



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.

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COMPUTING - CG1

MARK SCHEME

SUMMER 2013

1.

(a) (i) Distribution list to which customers email addresses are added 1

(ii) **Two** advantages and for the supermarket using email compared with conventional post - *any two of*:

2x1

- The supermarket can save resources by sending emails – **MUST** be environmental saving **NOT** cost
- Email arrives same day so could advertise sales or promotions that last one or two days / email arrives quicker than letter **NOT** just faster alone
- Additional information e.g. video, hyperlink, etc (about products) could be embedded or sent as an attachment

(b) DPA in summary – Any four of 4x1

- Data must be adequate, relevant and not excessive
- Data must be accurate and up to date
- Personal data stored for no longer than necessary
- Processed in line with your rights – individual can check and amend data
- Held securely
- Data can only be transferred outside EC to countries with adequate DPA

NOT

- Data is fairly and lawfully processed
- Data is processed for limited purposes

[Question total 7]

2.

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

(b) Characters are stored in one byte (1) while a string will require a byte for **each** character in the string (1)

NOTE Could be answered using an example 'B' would take one byte so Gareth would take 6 bytes

[Question total 7]

3.

(a) Spooling is carried out on a computer when a user wants to print several documents by: storing the documents in a queue (1) and then the documents are printed when printer is free (1) this has the benefit of allowing the user to carry on working or even log off when waiting for documents to print (1).

(b) When a file is compressed the file is made smaller (and the amount of data may be reduced) 1

OR

could give an example of a method such as replace frequently occurring character combinations by a single character, for example replace 'th' with the digit 0.

One reason for compressing a file is to save storage space / upload to a web site / speed up transfer over a network / send as email attachment 1

(c) Fragmented – files (NOT data) are split up and stored on different parts of the disc 1
Disc fragmentation will slow down disc access speed 1

[Question total 7]

4. (a)

One other possible problem with the current paper-based system:

- A. patient details on paper are time consuming to back up as need to be copied
- B. Time consuming to amend or create patient details
- C. Difficult to sort patient details into a useable order NOT just difficult to sort
- D. Patient records could be lost or filed in wrong place

Solution (which must follow problem described above)

- A. Database would be easy to back up NOT data is more secure on a computer
- B. It is easy to type data into a database and possibly have combo boxes, etc...
- C. Database can quickly sort data into any order required
- D. Patient records would be backed up or filed in incorrect location

One mark for problem, one mark for solution. Solution must follow problem.

2

4. (b)(i) The check must be described correctly with enough detail so that it is clear that the invalid data would be detected by the check described.

One mark for check correctly named or described.

1

One mark for an example of invalid data that the check described would detect.

1

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, telephone number must be between 9 and 20 characters long	12345 or 123456789123456789123456789
Format check to ensure that a data item matches a previously determined pattern; for example, data must only contain digits and match determined pattern ### #####	123456 or 74
Type check to ensure that all entries are digits	B or #

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

4. (b)(ii) Enter twice and compare (must have compared idea) (1) and if no match then telephone number might contain input errors (1)

OR

Enter twice and compare (must have compared idea) (1) and if match then OK (1)

[Question total 6]

5.

Reasons to install a star network

- If one cable breaks (NOT computer) network can still operate
- Can be easier to detect faults (as can ping each station directly)
- Data has to pass through hub (sent direct to workstation) so better security NOT just 'more secure' without explanation
- Easier to extend star / add new stations

Reasons to **NOT** install a ring network

- Expensive cabling (as cable carries power for repeater)
- If a repeater fails or ring is broken (NOT computer) then network will fail
- Can be difficult to add new stations (NOT TWICE)

Reasons **NOT** to install a bus network

- Difficult to extend bus / add new stations (NOT TWICE)
- Response time can deteriorate with many users (many collisions) NOT bus is slower or star is faster
- Break in **bus** or main cable idea – all network down (NOT single workstation down or break in cable)
- All data is broadcast so security can be compromised (NOT TWICE)

[Question total 5]

6.

A suitable procedure, **fully justifying** any hardware required, for the accountant to safely and securely back up the data is:

Marking

- One mark for hardware
- One mark for frequency of back up
- Three marks for justification referring to speed of access, cost and portability

Suitable storage medium is an external hard disc drive. (Condone removable drive)

Data should be backed up at the end of every day. (Condone weekly – do not accept any longer periods)

Justification of external hard disc drive:

- Speed of access – Very fast transfer which is important as daily updates
- Cost per unit of storage – external hard disc is quite cheap per byte of storage
- Portability reason – external hard disc is physically quite small and can be easily stored securely and safely for example in a fire proof safe

OR

Suitable storage medium is to upload to a third party storage provider

Data should be backed up at the end of every day OR every time specified files change. (Condone weekly – do not accept any longer periods)

Justification of uploading to a third party storage provider:

- Speed of access – very fast transfer achievable (depending on network speed) for daily updates
- Cost per unit of storage – could be cheaper or more expensive than external disk – accept either with justification
- Data is stored securely and safely on protected servers (or should be!)

OR

Suitable storage medium is a large capacity pen drive. (accept other names such as USB stick, etc...)

Data should be backed up at the end of every day. (Condone weekly – do not accept any longer periods)

Justification of pen drive:

- Speed of access – Very fast transfer which is important as daily updates
- Cost per unit of storage – pen drive is quite cheap
- Portability reason – pen drive is physically small and can be easily stored securely and safely for example in a fire proof safe

CONDONE tape as not considered suitable in this scenario

Suitable storage medium to back up the entire hard disc is magnetic tape / tape streamer

Data should be backed up at the end of every day. (Condone weekly – do not accept any longer periods)

Justification of magnetic tape / tape streamer:

- Speed of access reason – Access to tape is serial and can be slow but could only back up files amended that day
- Cost per unit of storage reason – Tape is relatively (but drive can be expensive!) cheap compared with other secondary storage mediums
- Portability reason – Tape is physically small and can be easily stored securely and safely for example in a fire proof safe

[Question total 5]

7.

(a) Process	1
(b) A – Application Form (Noun)	1
B – Mortgage approved or declined (Noun)	1
C – Credit agency database (Noun)	1
D – Decide whether to approve application (Verb)	1
E – Applicant's employer database (Noun)	1

[Question total 6]

8.

Benefits for the company of being able to employ programmers from a wide geographical area are:

- can employ the best skilled or best suited programmers
- labour costs might be a cheaper in different countries
- the work ethic might be different and programmers might be prepared to work harder and longer to meet deadlines
- work is being completed 24/7
- can employ programmers from same country as client as would have better understanding of law/culture/users of that country

Benefits for the company of being able to employ programmers who do not require an office are:

- Cost saving on office floor space required (rent)
- Cost saving on car parking space required
- Cost saving on office facilities such as chairs, desks, canteen
- Cost saving servicing offices such as cleaners, security, maintenance
- Cost saving on office energy such as lighting and heating (bills)
- Company can expand very easily just by employing more programmers with no need for capital expenditure on offices
- Cost of travelling could be saved (so could pay less) if company is paying to travel to meetings etc...
- No time spent travelling so more time working

5 - 6 marks Candidates give a clear, coherent answer fully and accurately describing benefits for the company of being able to employ programmers from a wide geographical **and** benefits for the company of being able to employ programmers who do not require an office.

3 - 4 marks Candidates give clear answers describing benefits for the company of being able to employ programmers from a wide geographical **and** benefits for the company of being able to employ programmers who do not require an office.

1 - 2 marks Candidates simply list benefits of either the company of being able to employ programmers from a wide geographical **or** benefits for the company of being able to employ programmers who do not require an office.

0 mark No appropriate response

[Question total 6]

9.

Benefits of using social networking web sites to post personal information, messages, share music and videos

- Can contact friends from all over the country / world
- Can send messages to many friends at once
- Can be quicker and/or cheaper to share photos, music and video
- Can be cheaper to talk using this method to communicate compared to the telephone – must be justified
- Can set up and join 'interest' groups
- Can invite people to meetings/parties
- Sharing music by new or unknown bands can increase their popularity
- Can obtain answers to questions and solve problems

Drawbacks of using social networking web sites to post personal information, messages, share music and videos:

- Information may be inaccurate or misleading / people may not be telling the truth and difficult to detect with no face to face contact
- May come into contact with people trying to sell illegal material such as drugs / weapons / pornography / paedophiles
- Site may be used for 'cyber bullying'
- People may give out personal information such as age and telephone number which can be used for identity fraud
- Lack of 'real' social contact may lead to losing social skills
- May download virus
- Prospective employers, landlords, partners might view site and find information or see photographs that might have been meant only for friends
- Could be inadvertently sharing copyright material and therefore breaking the law
- Information on page can be used by journalists or police if user is involved in a crime
- When information or a photo is posted it is 'out there' forever even when removed by owner

Additional marks may be given for an extension of any of the benefits or drawbacks by giving examples or more detail.

4 - 5 marks Candidates give clear extended answers describing benefits **and** drawbacks of using social networking web sites for to post personal information about themselves, chat, share ideas, music and videos.

1 - 3 marks Candidates briefly describe benefits **and/or** drawbacks of using social networking web sites to post personal information about themselves, chat, share ideas, music and videos.

0 marks No appropriate response

[Question total 5]

10.

(a) serial 1
 Sequential 1

(b) Advantages of fixed: 2

- Fixed length records are quicker to process (read/write) by computer as start and end locations are known
- Fixed length records are easier to program / estimate storage requirements as it can be calculated how much storage space will be required

Advantages of variable: 2

- Variable length record saves storage space as no blank space
- Variable length record avoids truncation as each field can extend to accommodate any number of characters

[Question total 6]

11.

i	A[i]	X	Y
1	25	0	false
2	47	0	false
3	17	0	false
4	63	0	false
5	81	5	true
	33		
	71		

One mark for each correct row

NOTE – deduct one mark if any additional row(s) completed.

Condone either of these tables

i	A[i]	X	Y
1	25	0	false
2	47	ditto	ditto
3	17	ditto	ditto
4	63	ditto	ditto
5	81	5	true

i	A[i]	X	Y
1	25	0	false
2	47		
3	17		
4	63		
5	81	5	true

[Question total 4]

12.

Membership: Gold	Day: Weekday	Time: 14	True
Membership: Silver	Day: Weekday	Time: 11	True
Membership: Bronze	Day: Weekday	Time: 12	False
Membership: Silver	Day: Weekend	Time: 12	True
Membership: Silver	Day: Weekday	Time: 19	False

[Question total 5]

13.

- (a) Typical roles of the user interface provided by the operating system 2
- Provides user interface with meaningful icons / avoid text input / drop-down menus
 - Can provide a command line interface
 - Allows customisation of interface e.g. change desktop colours / layout
 - Allows access to system settings such as hardware
 - Allows copying / deleting / moving / sorting / searching of files or folders
 - Allows creation of shortcuts
 - Controls security using passwords or access permissions
 - Allows user to have more than one window open
 - Allows user to switch between tasks (programs/windows)
 - Provides user with error/warning/help messages

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

Example answer worth two marks – create shortcut with extension

One feature of the user interface provided by the operating system is to allow the creation of shortcuts. The user can create a shortcut to a commonly used application or visited web site on the desk top.

- (b) Manages the resources - processor and memory 2

Manages memory (RAM) – any one of:

Ensures programs / data do not corrupt each other

Ensures all programs and data including itself is stored in correct memory locations

Manages processor – any one of:

Ensures different processes can utilise the CPU in order of priority and do not interfere with each other or crash

Ensure that all tasks appear to run simultaneously / allow user to run more than one program at a time

[Question total 4]

14.

Answer can be any reason that clearly demonstrates the use of the attribute or a good example could gain the mark.

A reason for setting a file attribute to read-only is when the user should not be able to alter the file.

A reason for setting a file attribute to archive is when the file no longer in regular use but may be required sometime in the future (for example a legal document or tax records that have to kept for a minimum number of years)

A reason for setting a file attribute to system is when the file is only used by the operating system (for example a device driver)

A reason for setting a file attribute to hidden is when the user should not be able to see the file (for example many files are hidden in Windows as the user cannot view or amend them if you view certain directories)

[Question total 4]

15.

(a) Suitable use for a mark-up language is creating web pages 1

Suitable use for visual language is writing applications that require a GUI or for a visual environment such as Windows, Mac or mobile devices OR create a visual game like using Scratch 1

Suitable use for procedural language is writing any general application such as pay roll, data handling, etc... 1

(b) A programmer may decide to use a low level programming language because – there are many acceptable answers and many program situations could be given if they are correctly justified.

One mark for situation and one mark for reason 2

Examples of acceptable answers are:

Tasks connected with the running of the computer (operating system) because execution speed is critical **or** size of code needs to be small

Embedded system because size of code needs to be small **or** primitive processor with limited instruction set

Real time systems like controlling an aeroplane as control is required over the hardware and they have to run fast and respond immediately.

Computer games because hardware producing graphics will need to be programmed and program has to run quickly

[Question total 5]

16.

(a) example of annotation – any one of: 1

- {input by user}
- {used to store current answer}

(b) meaningful identifier – any one of: 1

- Multiplier
- Product
- i
- MultiplicationTable

(c) The role of the variable i in the algorithm is to: 1

- counts the number of iterations through the loop
- stores the values ranging from 1 to 12
- to multiply the number input by the numbers 1 to 12

(d) 1

```
for i = 1 to 12
    set Product = i * Multiplier
    output Product
endfor
```

OR

```
for i = 1 to 12
    set Product = i * Multiplier
    output Product
endfor
```

Purpose of for-next loop is to repeatedly execute code (1) a fixed number of times (1).

[Question total 6]

17.

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 country.

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

Maintenance documentation would be used by the original developer or by different programmer at a future date.

Contents of Maintenance documentation is:

Algorithms for all code which are an unambiguous list of instructions to solve a problem (is the code in pseudo code or flowcharts)

Annotated listing which is the program code with comments.

Data dictionary is a file or printout containing descriptions of, and other information about, the structure of the data (held in a database) used in the system.

A record of all updates and changes made to the system.

- 9 - 12 marks Candidates give a clear, coherent answer fully and accurately describing methods of investigation and the purpose and contents of maintenance documentation. 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 or the contents of maintenance documentation. There are significant errors in spelling, punctuation and grammar.
- 0 marks No appropriate response

[Question total 12]

End of Paper

COMPUTING - CG3

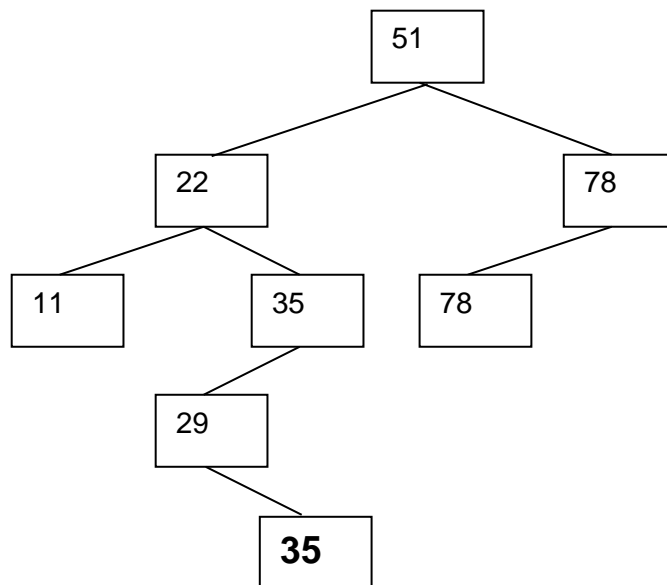
MARK SCHEME

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
-
- 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/sntp/voip/pop3 to transfer data between devices
- 05 Serial transmission: 1
- Data sent bit-by-bit along the same data line
- 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
-

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

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
	<ul style="list-style-type: none"> • 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.

13	Computer prompts for input into specific fields on a screen dialogue form Advantage: any one of:	1 1
	<ul style="list-style-type: none"> • 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	
<hr/>		
15	Any two of:	1+1
	<ul style="list-style-type: none"> • check for correspondence between the designed system and the specification • confirm that the most appropriate techniques have been used • confirm that the user interface is appropriate 	
<hr/>		
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	1+1
	<ul style="list-style-type: none"> • allow database users to <u>read / write to / amend / delete</u> only part of DB • 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 	
<hr/>		
18	Any eight of:	8x1
	<ul style="list-style-type: none"> • 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.

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 (or lines 5-7 where terminating condition is for when Num = 2)	1
20	$\begin{aligned} \text{FValue}(4) &= \text{FValue}(3) + \text{FValue}(2) \\ &= \text{FValue}(2) + \text{FValue}(1) + \text{FValue}(2) \\ &= 1 + 0 + 1 = 2 \end{aligned}$	
Marking:	1 mark for seeing $\text{FValue}(4) = \text{FValue}(3) + \text{FValue}(2)$	1
	1 mark for seeing final answer of 2	1
	This is the (Num term of the) Fibonacci sequence (or is a series where the last two numbers are added to give the next number)	1

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: <ul style="list-style-type: none">Any transitive dependencies need to be removed to convert from 2NF to 3NFIt needs to be ensured that each attribute / field depends only on the primary key	1

23	BRANCH (<u>BranchTown</u> , BranchAddress, BranchPhone)	
	INSTRUCTOR (<u>InstructorID</u> , InstructorName, InstructorAddress, InstructorPhone, <u>BranchTown</u>)	
	PUPIL (<u>PupilID</u> , PupilName, PupilAddress, PupilPhone, <u>InstructorID</u>)	
	BOOKING (<u>PupilID</u> , <u>BookingDate</u> , <u>BookingTime</u>)	
Marking:	Four suitable named tables	1
	Each table with suitable PK (identified as such) (2 or 3 correct = 1 mark)	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 (<u>BookingID</u> , <u>PupilID</u> , BookingDate, BookingTime)	

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]

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.

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
29	<pre> <digit> ::= 0 1 2 ... 9 <integer> ::= <digit> <digit><integer> <amount of money> ::= <integer>.<digit><digit> (<integer>.<digit><digit>) </pre>	<p>) 1</p> <p>) 1</p> <p>) 1+1</p>

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

30	AND	<table border="0"> <tr><td>Input 1</td><td></td><td></td></tr> <tr><td></td><td>0</td><td>1</td></tr> <tr><td>Input 2</td><td>0 0</td><td>0</td></tr> <tr><td></td><td>1 0</td><td>1</td></tr> </table>	Input 1				0	1	Input 2	0 0	0		1 0	1	<table border="0"> <tr><td><i>Alternatively: Input</i></td><td></td><td><i>Output</i></td></tr> <tr><td></td><td>0</td><td>0</td></tr> <tr><td></td><td>0</td><td>1</td></tr> <tr><td></td><td>1</td><td>0</td></tr> <tr><td></td><td>1</td><td>1</td></tr> </table>	<i>Alternatively: Input</i>		<i>Output</i>		0	0		0	1		1	0		1	1	1 1
Input 1																															
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Input 2	0 0	0																													
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<i>Alternatively: Input</i>		<i>Output</i>																													
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[Marking - all four cases must be correct for the mark]

31	XOR	<table border="0"> <tr><td>Input 1</td><td></td><td></td></tr> <tr><td></td><td>0</td><td>1</td></tr> <tr><td>Input 2</td><td>0 0</td><td>1</td></tr> <tr><td></td><td>1 1</td><td>0</td></tr> </table>	Input 1				0	1	Input 2	0 0	1		1 1	0	<table border="0"> <tr><td><i>Alternatively: Input</i></td><td></td><td><i>Output</i></td></tr> <tr><td></td><td>0</td><td>0</td></tr> <tr><td></td><td>0</td><td>1</td></tr> <tr><td></td><td>1</td><td>0</td></tr> <tr><td></td><td>1</td><td>1</td></tr> </table>	<i>Alternatively: Input</i>		<i>Output</i>		0	0		0	1		1	0		1	1	1 1
Input 1																															
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Input 2	0 0	1																													
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	0	0																													
	0	1																													
	1	0																													
	1	1																													

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

32

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

- 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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