GCE MARKING SCHEME

COMPUTING
AS/Advanced

JANUARY 2014

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2014. 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.

GCE COMPUTING CG1

JANUARY 2014 MARK SCHEME

1. (a) Teacher comments and pupil contact data could be entered (stored) in a database (condone spreadsheet) (1) and a standard report could be created with fields for the data (1) then the mail merge facility (1) of the word processor used to produce reports   3

   OR alternate answer

   Teacher comments and pupil contact data could be entered (stored) in a database (1) and a standard report could be created with fields for the data (1) then the DBMS could be used to merge the data and produce reports (1)

1.(b) Benefits of sending the reports home using email compared to conventional post - MUST have comparison idea for mark   3
   - No postage costs with email so the school can save money on postage costs (NOT just cheaper alone)
   - Less time consuming / Less labour intensive to send many emails compared to printing reports, placing in envelopes and posting (NOT just faster alone)
   - No printing with email so the school can save paper / resources by sending emails (environmental)
   - Reply is easy with email so parents can reply with confirmation of receipt so no need to post or give to pupil to return to school office
   - Parents can reply with questions / comments without having to telephone school or write letter
   - Parents can access reports even if away from home
   - Reports could contain hyperlinks or pictures for parents

                                                                                                [Question total 6]

2. (a)	String	1
	Character	1
	Boolean	1
	Integer	1
	Real	1

2. (b)   Record   1

   Most suitable because data stored about a pupil contains different data types (1) and a record can be processed as a single unit (1) (read or written in one operation)   2

                                                                                                [Question total 8]

3.

(a) Role of RAM is to temporarily store data/programs currently in use and programs (1). They would recommend more RAM as this will improve the performance of the PC (1) – tasks will be completed more quickly – NOT run more programs must have faster idea   2

(b) Role of the hard drive is to store data and programs   1

They would recommend a bigger hard disc drive so that the PC will be able to: (Any one of)   1x1
   - hold more data which will be required if storing many large files such as videos (must be qualified)
   - store all future data without having to be upgraded again (future proofing)

DO NOT award more data / files on its own.

(c) A computer with a larger word size generally will run faster.   1

(d) Either one of: 1
   - Solid State Drive will (generally) have far faster access (read/write) speeds NOT just quicker / faster
   - SSD less likely to fail

(e) Any 3 from: 3
   - Data is fairly and lawfully processed
   - Data is processed for limited purposes
   - Personal data shall be adequate, relevant and not excessive
   - Data must be accurate and up to date
   - Processed in line with your rights – individual can check and amend data
   - Data can only be transferred outside EC to countries with adequate DPA

   NOT
   - Personal data stored for no longer than necessary
   - Held securely

[Question total 9]

4. (a) Database / electronic diary / spreadsheet   1

4. (b) **Two** other possible problems with the current paper-based system:
   A. Difficult or time consuming to search for a specific client NOT just search
   B. Client details on paper could be lost and are time consuming to back up **as paper has to be copied** (idea required) – not just 'lost'
   C. Time consuming to amend client details on paper or paper becomes messy after several alterations and may require a new sheet
   D. Difficult to sort client details or appointments into a usable order – today's appointments in time order.

Not writing might be illegible – only hairdresser writing.

   Solutions (which must follow problem described above)
   A. Database can quickly search for client on different criteria
   B. Database would be easy to back up NOT data is more secure on a computer
   C. It is easy to update a record in a database and possibly have combo boxes, etc
   D. Database can quickly sort data into any order required

   One mark for problem, one mark for solution. Solutions must follow problem.   4

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4. (c) The checks must be described correctly with enough detail so that it is clear that the invalid data would be detected by the check described. A different check must be described in each part.

   One mark for each check correctly named or described.   2x1
   One mark for an example of invalid data that the check described would detect.   2x1

Postcode

Suitable checks	Example of invalid data
Presence check to reject data where required fields have been left blank (there has to be something input)	There is nothing in the box
Length check to ensure that the data entered are of a reasonable length; for example, postcode must be between 7 and 10 characters long	CF2 1Q CF233 3ERD
Format check to ensure that a data item matches a previously determined pattern; for example, data must only contain characters and digits and match determined pattern for example AA## #AA	CF2X 3AB

Date of appointment

Suitable checks	Example of invalid data
Presence check to reject data where required fields have been left blank (there has to be something input)	There is nothing in the box
Range check – days must be between 1 and 31, months between 1 and 12, year must be in future but not more than one year	23/13/2014
Format check to ensure that a data item matches a previously determined pattern; for example, data must only contain digits and match determined pattern for example ##/##/####	232/04/2014
Length check to ensure that the data entered are of a reasonable length; for example, date must have 10 characters	2/4/2014
Condone - Type check to ensure that a data item is of a particular type; for example, all entries should be digits or slash MUST deal with delimiter such as slash, space, colon etc…	B3/04/2014

NOTE - Example of invalid data **must** follow check described

[Question total 9]

5. (a) Advantages of a star network - Any three of:
- If one cable breaks network can still operate (NOT workstation)   1
- Faults can be easier to detect   1
- Data has to pass through hub (sent direct to workstation) so better security **NOT** just 'more secure' without explanation   1
- Easier to extend star / add new stations   1

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5. (b) Hardware required to make a wireless connection to a network would be **wireless** network card **and** a **wireless** router (or switch) - Both required for one mark   1

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5. (c) HTTP - transferring (multimedia) web pages over the Internet   1
FTP - copying a file from one location to another via the Internet   1
IMAP - transferring emails (NOT messages) between computer systems (via the internet) 1

[Question total 7]

6.(a) Fragmented – files (NOT data) are split up and stored on different parts of the disc (1)
Defragmentation will put parts of a file close together (1) (on same track if possible) to reduce read/write head movement and therefore reduce access times (1)
ONLY penalise once if 'data' used instead of 'files'   3

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6. (b) Many compression (lossy and lossless) methods exist but candidate must briefly describe a method that would make the file smaller   1

Examples include:
- Compress a text file is to replace frequently occurring character combinations by a single character, for example replace 'th' with the digit 0.
- Replace long strings of one's or zero's with a number for example 00000000000000000000000000000000 with 33.
- Approximate all shades of blue in a photograph with lots of blue sky to one shade of blue and only store this for the whole sky instead on individual colours for every pixel.

[Question total 4]

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7. External entity   1

A – Application form details (Condone application form) (must be a noun)   1
B - Confirmation (or not) of registered house owner (must be a noun)   1
C - Database of house owners (must be a noun)   1
D - Make decision (must be a verb)   1
E - Customer's bank (must be a noun)   1

[Question total 6]

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8. (a) Alpha testing (1) which is usually carried out 'in-house' by developers/programmers (1) (or company employees / people employed by the company for the specific purpose of testing)   2

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8. (b) Beta testing (1) has benefit for company as they get constructive comments from prospective / typical customers (1) and testers benefit as they get a free game to play before anyone else (1) (accept kudos idea)   3

[Question total 5]

9. (a) To add to a serial file the new record is appended to the end of the file   1

To add to a sequential file, a new file is made by copying the old file until an insertion is required then inserting the new record (1) and copying the rest of the file (1)   2

9. (b) Fixed length records are quicker to process (read/write) (1) by computer as start and end locations are known (1)
OR
Fixed length records are easier to program (1) as do not have to deal with field or record delimiters (1)

[Question total 5]

10. Manages peripherals such as input and output devices (including spooling – not hand held device)

Communicates with and sends data output to a printer / monitor / other valid output device
Communicates with and receives data input to a keyboard / mouse / other valid input device
Data is stored on hard disc / in memory / stored in a queue
Document is printed when printer is free / in correct order
Benefit of *spooling* - User can carry on working / log off when waiting for job to print

Manages backing store

Ensures that data is stored and can be retrieved correctly from any disc drive
Creates and maintains filing system such as FAT or NTFS (accepted but not expected)

Organise files in a hierarchical directory structure.

Manages memory (RAM)
Ensures programs / data do not corrupt each other
Ensures all programs and data including itself is stored in correct memory locations

Manages processor
Ensures different processes can utilise the CPU and do not interfere with each other or crash
On a multi-tasking O/S ensure that all tasks appear to run simultaneously

The description of any of the points could be extended with more detail and gain an extra mark.

5 - 6 marks   Candidates give a clear, coherent answer fully and accurately describing how the operating system manages resources which might include relevant examples.

3 - 4 marks   Candidates describe how the operating system manages resources.

1 - 2 marks   Candidates simply list resources managed by the operating system.

0 marks   No appropriate response

[Question total 6]

11. One mark for each correct item in table

S	E	M	Array[M]	F	P
0	7	3	49	False	-1
4	7	**5**	**67**	False	-1
6	7	**6**	**75**	**True**	**6**

NOTE – deduct one mark for each additional row with data.

[Question total 7]

12. (a) (i) Global variable – any one of:	1
SortArray	
i	
Last	
SwapMade	

12. (a) (ii) Local variable – Temp	1

12. (b) Global variable – can be used (changed/altered) anywhere in the program	1
Local variable - can only be used (changed/altered) in the procedure where it is declared	1

12. (c) Role of the procedure ProcOne is to swap (1) the two elements of the array position[i] with [i+1] (1)	2
One mark for swap and one mark for consecutive elements idea.	[Question total 6]

13. (a)	
Multiplication Table	
Multiplier	
Product	
i	1

13. (b) To make the program easier to understand (NOT read) by <u>programmers</u>	1

13. (c) Role of line 'if multiplier < 1 then' is test if input is positive (greater than zero)	1
Checks if multiplier is less than one	

13. (d)	
The line 'set Product =' should be completed	
set Product = i * Multiplier OR set Product = Multiplier * I	1
	[Question total 4]

14.

Benefits to the company

    Adverts are only shown to people who might be interested based on their: Location Age Birthday Sex Keywords Education Workplace Relationship Interests Language
    If a user 'Likes' a product company can target with similar products
    If user is not interested in product company can save money by not targeting with similar products
    If user tells a friend then friend is more likely to trust another friend and look at advert for product
    Friends of user might have similar likes and dislikes and be interested in same product
    Companies can build up a relationship with users over time which might increase brand loyalty
    Advert could be link to company web site so can make instant purchase
    Users could talk enthusiastically and start a discussion about the advert and generate more interest

Benefits for the user of the social networking

    Users only see adverts for products that they might be interested in so save time looking
    Advertisers paying social networking web site pay the bills so using site is free

Drawback for user of the social networking is:

     that they might feel that they are being watched or don't like their personal information being used in this way
    advert may contain link that could download tracking cookie / virus

Drawback for company of the social networking is that

    they might receive negative recommendations and lose custom
    users might find advert annoying (or spam) and ignore it (develop negative attitude to company)

The description of any of the points could be extended with more detail and gain an extra mark.

5 - 6 marks	Candidates give a clear, coherent answer fully and accurately describing benefits for the company and the user of this type of advertising, which might include relevant examples. A drawback is given.
3 - 4 marks	Candidates briefly describe benefits for the company and the user of this type of advertising, which might include relevant examples.
1 - 2 marks	Candidates simply list benefits for the company or the user of this type of advertising.
0 marks	No appropriate response
	[Question total 6]

15.

Study the existing system documentation - This is suitable for investigating current data storage requirements or data flow

> Benefits
> Team can see how current system 'should' be operating
> Inexpensive method of gathering lots of information fairly quickly
> Can identify storage requirements

Drawbacks
> Staff may not be following procedures in documentation and may be using system in their own way
> Documentation may be out of date and not updated to reflect system changes

Carry out a questionnaire of staff - This is suitable because the staff might be spread over a wide geographical area and there are many of them.

> Benefits
> Relatively cheap to produce for a large number of people
> Can be distributed worldwide
> Could be completed on-line so results can be available very quickly

> Drawbacks
> Have to be designed by experts or information could be unusable
> People are 'too busy' and may not complete
> People may not give correct answers

Interview staff - This is suitable when the analysts require a lot of information from a small number of people such as key staff

> Benefits
> Can gather large amount of detailed information
> Can make judgements on validity of information from personal contact or body language
> Can ask 'follow up' or 'open ended' questions to gather more detailed information in selected areas

> Drawbacks
> Time consuming and expensive to carry out
> Has to be carried out by trained interviewer or closed questions written by experts
> Difficult to analyse large amount of information
> Difficult to analyse wide variety of information

Observe the current system in practice - This is suitable for gathering information first hand

> Benefits
> Can actually see what is really happening and do not have to rely on what people tell you what they think is happening

> Drawbacks
> Very time consuming and therefore expensive to carry out
> Staff may feel like they are being watched and therefore behave differently so do not actually see what goes on every day
> Cost of sending analysts around the world.

The description, benefits or drawbacks of any of the methods could be extended with more detail and gain extra marks.

9 - 12 marks   Candidates give a clear, coherent answer fully and accurately describing at least three methods of investigation and the purpose. They use appropriate terminology and accurate spelling, punctuation and grammar.

4 - 8 marks   Candidates give a clear, coherent answer describing method(s) of investigation. There are a few errors in terminology and accurate spelling, punctuation and grammar.

1 - 3 marks   Candidates give an answer simply listing methods of investigation. There are significant errors in spelling, punctuation and grammar.

0 marks   No appropriate response

[Question total 12]

End of Paper

GCE COMPUTING - UNIT CG3

Mark Scheme - January 2014

Question	Answer	Mark
01	A web log is a set of entries / diary on the world wide web which is accessible to any web user.	1
	The student could add items including photos, videos etc. to keep their friends up-to-date with their activities / could keep in touch with other members of the charity etc.	1
02	<u>Downloading music</u>: refers to accessing music file via the internet either freely (legally or illegally) or from a web-site where payment is needed (for local storage)	1
	<u>Difficulty</u>: download speeds may be very low / access may be unreliable / excessive data charges	1
	<u>On-line banking</u>: refers to accessing balance details, transferring money etc in connection with your own account via a secure web-site	1
	<u>Difficulty</u>: there may be concerns over security with data transfers between countries or within the country	1
03	**Any 2 of:** • Should be easily navigable / should have links to other pages etc • All links should be correct • The page should be as accessible as possible for users with visual impairment, etc • It should make sensible/imaginative use of colour, graphics, fonts, etc • Should comply with established web standards • Should load quickly	2x1
04	Circuit switching: Dedicated path is set up between the sender and receiver	1
	Packet switching: • (Data split into packets) each packet may be transmitted by different routes • Packets may arrive out of order and are re-assembled	1 1
	Any 2 of (<u>both needed for the one mark</u>): • the actual data • the order number of the packet / reassembly data • error checking data **[Not source and destination addresses]**	1
05	**Any 3 of:** • Speeds up text input / faster than typing • Can be used by someone who is unable to type / not a skilled typist / disabled • May help to avoid RSI • Allows user to simultaneously do some other task with hands etc	3x1
	Ambiguity problems: • Different words may sound the same (e.g. too / to / two) • Command words may be taken as input words (or vice versa) (e.g. "start sentence")	1 1
06	The computer prompts for input into specific fields on a screen dialogue box. Many inputs may be via combo boxes, radio buttons, etc, so only certain entries are allowed.	1 1

07	Data structures: any <u>two</u> of the following for **ONE** mark:	1
	• queue • stack • (binary) tree • record • array (NOT linked list)	
	Marking: Accept single boxes with arrows rather than twin boxes	1
	• pointers (including start and end - accept other indications of start and end) • data	1
08	**AND**	1
	An example could be: MASK **10000000** VALUE **11001011** MASK **AND** VALUE **10000000**	1
	Explanation: when **AND**ed with another number, this (example) mask determines whether the left hand bit of the number is 1 or 0	1
09	The physical location of the record is calculated from the data in the key field	1
	This calculation is carried out by a hashing algorithm	1
	A data collision occurs when two data items are hashed to the same location	1
	In this case there needs to be an overflow area where the latest data is stored, usually in a linear structure	1
	When there are many items in the overflow area, access may become slow, in which case a new/updated hashing algorithm is required and a larger file may/will be needed (both points needed for this mark)	1 1
	An example of an extended answer worth six marks is:	
	A random access file is one where the physical location of the record is calculated (using a hashing algorithm) from the data in the key field. Sometimes, a data collision occurs (i.e. two data items are hashed to the same location.) In these circumstances, there needs to be an overflow area where the latest data is stored. When the file begins to get quite full, there may be many items in the overflow area and access may become slow. A solution to this problem is to create a new hashing algorithm and a larger file may be needed.	
10	Item is compared with (sorted) list to find correct position	1
	Items in the sorted list are moved up/down to enable new items to be added in the correct place	1
11	Rounding: number is approximated to <u>nearest</u> whole number/tenth/hundredth, etc	1
	Truncating: number is approximated to whole number/tenth/hundredth, etc, <u>nearer zero</u> (accept *lower*)	1

12	Either of: a more serious problem might arise where: • successive use in further calculations may seriously increase inaccuracy • a test for equality might fail if a minor difference is caused by rounding (**Not** the idea of "cause an error" or "inaccurate" alone)	1
13	If in point form: any 6 of **(but must have both of first two*** to gain six)** • *** An expert system is based on facts and rules / inference engine • *** employing a large database (*Knowledge base*: accepted not expected) • might help them to diagnose / treat unusual conditions • might save doctor's time • might reduce time spent in training doctors • up to date information • might cause the doctor to be held in lower esteem (de-skilling: accepted not expected) • doctor may become over reliant on system ***An example of an extended answer worth six marks is:*** An expert system is a software system with a large database (often called a knowledge base) and a built-in set of facts and rules which enable it to appear to be an expert in a certain area similar to a human expert, by analysing and solving complex problems. An ES might be used by the doctor to diagnose unusual or complex conditions from information gathered from the patient. The ES might reduce the number of years spent training to be a doctor. It might save the doctor's time by covering simple conditions first and allowing the doctor to concentrate on more difficult medical situations. Doctors might also welcome the ES if it enables unusual medical conditions to be diagnosed rapidly and reliably. The doctor / medical profession might be concerned that ES might lead to the loss of status / esteem or deskilling of the profession.	6
14	If answered in point form, any five from: • Biometric data is unique to a person • Biometric data is very difficult to copy, steal or imitate (unlike PINs, signatures, etc) • It is not possible to "forget" as it would be with access cards, PINs, etc • Some people might see this use of biometrics as an infringement of privacy / modesty, etc, (personal liberty) • People might also be concerned about the uses the data might be put to • People might be concerned about physical damage (e.g. eye damage from repeated flash photography) • Will not work if the original data capture was flawed (e.g. if criminals manage to have their data recorded and fraudulently become authorised) ***An example of an extended answer worth five marks is:*** Biometric systems usually work by biometric data being recorded for authorised persons, for instance the staff of a bank. When someone requires access (for instance physical entry to the bank) a comparison is made between the stored biometric data and that of the presenting person - access is only allowed if they match. This approach has the benefit that biometric data is very difficult to copy, steal or imitate (unlike PINs, door keys, signatures, etc) Also it is not possible to "forget" as it would be with access cards, PINs, etc. However, some people might see this use of biometrics as an infringement of their privacy or modesty and might be concerned about physical damage (e.g. eye damage from flash repeated photography. People might also be concerned about the uses the data might be put to.	5x1

15	Data mining: the <u>analysis of a large amount of data</u> (in a data warehouse) to provide <u>new information / find patterns/trends</u> in the data	1 1
	Supermarket: Any 2 of: • could attract customers to make additional purchases via targeted special offers, etc • could reward customers for purchases made • could learn about individual customer choice, shopping times, etc • could sell info on to third parties	2x1
	An example of an extended answer worth four marks is: Data mining is the analysis of a large amount of data in a data warehouse to provide new information or to find new patterns in the existing data. A supermarket could use the intelligence derived from data mining on data extracted from loyalty card data to increase its profits by attracting customers to make additional purchases via targeted special offers, etc and to reward customers for previous purchases.	
16	Buffer A buffer is filled at one end and emptied at the other end / while one buffer is being emptied, another can be filled buffering avoids fast device waiting for the data transfer Double buffering is quicker than single buffering	1 1 1 1
	An example of an extended answer worth four marks is: A buffer is an area of computer memory where data is held while transferring it to or from a (slower) peripheral. With double buffering, while one buffer is being emptied, another can be filled. This avoids waiting for the data transfer.	
17	Interrupt: is a signal generated by a device/software which may cause a break in execution	1
	Afterwards, execution of the original routine may continue or another high priority interrupt may be serviced. (both points needed)	1
	Situations giving rise to interrupts: **any two of** (Must indicate S/W or H/W): • May arise from a run time error (S/W) • May arise from input/output request (S/W) • May arise from a user request (S/W) • May arise from a software fault (S/W) • May arise from a peripheral e.g. keyboard key pressed (H/W) • May arise from a peripheral e.g. printer run out of paper (H/W) • May arise from e.g. a timer pulse (H/W) • May arise from a hardware fault (H/W)	2x1
	An example of an extended answer worth four marks is: An interrupt is a signal generated by a device or software which may cause a break in the execution of the current routine. Afterwards, execution of the original routine may continue (or another high priority interrupt may be serviced.) Situations giving rise to interrupts include: an input/output request (software) and a timer pulse (hardware.)	
18	A flat file is database held as a table and stored in a single file, whereas a relational database normally contains a number of <u>linked</u> tables.	1
19	Any two of: The DBMS allows access via passwords. The DBMS allows certain users access to <u>certain records or fields</u> only. The DBMS may allow <u>read and/or write</u> access only.	2x1
20	Either of: An index is used to: • improve (read) access times to records / allow direct access to data in the database (not	1

	"quick" alone) • sort the records (for viewing/output)		
21	`00001011 -> ` **`01011000`**		1
	Any 1 of: • Multiplies the original number by 8 • Multiplies by 2 three times • Multiplies by 1000_2 – in which case subscript must be shown		1
22	An arithmetic shift maintains/deals with the sign bit; a logical shift does not. (Example is acceptable if clear)		1
23	The table contains <u>repeating groups/entities</u> (English, Mathematics, Computing, etc)		1

24	FILM (<u>FilmID</u>, FilmName, Genre, ReleaseYear)
	
	COPY (<u>CopyID</u>, FilmID, PurchaseDate)
	
	MEMBER (<u>MemberID</u>, MemberName, MemberAddress)
	
	LOAN (<u>LoanID</u>, MemberID, RequestDate, CopyID)
	
	Marking:
	    Four suitable named tables
	    Each of four table with suitable PK shown as such (**1 mark if 2 or 3 PKs**)
	    Each FK shown as such
	
	    Remove only 1 for any number of incorrect fields / FKs)
	    Ignore additional irrelevant fields
			1
			2
			3x1

25	BNF is used to describe (unambiguously) the syntax / grammar / rules of a programming / computer language.		1
	Natural languages such as English or Welsh are normally ambiguous/imprecise.		1
26	<digit> ::= 0|1|2| ... |9		1
	<signornull> ::= +|-|null) <point> ::= **.**)		1
	<digits> ::= <digit>|digit><digits>		1

	<decimalnum> ::= <signornull><digits><point><digit><digit><digit><digit>
	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 one mark lost
			1

27	One solution is shown. Other correct solutions will receive full credit.		
	``` input Digit1, input Digit2, input Digit3, input Digit4, input Digit5 while (Digit1>0 AND Digit2>0 AND Digit3>0 AND Digit4>0 AND Digit5>0) do set CheckNum = Digit1*5 + Digit2*6 + Digit3*7 + Digit4*8 + Digit5*9 while CheckNum >99 do set CheckNum = CheckNum -100 endwhile output Digit1, Digit2, Digit3, Digit4, Digit5, CheckNum input Digit1, input Digit2, input Digit3, input Digit4, input Digit5 endwhile ```	**Marking** Input five digits Loop until data terminates First calc Checknum Removal of 100s Output all	1 1 1 1 1
28	Any 1 of: - If programmer A modifies current version, and programmer B modifies an earlier version, neither new version will contain both modifications - Any amendments must be made to the most recent versions		1
29	Procedural languages are concerned with: any one of: - carrying out actions / calculations, etc - obeying (ordered) set of instructions Non-procedural languages are to do with <u>facts</u> / <u>rules</u> / making <u>queries</u> **Marking:** Two of the above are needed for the mark		1 1
30	A link loader is a software tool which combines already compiled modules/subprograms into the executable program. Example of error - **any one of:** - link loader cannot find a compiled module/subprogram / it doesn't exist - the number or type of parameters provided is wrong		1 1

31	**Compilation:**	11

Compilation:
- 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 Lexical Analysis 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 (accepted not expected)

[**Note**:
If simply named 3 or 4 of:
Lexical Analysis / Syntax Analysis / Semantic Analysis / Code Generation: two marks
If simply named 2 or 4 of:
Lexical Analysis / Syntax Analysis / Semantic Analysis / Code Generation: one mark]

Debugger:
- Program trace/Step-through: enables the programmer to see the progress through the program - which statements/procedures are being executed at any time
- Break point: allows the programmer temporarily to halt execution in order to ascertain the value of variables at that point (or to step through the program from that point)
- Variable watch: lists the value of a variable at specific points during the execution
- Store dump: lists the entire contents of memory at a specific point
- Error diagnostics: provision of messages relating to errors in the program

Accepted not expected:
- Post-mortem routines: enables programmer to see the values of variables at the point where the program failed.

Marking: The description of any of the points could be extended with more detail and/or a good example to gain extra marks.

Maximum of 8 marks if only 1 of the 2 sections attempted.

9-11 Candidates give a clear, coherent answer fully and accurately describing and explaining both areas. They use appropriate terminology and accurate spelling, punctuation and grammar.

5-8 Candidates describe and explain at least one of the two areas, but responses lack clarity. There are a few errors in spelling, punctuation and grammar.

1-4 Candidates simply list a range of points or give a brief explanation of one of the areas. The response lacks clarity and there are significant errors in spelling, punctuation and grammar.

0 No valid response.

		Total	100