GCE MARKING SCHEME

COMPUTING
AS/Advanced

JANUARY 2013

INTRODUCTION

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

CG1

1. (a) **Mail merge** (1) is taking data from an **external** source (1) and **combining it with a standard letter** (1) to form personalised letters. 3

(b) A suitable description of a distribution list where **email addresses are stored as a group** and can be sent the same email in one operation (other names are acceptable such as 'group' with clear description) 1

One advantage for the agency of communicating with customers using email compared with conventional post - - *any one of:* 1x1

- The agency can save paper / resources / money by sending emails (environmental)
- Arrives quicker than letter so could advertise last minute ticket availability / deals NOT just faster than mail or speed alone MUST say why it is an advantage
- Additional information e.g. video, hyperlink, etc (about event) could be embedded or sent as an attachment

One disadvantage for the agency of communicating with customers using email compared with conventional post - - *any one of:* 1x1

- Could spread virus(es)
- Email may be considered as 'spam' and filtered by software / ISP and never read
- Customer may not access email regularly

(c) DPA in summary – Any two of: 2x1

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

(d) Two reasons why the agency would ask employees to sign a code of conduct 2x1

- It ensures that staff are aware that some activities are illegal / unacceptable
- May form basis for legal sanction / disciplinary action

[Question total 10]

2. One mark for each **comparison** 3

	multiple writable DVDs	**external hard disc**
speed of access	Slower than external hard disc	Faster than multiple writable DVDs
cost per unit of storage	Cheaper than external hard disc	More expensive than multiple writable DVDs for storing 20 Gbytes
Durability	More robust than external hard disc	External hard drive is more likely to fail as mechanical or brake if dropped

Other method could use a USB pen drive 1
because they have a faster access speed / are smaller and easier to store away from computer 1

Data is uploaded to a third party 1
Because any one of: 1x1
data is stored securely / will not be lost
there is no physical medium to lose
data is accessible from any of David's computers / downloaded when required

Example answer – worth five marks:

Multiple DVDs would be good as they would be a lot cheaper than buying an external hard disc; they are slower to access but as it is only for back up and used infrequently this will not be an issue. They are stronger than an external hard disc which could brake if dropped. I would use a 32 gigabyte USB pen drive as it is faster to access than both the others.

[Question total 5]

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

(b) Record (1) because there is more than one data type to store (1) 2

[Question total 7]

4 (a) A bit is a single digit (in a binary number) for example 0 or 1 1
A byte is a group of eight bits for example 11000010 1
A correct description of a bit and byte without examples is worth 1 mark.

(b) A word is a group of bits that can be addressed / transferred / manipulated as a single unit by the CPU.
A computer using a larger word size would generally operate faster. 2

[Question total 4]

5 (a) One mark for problem, one mark for solution. Solution **must** follow problem. 2x2

Other possible problems with the current paper-based system:

A. Difficult and/or time consuming to find stock details NOT just 'difficult to search' alone
B. Paper based systems are difficult and/or time consuming to back up as each piece of paper will have to be copied NOT just 'difficult to back up' alone
C. Time consuming to amend or create new stock details
D. Difficult to sort stock details (into a useable order for example best selling records) NOT just 'difficult to sort alone
E. Employees hand writing might be illegible / paper deteriorates and can become illegible

Solution (which **must** follow problem described above)

A. Database would be easy to and quick to search for stock details
B. Easy to back up a computerised database
C. It is easy to type data into a database or more likely to use data previously stored data
D. Database can quickly sort data into any order required
E. Writing on screen can easily be read and clear printed reports produced

(b) Two different reports – many suitable answers but must be related to business, for example: 2x1

- Number of sales made each week/month/year
- Days or times when most sales are made
- Any report about sales' trends - genre
- Find an individual sale for returns
- Any stock report like alphabetical list / best or worst selling records / total stock

(c) (i) Another suitable check would be a range check to ensure data is between set limits for example data input must be between 1 and 100 1

Example of invalid data would be 125 1

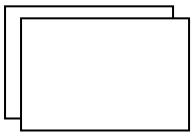
Condone format check for two digits ONLY if well described

(ii) The only suitable check is a look-up check where the user is presented with a limited list of acceptable input, new, good or poor in this case. 1

[Question total 9]

6 (a) (i) Idea of power of diagrams to convey complexity / 1 picture worth 10000 words etc 1

(ii) Process 1

(iii)  1

(b) A - Member (must be suitable noun) 1

B - Local library book list (must be suitable noun, different from any other data store) 1

C – Check local library book list (must be suitable verb, different from any other process) 1

D - Central Library availability (must be suitable noun, different from any other data flow name) 1

[Question total 7]

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7 (a) Who would be most likely to access and how that individual is given access to their intranet and web site:

- An intranet is only accessible by authorised people within the company (with a login and
- password e.g. employees) 1
- An Internet web site is accessible by everyone (customers or employees) with no access restrictions 1

(b) Many other services the company could offer customers using their extranet exist but examples are: 1x1

- View previous and current bills / energy use / predict future bills / pay bills
- Change personal details such as telephone number
- Send secure emails / messages / forms to company
- Could target or offer new tariffs/deals to customers
- Book heating service

The effect on the employment within the company:

- Company will require employees to set up and maintain their intranet, extranet and Internet web site 1
- Company will require fewer employees to take and/or enter customer meter readings 1

[Question total 5]

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8 (a) Advantages and disadvantages of using handwriting recognition on these devices: 3

Advantages
No need to learn a new method of input as can already write – less intimidating for new users
Quicker than other methods of input such as typing using on-screen keyboard

Disadvantages
Very poor hand writing will not be recognised
Can take a long time to 'train' the device to recognise user's handwriting
Some words will not be recognised and still require another method of input
Require a fairly large screen to be able to write
Powerful device required for the processing involved to recognise hand writing
Difficult to use when walking, driving, on a bus or train, etc…
May require a special pen or stylus which could easily be lost and system becomes unusable
Handwriting might change, for example, if rushing and therefore not recognised

NOTE at least **one** advantage and **one** disadvantage for three marks.

(b) Candidates are expected to give full reasons which describe why this is a suitable HCI for such devices. 4

- Touch screen is intuitive and easy to use and users may be familiar with concept
- Whole screen on the device can be used for input such as a large keyboard for example (poor eyesight and avoiding small physical keyboard which is difficult for some people to use)
- Whole screen on the device can be used for output to watch films
- Touch screen is very versatile and it can be a keyboard / used to display icons
- Touch screen is very versatile and it can be used for interactive multimedia applications such as playing games
- No need for a method for input and one for output therefore device can be kept small / less weight
- Touch screen has no moving parts to fail or break
- Users can easily zoom in on small text or to see more detail

Additional mark for extension giving examples or more detail.

Example of extended answer worth four marks is:
Touch screens are very intuitive and people are used to them and know how to use them. When the whole screen on the device is used for both input and output it is possible to play games using the full screen which can be far bigger and therefore a lot better for game playing than if half the device is taken up by a small keyboard being used for input. The whole screen can also be used for input by touching icons or a large keyboard could be displayed. Watching videos using the whole screen is better than on a smaller screen where half the device is a keyboard. Touch screen does not have any little buttons which can be fiddly to use particularly if you have big fingers whereas you can zoom the keyboard on a touch screen also the buttons sometimes break.

[Question total 7]

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9. The difference between fixed and variable length records is that a fixed length record has same number of bytes in each record (and same number of fields) but a variable length record has different number of bytes in each record (or different number of fields).
Fixed length record is easier to program as it can be calculated to know how much storage space will be required
Variable length record makes it difficult to calculate how much storage space will be required
Fixed length records are quicker to process (read/write) by computer as start and end locations are known
Variable length records are slower to process (read/write) by computer as start and end locations have to be calculated at read/write time
Fixed length record wastes storage space as fields have blank space
Variable length record saves storage space as no blank space
Fixed length record will truncate long fields
Variable length record avoids truncation as each field can extend to accommodate any number of characters
Any advantage or disadvantage could be extended and gain an extra mark.

Example of an extended answer worth six marks:
The difference between fixed and variable length records is that a fixed length record has same number of bytes in each record but a variable length record has different number of bytes in each record.
Fixed length records are easier to program as it can be calculated to know how much storage space will be required but a variable length record makes it difficult to calculate how much storage space will be required. Fixed length records are quicker to process (read/write) by computer as start and end locations are known but variable length records are slower to process (read/write) by computer as start and end locations have to be calculated at read/write time. Fixed length record wastes storage space as fields have blank space whereas variable length record saves storage space as no blank space.

5 - 6 marks Candidates give a clear, coherent answer fully discussing fixed and variable length records. The difference between them is described in detail.

1 - 4 marks Candidates give an answer discussing fixed and variable length records. The difference between them is described in detail.

0 marks No appropriate response

[Question total 6]

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10. (a) Test data: 30 18 22 77 -1

X	Y	Z	
	0	100	
30	30	30	(1)
18	30	18	(1)
22	30	18	(1)
77	77	18	(1)
-1	77	18	(1)

Deduct one mark if any additional rows completed

(b) To stop the algorithm / terminates input / ends the loop / stops repeating 1

[Question total 6]

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11. (a) Local variable = Area 1
Global variable = Radius 1
Constant = Pi 1

(b) The variable Area is local to the procedure FindArea (and will be out of scope) 1

(c) Could cross output from main program (1) and write in procedure (1) as shown below

```
Algorithm CalculateArea

Pi = 3.142
Radius is real

        declare subprocedure FindArea {procedure to calculate the area of a circle}

        Area is real

                start
                        Area = Pi * Radius * Radius
                        output "The area is ",Area
                End

Startmainprog
        output "Type in the radius"
        input Radius
        call FindArea
        output "The area is ",Area
endmainprog
```

Alternatively Cross out Area as local variable (1) and declare Area as a global variable (1)

[Question total 6]

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12. (a) One example of a meaningful identifier – any one of: 1

- SearchValue
- Position
- Found
- SearchArray

Programmers use meaningful identifiers so that the program is easier to read by **other programmers** or the **same programmer at a future date** 1

(b) An example from the algorithm of selection 1

```
if Found = true then
        output "item found in array at ", Position
else
        output "item not found in array"
endif

Accept 'if Found = true then'
```

OR

```
if SearchValue = SearchArray[i] then
        Found = true
        Position = i
else
        set i = i + 1
endif

Accept 'if SearchValue = SearchArray[i] then'
```

Purpose of selection is to execute a **selected** piece of code (1), if a **condition is satisfied** or true (1) 2

[Question total 5]

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13. (a) Corrective – is usually carried out when a bug in the program has been identified. 1

Adaptive – is usually carried out to reflect external changes or operate with new hardware / OS 1

(b) Alpha testing is the issue of the software to a **restricted audience of testers** within the developer's own company. 1

Beta testing is when a version is released to a number of **prospective customers or general public** in exchange for their constructive comments. 1

Acceptance testing is the testing carried out **by the customer** to ensure that the system works correctly. 1

[Question total 5]

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14. (a) Accidental damage is when data is unintentionally amended or deleted 1

People likely to cause accidental damage to data stored at the on-line music store are customers or store employees deleting or amending data by accident 1

Malicious damage is when data is intentionally amended or deleted 1

People likely to cause malicious damage to data stored at the on-line music store are hackers (or similar) or disgruntled store employees deleting or amending data on purpose 1

(b) Procedures the store should adopt to ensure that data are restored after damage has occurred

Servers should be backed up at regular intervals 1
Backups should be stored in a secure location / off site 1
'Cloud computing'

[Question total 6]

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15. The following points are required but need to be described in full and make a coherent answer to achieve the top mark band.

Real time transaction processing:

- could be used by a theatre selling tickets
- when **record** is accessed other users are locked out
- the **record** is updated immediately
- avoids double booking

Real time control processing:

- could be used to control temperature
- continuously monitoring
- Inputs are processed immediately
- output is adjusted immediately
- accidents can be avoided or states such as temperature can be maintained
- whole system can be automated with a few operatives monitoring

Batch processing:

- could be used to produce electricity bills / payroll
- collecting all the data which can then be used with the billing application to produce the bills
- can be carried out overnight without any further human intervention / resources available
- explanation of master update with transaction
- jobs can wait in a queue until they are processed

Example answer worth maximum marks:

Real time transaction processing could be used by a **theatre selling tickets** because as a seat is booked, **other users are locked out** (1), the record is **updated immediately** and availability of that seat on that date is immediately removed/changed this avoids **double booking** a seat.

Real time control processing could be used by a chemical plant to **control temperature** by **continuously monitoring** the temperature which is input to the system. These Inputs are processed **immediately** and the output is adjusted **immediately** this means that **accidents can be avoided**. The whole system can be automated but a few operatives will be required to monitor and react if limits are reached or exceeded.

Batch processing could be used to **produce electricity bills** by **collecting together all the data** such as amount of electricity used this month for all customers to be billed, and using the customer file, with details such as tariff and payment method. This data can then be used with the billing application to produce the bills **without any further human intervention**. This could be **carried out overnight** or at any time when the computer resources are not in demand.

9 - 12 marks Candidates give a clear, coherent answer fully and accurately describing real time transaction, real time control **and** batch mode of operation including a situation where each mode of operation would be the most suitable and why it the most suitable. They use appropriate terminology and accurate spelling, punctuation and grammar.

4 - 8 marks Candidates give a clear, coherent answer describing real time transaction, real time control **or** batch mode of operation including a situation where each mode of operation would be the most suitable and why it the most suitable. There are a few errors in terminology and accurate spelling, punctuation and grammar.

1 - 3 marks Candidates give an answer describing real time transaction, real time control **or** batch mode of operation which might include a situation where each mode of operation would be the most suitable and why it the most suitable. There are significant errors in spelling, punctuation and grammar.

0 marks No appropriate response

[Question total 12]

End of Paper

CG3

01 A VLE is a **software system** designed to help teachers and pupils in the management and use of learning resources. 1

The school VLE could contain details about - any 1 of: 1
(must be related to learning – not generic)

- homework / coursework assignments
- feedback from teachers to students (not twice)
- additional / background teaching materials, etc

---

02 An intranet can only be accessed by (in this case) staff/students (using a log in/password). 1

The school intranet could contain details about; (any 1 of): 1

- teachers / teacher-rooms
- school newsletter / achievements of pupils, etc (not twice)
- feedback from teachers to students / grades / student details (not twice)
- internal telephone book, etc
- teaching resources / homework etc…

---

03 The school web site could contain; (any 1 of): 1

- school newsletter / achievements of pupils / open or parent evening (not twice)
- school prospectus etc
- information about school's interaction with local community etc
- school inspection reports etc
- weather warnings / discussion board / forum etc…
- contact details / location

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04 Multi-tasking is a method of organising computer use which allows several different tasks or applications to be available (/ run) at (apparently) the same time. 1

The user is able to switch from one task to another. 1

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05 Benefit of standalone – any one of: 1x1
Security may be improved – reduced chance of hacking / unauthorised access via a network / virus spreading / cheaper and easier to buy and set up
not susceptible to network or server failure

Drawback of standalone:
It is not possible to communicate or share resources such as devices, software or data 1

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06 Any one of:
Digital transmission is preferred as it is less likely to suffer corruption/degradation. 1
Can error check data.
Can compress data and therefore transfer time is quicker.

07

Simplex:	Data transmission is possible in one direction only	1
Half duplex:	Data transmission is possible in both directions, but only in one direction at a time	1
Full duplex:	Data transmission is possible in both directions simultaneously	1

---

08 Either of:
Switching sends data along the appropriate path. 1
Switching prevents all the data being sent to all parts of the network.

It requires less bandwidth / is more efficient not to send data where it is not required 1

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09 A router is a device in the network which holds information about the address of computers in its network (or address of other networks) 1

… and can therefore send data to the correct computer. 1

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10 Benefits: any 2 of:

- less programming skill required 1+1
- much of the "work" is done for user by package / quicker to achieve objective
- can import / export from / to other packages
- less likely to contain errors / package has already been well tested
- package might include library of standard functions
- more help is available in the package

Drawback:

- Programming might have achieved special functionality unavailable in the package 1

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11 A special purpose language might have helpful/vital features relevant to the application 1

Examples include:

- simulation eg for queuing systems 1
- control of equipment
- computer aided design
- artificial intelligence
- expert systems
- scientific applications, etc
- games programming

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12 Either of:
A scripting language is … 1
a set of commands understood by the applications software
usually embedded in another language and is used to control aspects of the software
(and is a high-level language, interpreted not compiled)

Examples include:

- script embedded in (the HTML in) a web site to control graphics, etc 1
- script embedded in a web site to load/execute a file when clicked, etc

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13 Data mining: the analysis of a **large amount** of data (in a data warehouse) to provide new information / find patterns in the data 1

Insurance company: could use data extracted from customers:

- to develop new products 3x1
- to improve marketing to existing / new clients
- identify groups of safer clients
- to attempt to reduce fraud …
- … via sharing information with other insurance companies/(police?)

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. An insurance company could use data extracted from customers to develop new insurance products, to improve marketing to existing or new clients and make special offers etc to them. The insurance company could also attempt to reduce fraud by a better understanding of unusual claims etc and could augment this by sharing relevant data with other insurance companies, and possibly the police.

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14 Accept abbreviations in left hand columns.

Address	*Name*	*Pointer*
501	*Lindsey*	**502**
502	*Markowicz*	**503**
503	*Wong*	**Null** / **-1**
504	*Edgeley*	**506**
505	*Abbott*	**504**
506	*Farooq*	**501**

3

Accept any similar ending but not blank

Marking: 6 correct -> 3 marks
4 or 5 correct -> 2 marks
2 or 3 correct -> 1 mark

15
AND 1

Any 1 of:

- Will identify / pick out / produce left bit / most significant bit 1
- Will determine whether left bit / most significant bit is a 0 or 1

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16 Indexed sequential file:

- Records are stored in key order in the file 1
- Index allows data to be accessed directly 1

Multilevel index:

- There is a main index which contains the location of the next index 1
- This process may extend to several levels and the last index contains the physical address of the record 1

Advantage over standard sequential file:

- Allows faster access because can move directly to individual records 1

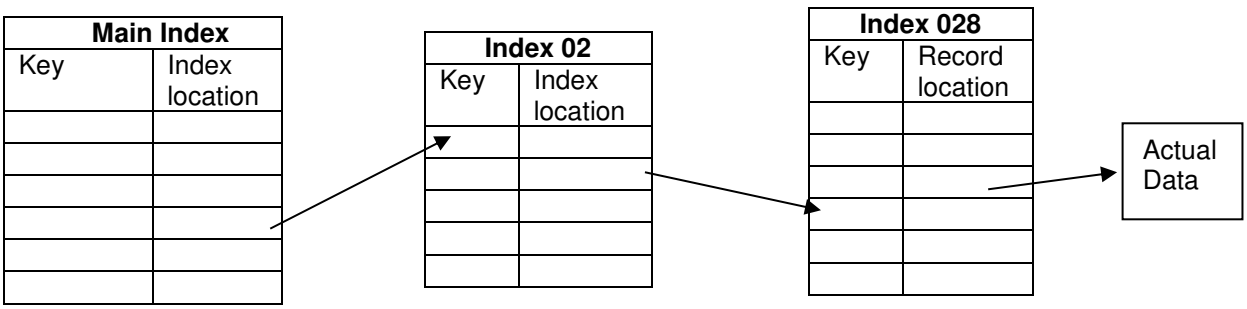
An example of an extended answer worth five marks is:

An indexed sequential file is a file structure where records are stored in key sequence order in the file and where an index is used to allow data to be accessed directly.

A multilevel index arises where this index is a main index which itself contains a range of addresses and the location/block of the next level index. This process may extend to several levels, with the last index containing the physical address of the record.

An indexed sequential file allows faster access because you can move directly to the individual record.

Diagram:



[Marking of diagram: 1 mark for three suitably labelled tables
1 mark for three suitable arrows] 2

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17 A transaction log is used with on-line updating - stores all the update data 1

It can be used in case of failure - could restore data by being combined with previous master/backup file, with minimal data loss. 1

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18 Any 6 of:

- Many organisations eg *Towy* could not survive if their computer system failed
- All computer systems are liable to fail
- You can't always avoid fires, floods, etc. 6x1
- Backups should be made **regularly** / **periodically**
- Files should be archived off-site
- There should be an alternative computer system / ability to replace hardware quickly
- There should be a back-up power supply
- Even if effective, some data/money/business is likely to be lost after the disaster
- Staff trained in recovery procedures
- Data can be restored from safely stored back up

An example of an extended answer worth six marks is:

Many organisations, particularly on-line retailers like *Towy,* are completely reliant on their computer systems and could not continue / survive if the system lost data or failed for anything but a very short time. All computer systems are liable to fail, however well designed and maintained, and it is never possible to be completely secure against fires, floods, earthquakes, terrorist attacks, etc.

To aid a rapid recovery from disaster, periodic / regular backups should be made, with files archived off-site and/or in a fire-proof environment. *Towy* should ensure that an alternative system (computer-based or manual) is available, also a back-up power supply.

However, even if disaster planning is comprehensive and the recovery is well executed, it is still likely that *Towy* will suffer some unavoidable damage, and some money and/or customer good-will will be lost.

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19 parameter 1

How passing by value operates:
A local copy of the variable is created for the procedure (discarded afterwards) 1

Other method: passing by reference: 1
The address of the required data is passed to the procedure 1
(rather than the actual value of the data)

Benefits of passing by value: any 1 of:

- preserves value-at-calling of the parameter 1
- avoids unwanted side-effects

---

20 A process is blocked if it is waiting for some event. 1

Example: waiting for an input/output operation with a slow peripheral 1

---

21 Partitioning is the dividing up of memory 1
allows more than one job to be resident in the (main) memory at the same time. 1

Code can be loaded into any partition. 1
(If the code is not re-locatable it will have to wait until it can go into one particular Partition / Memory may not be available for the process.)

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22 Any 2 of: 2x1

- Redundancy (data duplication) is reduced (therefore saving space)
- Risk of inconsistent data is reduced (better integrity of data)
- Data independence allows different views of the same data
- Allows easy extension/amendment to the structure of the database.

---

23 A database administrator is the person in a company who – any one of: 1
Is responsible for the **maintenance** of the structure and management of the database system and the data in it.
Allows users access to the database possibly with usernames and passwords
Monitoring user activity
Ensuring data backup procedures are followed

---

24 Any 2 of this type of example: 4
(Marking: 1 for condition and 1 for both parts of test data x2)

Condition being tested	Array data	Search integer
Search integer occurs once	5 8 5 7 2 3 6 4	7
Search integer occurs more than once	5 8 5 7 2 3 7 4	7
Array data contains all same integer (= or ≠ Search)	2 2 2 2 2 2 2 2	2
Array empty		2
Search integer does not exist	5 8 5 9 2 3 9 4	

Other possibilities can be credited

25

STUDENT (StudentNum, StudentName, …)

TEACHER (TeacherNum, TeacherName, …)

COURSE (CourseNum, TeacherNum, …)

STUDENT-COURSE (StuNum, CourseNum, StartDate, …)

[**Marking**: Four suitably named tables: 1
Four tables with suitable Primary Key shown (2 or 3 correct = 1 mark) 2
One mark for each foreign key (don't need to be identified as such) 3x1
-1 mark for any number of additional bad foreign keys

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26 BNF is used to describe unambiguously the syntax/grammar of a programming language. (Natural languages are generally ambiguous) 1

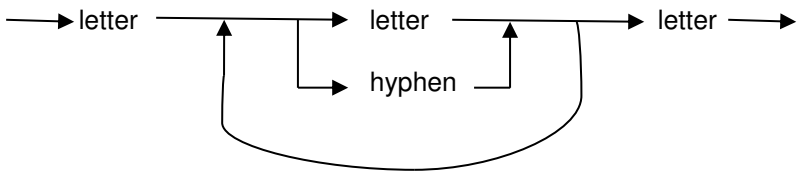
27

```
<letter>      ::=  a|b|c|.....|z
<hyphen>      ::=  -
<word_char>   ::=  <letter>|<hyphen>
<word_chars>  ::=  <word_char>|<word_char><word_chars>
<word>        ::=  <letter>|<letter><letter>|<letter><word_chars><letter>
```

4

[Marking: One mark for attempted recursion even if incorrect
(same item L and R + other item(s) on R are needed)
Max of 1 mark lost for notation
Other equally valid answers exist
Condone any upper case letters seen
However it's done, can only get 4 if completely correct**]**

28



3

[**Marking**: 1 mark for **letter** at start and end with suitable arrows
1 mark for alternative **letter**/**hyphen**
1 mark for loop]

29

```
1   input Name, Mark, Attempt
2   if Attempt = "F"
3       then if Mark ≥ 60
4                then set Grade = "Merit"
5                else if Mark ≥ 50
6                         then set Grade = "Pass"
7                         else set Grade = "Fail"
8                     endif
9            endif
10      else
11               if Mark ≥ 50
12                        then
13                             set Mark = 50
14                             set Grade = "Pass"
15                        else
16                             set Grade = "Fail"
17               endif
18  endif
19  output Name, Mark, Grade
```

Marking	
Input	1
if structure (**F** or **S)**	1
Correct processing for **F**	1
Reduce mark for **S**	1
Otherwise correct processing for **S**	1
Output	1

[**Marking**: Other approaches are possible and will be given full credit if correct
No validation expected (e.g. trapping **Attempt** if neither **F** or **S**)
Condone **>** for **≥** throughout
Condone no **endif**s if structure clear
No marks are given for brevity/efficiency/elegance]

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30 Number would be doubled/multiplied by two/multiplied by 10_2 (subscript required) 1

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31 Overflow occurs when the number is too large to be stored (satisfactorily) by the computer 1

Underflow occurs when the number is very close to zero (**Condone** too small) to be stored (satisfactorily) by the computer 1

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32 Advantage of floating point form:
Can store numbers which are not integers / are real numbers / have decimals 1

Advantage of integer form:
Stores numbers completely precisely / accurately 1

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33 **011000010000 0101 or 0 11000 01 0000 0101** etc (Spacing unimportant) 1+1

24 -> 11000
·25 -> ·01

[Marking: 1 for correct mantissa, 1 for correct exponent]

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34 Answers need to address specific types of disabilities.

(Input)
- Speech recognition interface (SRI) can be used by someone unable to type/disabled
- SRI may have difficulty with background noise / interference / can overhear others' input
- SRI may have difficulty with proper nouns / ambiguity etc

- Foot controlled keyboard / mouse

- Head/eye movement detector

- Oversize keyboard

- Use of head stalk etc

- Braille key overlays

- Screen readers can be used together with a standard GUI

- However any such device will not be suitable if unable to use that part of the body
- Many such devices may have considerable resource implications for the computer system

(Output)
- Screen output can use large / clear fonts / clear colour contrasts etc

- Speech synthesis is useful for people with visual impairment
- Speech synthesis may pronounce words incorrectly
- Speech synthesis can be annoying / obtrusive
- Speech synthesis may have heavy hardware performance requirements **(once only)**

- Braille output may be possible – device punches paper with Braille characters

[**Marking**: The description of any point can be extended with more detail to gain extra marks]

6-8 Candidates give a clear, coherent answer fully and accurately describing and explaining **several** methods of input **and** output which are particularly suitable for users with various types of disabilities. They use appropriate terminology and accurate spelling, punctuation and grammar.
4-5 Candidates describe and explain methods of input **or** output which are particularly suitable for users with various types of disabilities, but responses lack clarity. There are a few errors in spelling, punctuation and grammar.
1-3 Candidates simply describe a method of input **or** output which are particularly suitable for users with various types of disabilities. The response lacks clarity and there are significant errors in spelling, punctuation and grammar.
0 No appropriate response

[End of Paper]

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