jobs can now be processed
The operating system may move jobs in and out of memory and allows each job a pre-determined time-slice to access the CPU: this process is called scheduling and is controlled by a scheduler program. To allow more than one job to be resident in the main memory at any one time, the memory needs to be separated into separate parts - this is called partitioning. Partitioning is usually variable, depending on the relative sizes of the jobs concerned.

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19 Recursive (algorithm) 1

Must also have a terminating condition(s) (Base case(s) / stopping condition(s)) 1

Example here is lines 2-4 where terminating condition is for when Num = 1 1
(or lines 5-7 where terminating condition is for when Num = 2)

20 FValue(4) = FValue(3) + FValue(2)

= FValue(2) + FValue(1) + FValue(2)

= 1 + 0 + 1 = 2

Marking: 1 mark for seeing **FValue(4) = FValue(3) + FValue(2)** 1
1 mark for seeing final answer of **2** 1

This is the (**Num** term of the) Fibonacci sequence 1
(or is a series where the last two numbers are added to give the next number)

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21 A foreign key (in a database is a field in a table which) links to (or establishes a relationship with) another table 1

It enables the data in different tables to be linked together 1

22 Any one of: 1
- Any transitive dependencies need to be removed to convert from 2NF to 3NF
- It needs to be ensured that each attribute / field depends only on the primary key

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23 BRANCH (BranchTown, BranchAddress, BranchPhone)

INSTRUCTOR (InstructorID, InstructorName, InstructorAddress, InstructorPhone, BranchTown)

PUPIL (PupilID, PupilName, PupilAddress, PupilPhone, InstructorID)

BOOKING (PupilID, BookingDate, BookingTime)

Marking: Four suitable named tables 1
Each table with suitable PK (identified as such) (2 or 3 correct = 1mark) 2
Correct FKs (identified as such) (3 x 1) 3

Any number of bad fields / bad FKs subtract 1 mark

Note: Can be done in other ways, eg

BOOKING (BookingID,PupilID, BookingDate, BookingTime)

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24 Assembler converts a low level (assembly language) (source code) program to machine code / executable language prior to execution 1+1

Marking: 1 mark for input: assembly language / low-level language
1 mark for output: machine code / executable code / object code / binary

25 An *interpreter* translates each line of the source program then executes it 1

A *compiler* translates a whole (source code) program prior to execution 1

26 8x1

- During Lexical Analysis, input stream is broken into tokens
- During Lexical Analysis, comments and unneeded spaces are removed
- During Lexical Analysis, error messages are generated if appropriate

- During Syntax Analysis, symbol table / dictionary is produced *(could be in LexAn instead)*
- During Syntax Analysis, tokens are checked for fit to the grammar, using BNF-type rules
- During Syntax Analysis, if not the case, error message(s) are produced

- During Semantic Analysis, checks that all variables are declared (and used)
- During Semantic Analysis, checks that e.g. real values are not being assigned to integers
- During Semantic Analysis, checks that operation is legal for type/no mixed mode arithmetic
- During Semantic Analysis, Reverse Polish logic will be used (Accepted not expected)

- During Code Generation, machine code is generated (**NOT** twice for compiler)
- During Code Generation, code optimisation may be employed to make it more efficient/faster / less resource greedy

[**Marking**:

- Description of any point could be extended, for instance by an example, to gain extra marks
- If no other marks given, and simply named 3 or 4 of:
  Lexical Analysis / Syntax Analysis / Semantic Analysis / Code Generation: 2 marks
- If no other marks given, and simply named 2 of 4 of:
  Lexical Analysis / Syntax Analysis / Semantic Analysis / Code Generation: 1 mark
- Only 1 mark in total however many error messages are mentioned]

27

Robotic equipment: any six of: 6x1

- Expensive to install but probably cheaper than human workers over a longer period ("cheaper" alone not enough)
- Is likely to be more accurate / the same each time
- Doesn't get tired / ill / can work 24hr / without breaks etc
- May be able to work in unheated, unlit environment
- May be involved in a process which may be hazardous to human health
- There may be feedback loop / artificial intelligence - each time an item is welded etc, quality checked - improves each time
- Human workers may be better at spotting impending problems etc
- There may be many redundancies (of skilled workforce)
- Most jobs which remain may be deskilled ("machine minders")
- Some highly skilled jobs may be created for system designers etc
- Machinery may need to "learn" from existing skilled human operators
- These people may not be available in the future for work on new car models etc

An example of an extended answer worth six marks is:
Robotic equipment is expensive to install but will probably be cheaper than human workers over a longer period. Robots are likely to be more accurate than human workers and doesn't get tired of suffer from illness. Robots can work 24hr per day every day if necessary. It may be possible to save money since robots could work in unheated, unlit environment. They may also safeguard humans by doing processes which may be hazardous to human health.

There may be feedback or artificial intelligence systems whereby each time an item is welded etc, the quality is checked and may improve each time. However, human workers may be better at spotting impending problems etc.

There may be many redundancies of skilled workers, and most jobs which remain may be deskilled as staff basically become "machine minders", although some highly skilled jobs may be created for system designers or maintainers. The machinery may need to "learn" from existing skilled human operators but these skilled people may not be available in the future for work on new car models.

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28 BNF is used to describe (unambiguously) the syntax/grammar of a programming/computer language 1

Natural languages such as English or Welsh tend to be too ambiguous 1

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<digit>	::= 0|1|2| ... |9	)	1
<integer>	::= <digit>|<digit><integer>	)	1
<amount of money>	::= <integer>.<digit><digit> | (<integer>.<digit><digit>)	)	1+1

Marking: one mark for attempted recursion even if incorrect:
-same item Left and Right + other item(s) on Right are needed
Can't get 4 unless completely correct
Notation error max 1 mark lost

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30 **AND** 1

	Input 1		*Alternatively: Input*	*Output*	
	0	1	*0 0*	*0*	1
Input 2 0	0	0	*0 1*	*0*	
1	0	1	*1 0*	*0*	
			1 1	*1*	

[**Marking** - all four cases must be correct for the mark]

31 **XOR** 1

	Input 1		*Alternatively: Input*	*Output*	
	0	1	*0 0*	*0*	1
Input 2 0	0	1	*0 1*	*1*	
1	1	0	*1 0*	*1*	
			1 1	*0*	

[**Marking** - all four cases must be correct for the mark]

32

1	set Total = 0	All initialisations	1
2	set Max = 0		
3	set Min = 999		
4	for Count = 1 to 12	Input loop and increment Mean	1
5	input Value		
6	Total = Total + Value		
7	if Value > Max then set Max = Value	Compare and increment Max & Min	1
8	if Value < Min then set Min = Value		
9	endfor		
10	set Mean = Total /12	Calculate and output mean *	1
11	set range = Max – Min		
12	output “Mean Value = ” Mean	Calculate and output Range *	1
13	output “Range = ” Range		
14	if ((Mean > 75) **OR** (Range > 25)	Test then output correct Message	1
15	then output “Further treatment”		
16	else output “No treatment”		

* **Condone** no message for these two outputs

Condone if it correctly outputs “Further treatment” twice (if both conditions apply)
Do not condone if it outputs eg “Further treatment” then “No treatment” or vice versa

Other approaches (eg use of an array) equally acceptable

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33 Sequential 10

- Records are stored and accessed in key sequence order.

Addition of a record:

- Make a new copy of the records until in the correct place to add the new record
- Add the new record to the new copy
- Continue until the end of the file
- If multiple records to be added, these should preferably be sorted before the above process to avoid multiple updates

Deletion of a record:

- Make a new copy of the records until in the correct place for deletion
- Do not copy the record to be deleted
- Continue until the end of the file
- If multiple records to be deleted, these should preferably be sorted before the above process to avoid multiple updates

Indexed Sequential

- Records are stored in key order in the file
- An index allows data to be accessed directly
- Multilevel index usually used:
    - There is a main index which contains the location of the next index
    - This process may extend to several levels and the last index
    - contains the physical address of the record

Note: can get up to 6 marks only for addition and deletion for sequential and indexed sequential

Random Access

- Physical location for new record is calculated from the key field
- A hashing algorithm is used for this calculation to find the location
- If data collision / something there, the record is stored instead in an overflow area
- Data in the overflow area is normally stored and searched in a linear manner
- File may need reorganising (and new hashing algorithm) if overflow becomes too large
- Existing records are accessed in the same way.

ADVANTAGES (could be reversed as disadvantages)

Seq:
- Easier to program / fewer overheads than other two methods
- Particularly suitable (and faster) if access only ever needs to be sequential

Ind Seq:
- Allows faster access than sequential because can move directly to individual records
- Avoids overheads of random
- If only sequential access is required for one application, should be faster than random

Random:
- Allows very fast access irrespective of position in file – very suitable for large files which need this sort of access

8-10 marks Candidates give a clear, coherent answer fully and accurately describing and explaining all three areas. They use appropriate terminology and accurate spelling, punctuation and grammar.

4-7 marks Candidates describe and explain a range of a least two of the areas, but responses lack clarity. There are a few errors in spelling, punctuation and grammar.

1-3 marks Candidates give a brief explanation of one area. The response lacks clarity and there are significant errors in spelling, punctuation and grammar.

0 marks No valid response

[Note: Max of 8 if only 2 of the 3 area attempted; Max of 6 if only 1 area attempted]

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