GCE MARKING SCHEME

COMPUTING
AS/Advanced

SUMMER 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 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) String Integer Real Boolean (Correct answer only) 4

1.(b) Record (1) because it is capable of storing several different data types (1) 2

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2. (a) *Mail merge* is taking data from an **external** source and **combining it with a (standard) letter or document** to form personalised letters. (Both ideas required for mark) (1)

Suitable example of how the organiser might make use of *mail merge* – many suitable answers are acceptable but must be a sensible communication with all or most participants, examples include:

- Letter about walk arrangements to all participants
- Certificates of completion to all participants who completed. (1)

A macro is the **recording** of key strokes which can then be **replayed** by clicking a button, menu item or allocated key combination. (Both ideas required for mark) (1)

Suitable example of how the organiser might make use of *macros* - many suitable answers are acceptable but must be a sensible task that is performed more than once, examples include

- Inserting salutation on individual letters
- Performing a mail merge
- Inserting a special character such as Ŵ for Welsh names or Ñ for Spanish names
- Inserting a picture or graphic in a document (1) 4

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2. (b) DPA in summary – Any three of:

- 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 3

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3. (a) One possible problem with the current paper-based - any one of: (1)

A. They may not be able to read the hand writing on the order or the wrong address
B. Order could be written down incorrectly
C. Incorrect calculations
D. The order could be lost and there is no other copy

Solution (which must follow problem described above) (1)

A. Order is printed or displayed on monitor in kitchen which is clear
B. Computerised system would have validation / drop down lists, etc… to minimise errors
C. Calculations will be accurate
D. If printed and lost can easily print another 2

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3. (b) An additional benefit the new computerised system will provide for the customer – many suitable answers but must be as a result of installing a computerised database system and NOT solving problems with paper-based system

For example
Any MIS report about sales, money, profit
Customer only has to give address once
Order taking will be quicker
Could store orders and customer could order 'the usual'
Sending automated letters to regular customers or customers who have not visited for a while
Customers may have loyalty card / Identify regular customers and could give discount 1

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3. (c) A useful report – many suitable answers but must be related to business, for example: 1
Number of sales made for each menu item – best and worst / trends / busy and quiet times
Items that have not sold in last month
Providing statistics of total sales, monthly sales, busiest periods, best selling items, etc…
Which customers buy what - offers and deals

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3. (d) 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 described.
One mark for an example of invalid data that the check described would detect.

The amount of each menu item ordered

Suitable checks	**Example of invalid data**
Presence check	Nothing in box
Range check to ensure data is between sensible limits for example 0 and 9	12000, -23
Type check to ensure that a data item is of a particular type; for example, all entries should be digits	Bob or 160j

NOTE - Example of invalid data **must** follow check described 2

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3. (e) Postcode (must be **different** check)
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 described.
One mark for an example of invalid data that the check described would detect.

Suitable checks	**Example of invalid data**
Presence check	Nothing in box
Format check to ensure that a data item matches a previously determined pattern; for example, data must only contain digits and match determined pattern ### ########	CF 3EW, CF123 5WED
Length check to ensure that the data entered are of a reasonable length; for example, postcode must be between 7 and 9 characters long	CF 3EW, CF123 5WED

NOTE - Example of invalid data **must** follow check described 2

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

Examples of accidental loss for on-line supermarket accounts are: (1)
- Customer or supermarket employees deleting or amending contact details by accident
- Customer or supermarket employees deleting or amending payment details by accident
- Supermarket employees may incorrectly amend loyalty card points balance

NOTE – not other type of accidental damage such as server crashes or floods, etc….

How the supermarket could prevent accidental damage: (1)
- Verify amendments or deletions on-line – “are you sure you want to …” or double entry
- Customer has to confirm amendments or deletions in writing or by telephone
- Suitable staff training or clear customer instructions
- Make some data read only or restrict who can amend data. 3

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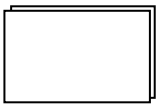
5. (a) Hardware required for each computer / laptop would be wireless network interface card/device (1)
Hardware required for network would be a wireless router (or switch) **CONDONE** hub (1) 2

5. (b) Wireless device and a typical use – many acceptable answers but use must be sensible, for example:
Mobile phone / tablet / PDA (1) to browse web, play games, listen to music, check emails, etc…(1)
Television (1) to download films (1)
Camera (1) to upload pictures (1)
Games console (1) to play multi player games
Printer (1) to share resource wirelessly 2

6. (a) Process (1)



(1) 2

6. (b) **A** = e.g. Tutor Application / details (1)
(Must be a noun, sensible, different from any other data name]

B = e.g. Reference (1)
(Must be a noun, sensible, different from any other data name]

C = e.g. Interview Tutor (1)
(Must be a verb, sensible, different from any other data name]

D = *TutorsDirect* Register (1)
(Must be a noun, sensible, different from any other data name] 4

7. (a) One mark for each correct row in table

i	X	Y	Z	
	2	4	1	
1	2	4	2	(1)
2	2	4	4	(1)
3	2	4	8	(1)
4	2	4	16	(1)

NOTE – deduct one mark if any additional rows are completed. 4

Accept table that only shows variables that change as below

i	X	Y	Z
	2	4	1
1			2
2			4
3			8
4			16

7. (b) The purpose of this algorithm is to raise X to the power Y (calculate the power of a number)
or
multiplies X by itself Y times 1

8. (a) Comment – Any one of: (1)

- {number input by user}
- {procedure to find the difference of two numbers}
- {the difference of the two numbers}

Comments used to make the program/code easier to understand (1) or help (other) **programmers** understand the program/code. (1) 2

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8. (b) Local can only be used in the sub program where they are defined (1)
Global can be used throughout the entire program (1)

Local variable - Difference (1)

Global variable - Any one of: (1)

- FirstNum
- SecondNum 4

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9. (a) AmountInPence = 37 – 20p 10p 5p 2p (1)

AmountInPence = 97 – 50p 20p 10p 5p 2p 1p (1)

AmountInPence = 44 – 20p 10p 5p 2p 1p (1) 3

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9. (b) Algorithm does not repeatedly deduct the coins 2p and 20p that could appear twice in the output (1)
Or
Could be described in what it should do - Algorithm should repeatedly deduct the coins 2p and 20p that could appear twice in the output (1) 1

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10. (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) 3

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10. (b) A. Fixed length record has same number of **bytes** in each record and same number of fields
Variable length record has different number of **bytes** in each record or different number of fields

B. Fixed length record is easier to program as it can be calculated know how much space will be required
Variable length record makes it difficult to calculate how much space will be required

C. 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

D. Fixed length record wastes storage space as fields have blank space
Variable length record saves storage space as no blank space

E. Fixed length record will truncate long fields
Variable length record avoids truncation as each field can extend to accommodate any number of characters

3 - 4 marks Candidates give clear answers **comparing** fixed and variable length records
1 - 2 marks Candidates describe fixed length records and variable length records
0 marks No appropriate response 4

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10. (c) Archive (1)
Read-only (1)
System (1) 3

11.(a) One mark for description of a point up to max of four. The description of any of the points could be extended with more detail and/or examples and gain an extra mark.

Answers must be benefits when compared to conventional post and include:
No cost other that Internet access which they have anyway or can be free in school or libraries
Quicker to write on Internet and upload a picture than writing and posting a letter
Very easy (more likely) for people to reply
Can include video, sound, hyperlinks, etc…
Pictures and information can be posted instantly
Can be accessed from anywhere (mobile phone) as you do not need actual photos and/or letter
No cost in developing pictures
Saves resources (not cost again) such as paper and fuel to deliver parcel
Can upload lots of information and photos – would be difficult/time consuming to do this by post
Can make use of interactive features such as 'like', 'tag, etc…
Uploaded files can be easily backed up
Some people will communicate using this medium who would never write a letter (informal idea)
Pictures can be downloaded and used or shared by (many) friends and family 4

11.(b) Two other people, other than friends or family, who might use the information from a personal page include:
Fraudsters looking for personal information to create a false identity / answer security questions
Police investigating a crime may look for contacts and pictures of suspected criminal
Police investigating a crime may look for contacts and pictures of crime victim
Prospective (or current) landlord to check if prospective tenant is a 'party animal'
Prospective (or current) employer might view a personal page to look at prospective employee's social life
Companies who want to target people with marketing material (could be spam)
Lawbreakers looking for images (perhaps of children) that they could sell
Predator/stalker gathering personal information
Opponents or bullies (political / interviewees / sporting) looking for information to use against person (or aggravate)
Hackers looking for computer or email information

NOTE Person and why they might view the information required for one mark 2

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12. (a) Starting at the beginning of the array SearchValue is **compared to every consecutive item** in SearchArray (1) until either an item **matches** (1) SearchValue or the **end of the array is reached**(1).

Alternatively candidate could give an algorithm - accepted not expected

```
i = 1
repeat
if SearchValue = SearchArray(i) then item found
increment i
until item found or end of array
```

Comparison and increment (1)
Terminating loop conditions (2x1) 3

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12. (b) Two different situations where a linear search will generally perform faster than a binary search are:
1. when the number of items to be searched is very small (1)
2. the SearchValue is one of the first data items in the SearchArray (1)

One situation where a binary search will generally perform faster than a linear search is when there is a large **sorted** set of data (1)

Condone – if the item being searched for was the middle item (found first comparison idea) 3

13. The difference between ROM and RAM is that in ROM the data is fixed during manufacture or is permanent and cannot be deleted or amended (1) whereas RAM is where data can be added, amended or deleted(1)
Condone ROM is non-volatile and RAM is volatile without any explanation of meaning of non-volatile and volatile

Example of data in ROM would be the boot strap loader, other systems software or hardware (system) settings / BIOS (1)

Example of data in RAM would be a running program such as an application or the operating system. (1) 4

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14. **One mark for situation and one mark for reason**

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.

Examples of acceptable answers are:
Tasks connected with the running of the computer (operating system) (1) **because** execution speed is critical **or** size of code needs to be small(1)
Embedded system (1) **because** size of code needs to be small **or** primitive processor with limited instruction set (1)
Real time systems like controlling an aeroplane (1) **because** control is required over the hardware and they have to run fast and respond immediately (1)
Computer games (1) **because** hardware producing graphics will need to be programmed and program has to run quickly (1)

One mark for reason why some programmers prefer to use high level programming languages from:
Easier to understand / learn / program as commands are more English like and identifiers can be long and meaningful
Availability of powerful commands (NOT more powerful language) that perform quite complex tasks such as Msgbox in VB or the SORT clause in COBOL
May reflect the nature of the problem (problem orientated) and can be easier to program a solution such as HTML for web pages, SQL for database applications
Suitable for general program production
Can be translated to run on different platforms 3

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15. Two reasons why most companies would find a code of conduct useful:
    - May concentrate the minds of employees on the issues
    - It ensures that staff are aware that some activities are unacceptable
    - May form basis for legal sanction / disciplinary action

    Alternatively

    Related to programmers' code of conduct:
    - writing documentation that is intentionally confusing or inaccurate
    - intentionally introducing bugs with the intent of later claiming credit for fixing the bugs, or to stimulate the uptake of later versions
    - writing viruses
    - stealing sensitive company data
    - not to use the code or ideas for personal gain
    - confirming that the current legislation is being complied with
    - not to divulge new innovative technologies to competitors 2

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16 (a) Manages peripherals such as input and output devices
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

Spooling
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.

File compression
The amount of data is reduced and the file is made smaller
Compression is used to save disc space

Disc de-fragmentation
Fragmented files are split up and stored on different parts of the disc
Disc fragmentation will slow down disc access speed
Disc de-fragmentation is when file parts are physically re-arranged (re-organised, moved, re-ordered) on disc (into the order required for access)

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 processes
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

Award a mark for a suitable example of any feature that is described

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 and provides suitable examples.
3 - 4 marks Candidates describe how the operating system manages resources
1 - 2 marks Candidates briefly describe the resources managed by the operating system.
0 marks No appropriate response

Example answer worth four out of six marks – only manages backing store explaining compression with example

The operating system manages the backing store which is usually the hard drive but it also manages pen drives when they are inserted. One job it can carry out is file compression so that the amount of data is reduced and the file is made smaller for example compressing a picture before uploading to a social networking web site.

6

16.(b) Real time transaction processing has to be used because as a seat is booked, **other users are locked out** (1), the record is **updated immediately** (1) and availability of that seat/ticket on that date is immediately removed/changed this **avoids double booking** (1) a seat. 3

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17. Changeover

Direct “big bang” approach can be adopted - sudden change to new system
- Could be used where a failure would not be catastrophic
- Can be cheaper to implement
- New system is available immediately if required (NOT TWICE)
- Can be the least disruptive if implemented well
- New system may not work as well until staff are fully used to using it
- If new system fails organisation have no system which could be costly or dangerous

Parallel running - both systems running together for a time
- Safest option as if new system fails they still have existing system
- Expensive as require temporary staff or overtime for current staff to operate both systems
- Could cause confusion for staff and customers having two systems
- New system is available immediately if required (NOT TWICE)

Phased changeover - part-by-part (by functionality)
- Suitable for different departments
- All staff can focus on one area to resolve any problems (NOT TWICE)
- Problems can be fixed quicker as more experts to resolve problem (NOT TWICE)
- Difficulties identified in one area can be resolved and managed in next area (NOT TWICE)
- Might cause problems in the changeover period when they need to communicate with each other and have different systems (NOT TWICE)
- Slower to get new system up and running compared to some other methods (NOT TWICE)

Pilot changeover - part-by-part (by part of the organisation)
- Suitable for different offices
- All staff can focus on one area to resolve any problems (NOT TWICE)
- Problems can be fixed quicker as more experts to resolve problem (NOT TWICE)
- Difficulties identified in one area can be resolved and managed in next area (NOT TWICE)
- Might cause problems in the changeover period when they need to communicate with each other and have different systems (NOT TWICE)
- Slower to get new system up and running compared to some other methods (NOT TWICE)

Advantages of using a team of analysts compared with using an individual:
- Changeover should be completed quicker
- Different levels of experience and expertise so can carry out different tasks, for example senior analysts would be implementing a direct changeover
- More people have a more varied experience of businesses and changeovers

The description of any of the advantages of using a team of analysts could be extended with more detail and/or examples and gain extra credit.

9 -11 Candidates give a clear, coherent answer fully and accurately describing and explaining at least three of the changeover methods plus benefits of teamwork. They use appropriate terminology and accurate spelling, punctuation and grammar.

5 - 8 Candidates describe and explain a range of the changeover methods, 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 changeover methods. The response lacks clarity and there are significant errors in spelling, punctuation and grammar.

0 No appropriate response.

11

CG3

01 Any one of: 1

- a printer queue
- a keyboard buffer
- a download buffer
- a processor scheduling queue

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

Why: In each case, because the natural / desirable processing order is first in first out (or e.g. job waiting longest should be printed next) 1
But **just** putting e.g. "because it's first in first out" is not enough

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02 Any 1 of:

- subprogram return addresses 1
- recursion values
- short-term arithmetical results
- reversing a queue / list
- undo function
- reverse Polish calculations - **accepted not expected**

[**Note:** other computer applications are possible, but **not** e.g. a pile of plates]

Why: In each case, because the natural / desirable processing order is first in last out (or e.g. last address placed on stack needs to be first one to be accessed, etc)
But **just** putting e.g. "because it's first in last out" is not enough 1

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03 Any three from:

- Cannot see / feel / try-on the item (for a tangible item) / may not be as advertised
- Lacks the social aspect of shopping
- Need access to a debit card / credit card
- Can't get the item immediately (tangible item)
- There is often a delivery charge (tangible item)
- If not at home when delivered you may need to visit post office, etc (tangible item) / you need to be at home when delivered
- Something may get lost or broken in the post (tangible item)
- May need to return item - more difficult than going back to shop (tangible item)
- Website may be fraudulent - may not receive goods (Separate points
- Website may be fraudulent - credit card details may be stolen if well argued)
- May have an impact on traditional shops closing down. 3

Not health related risks e.g. RSI / lack of exercise

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04 **Half-duplex** transmission is when data can be sent in either direction (along a computer network / pathway / cable), but only in one direction at a time. 1

Full-duplex transmission is when data can be sent in either direction (along a computer network / pathway / cable), in both directions at the same time / simultaneously. 1

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05 A network protocol is necessary to enable devices/computers to communicate with each other, e.g. 1

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

06 Data collision occurs when two sets of data are detected on the network simultaneously 1

Once detected, a computer waits for a short/random time then sends again 1

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07 Parallel <u>transmission</u>: occurs when a number of bits are sent simultaneously / sent over multiple paths / lines. 1

Parallel <u>processing</u>: the simultaneous use of several processors/cores to perform a single task 1

PP could be useful where an extremely large/complicated calculation is being carried out (e.g. weather forecasting, image processing…) 1

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08 Any 5 from:

- GUI system is usually easier to learn for a novice user
- GUI system is usually more intuitive to use once learned e.g. icons relevant to the application
- may be similar to other packages with which users are familiar
- there is no need to remember complex text commands
- it is easier to cut and paste between applications
- users can customise desk-top, e.g. creating shortcuts, etc
- GUIs often have a good help system / tutorials / wizards, etc 5

An example of an extended answer worth five marks is:

A GUI system is usually easier to learn for a novice user and is also usually more intuitive to use once learned. It may be similar to other packages with which users are familiar, which will also help to make it easy to learn. It may use icons, etc which are relevant to the application which make it more transparent to the user. There is no need to remember complex text commands. It is usually easy to cut and paste between applications. In many cases, the user can customise the desk-top, etc, and many GUIs have a good help system and may come with a tutorial.

[**Marking**: Note: question asks about **<u>benefits</u>**. No marks for features or drawbacks of a GUI]

09

- person's voice (print) originally captured, digitised and stored
- on attempted entry, person's voiceprint captured (and digitised)
- digitised data compared (and entry allowed if successful) 3

An example of an extended answer worth three marks is:

Voiceprint recognition is the process of capturing the person's voiceprints then digitising and storing this data on a computer system. When entry is attempted, the voiceprint of that person is captured. The two data items are compared, with entry being allowed if there is a match.

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10 XOR Truth Table (either format)

Worked example must show **data** and **key** correctly combined using **XOR** then combined using **XOR** to retrieve original data. 1

Eg:

D(ata)	10111101	
K(ey)	10001111	
D **XOR** K	01111010	= **Y**
Y **XOR** Key	10111101	2

Marking 1 for correct XOR on Data and Key
1 for correct XOR on the result with Key again

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11 An algorithm is a (finite) <u>set of rules / instructions</u> 1

to solve a (specific) <u>problem</u> 1

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12 A recursive algorithm is one which calls itself. 1

It must also have a "base case" (or "simple case") to allow it to terminate / terminating condition. (**Condone** idea of unwinding) 1

<u>Quicksort: why often used:</u>
Because it is the fastest / most efficient type of sort algorithm 1

<u>Quicksort description</u>:

- An item/pivot selected (which item is unimportant) **<u>Condone</u>** "middle" 1
- Produce two new lists of smaller and larger numbers 1
- Repeat above points on new sub lists (recursively) until sorted 1

Accept examples/diagram instead

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13 [In this order]

- The O/S suspends current interrupt routine 1
- It runs the new higher priority interrupt routine 1
- The O/S returns to original interrupt routine and continues 1

Description of high priority interrupt involving any of:

- Impending data loss 1
- Impending hardware / software failure
- Detection of imminent power failure
- **<u>Allow</u>** run time error

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14 Random Access file is a computer file where: 6x1

- Physical location for new record is calculated from the key field / user-Id
- 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 algoriyhm) if overflow becomes too large
- Existing records are accessed in the same way.

A well explained example could gain all six marks.
An example of an extended answer worth six marks is:

A random access file is a computer file where the physical location for a new record is calculated from the data in the record's key field, the user id in this example. A hashing algorithm is used for this calculation. If this location is empty, the encrypted password is stored there, but if the location is already occupied with data, the password is normally stored instead in an overflow area. Data in the overflow area is normally stored and searched in a linear manner. When access is required to an existing record, the process is similar to above – the same hashing algorithm is used to derive the location, with the overflow area being accessed if necessary. If the overflow area becomes too large access times may lengthen and the file may need re-organisation.

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15 -9 (CAO) 1

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16 One method is:

- From RHS, rewrite it up to and including the first one 1
- Change other 1 digits to 0 and 0 digits to 1 1
- Correct working and answer for example
  `00001000 -> xxxx1000 -> 11111000` 1

Alternatively

- Flip the bits 1
- Add one 1
- (Ignore carry (ninth bit))

(Other methods equally acceptable)

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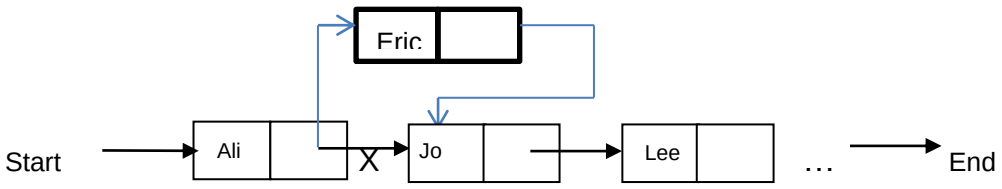
17 Any 1 of:

- enables computer (systems) to communicate with each other easily 1
- use of (mainly) just one code avoids confusion

"L" = 76 1

18



Marking:

	Crossing out / non copying of link Anu -> Jo	1
	Insertion of name in correct place with arrow to it	1
	Correct arrow to Jo	1

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19 A robot is a computer controlled (**accept** programmed/programmable, etc) device(s) 1

which can carry out (a variety of) complex (useful / repetitive) tasks
(**accept** mimic human activity, etc) 1

In a car factory, a robot could be used for:
Welding, painting, moving of raw materials, finished components / vehicles, etc 1

Benefits
- Perform the required task more consistently than human worker
- Perform the required task more accurately / with finer tolerances than human worker
- Work 24 hours per day, 7 days a week
- Don't get tired / ill / go on strike / need tea break / toilet break
- Cheaper to run (no salary costs)
- Can work more quickly than human worker
- Factory may be able to run without heating / lighting
- Human workers will not be subject to dangerous fumes / heat, etc
- Less chance of employees developing computer related ailments such as RSI

4x1

Drawbacks
- Staff remaining will have to be highly skilled / need significant training, etc
- Lacks touch / sensitivity / versatility / intelligence of human worker
- Robots may not notice obvious/repeated errors in process / cannot adapt to changes
- Expensive to buy / set-up / install
- May require factory to be rebuilt / extended, etc
- May be expensive to maintain / repair
- Difficult to reset / change for new production run / take time to reset, etc
- Robots may not notice obvious situations such as factory on fire if no humans around
  Not "may break down" alone

[Marking of Benefits/Drawbacks: 1 mark for each point up to max of 4, but max of three if only Benefits or only Drawbacks attempted]

An example of an extended answer worth seven marks is:

A robot is a computer controlled mechanical device which can carry out a variety of complex useful tasks.

In a car factory, a robot could, for instance, be used for: welding, then painting car components and the moving of raw materials or finished vehicles around the factory.

There would be a large number of benefits to the owners of the car factory. For instance, the robot would:
- perform the required task more consistently and with finer tolerances than a human
- work 24 hours per day, 7 days a week
- be cheaper to run, since the system itself would have no salary costs
- work more quickly than human workers
- avoid workers being subject to dangerous fumes, etc

Drawbacks would include:
- there would be significant training cost for those staff who remain
- the robot may lack the versatility and intelligence of human workers
- the robots are expensive to buy
- the robots may be difficult to reset or change for new production run

20 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. The real-time clock causes regular interrupts to create time-slices, which the operating system allocates to the various jobs: this process is called scheduling and is controlled by a scheduler program. Each job is checked sequentially to ensure that it gets its appropriate share of time – this is known as polling. 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.

6

[When answers are given in well-expressed point form:
6 marks may be gained for six or more of the individual points listed below
5 marks may be gained for five of the individual points listed below
4 marks may be gained for four of the individual points listed below
3 marks may be gained for three of the individual points listed below
2 marks may be gained for two of the individual points listed below
1 mark may be gained for one of the individual points listed below
However answered, can't get all 6 unless gained mark for each of scheduling & polling]

- More than one job is in memory at same time
- More than one job is processed (apparently) at same time
- Real-time clock causes regular interrupts to create time-slices
- Scheduling allocates time-slices to each job
- Polling is the sequential checking of jobs so that each gets its appropriate share of time
- OS uses partitioning, ie the division of computer memory for different jobs
- OS pages jobs in and out to make better use of memory
- OS promotes efficient use of CPU

21

<lowercaseletter>	::=	a|b|c|……|z		)
<uppercaseletter>	::=	A|B|C|.....|Z		)1
<digit>	::=	0|1|2|……|9	(Condone if 0 missing)	)
<underscore>	::=	_		)
<char>	::=	<lowercaseletter>|<uppercaseletter>|<digit>|<underscore>		1
<chars>	::=	<char>|<char><chars>		1
<variablename>	::=	<uppercaseletter>|<uppercaseletter><chars>		1

[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
However it's done, can only get 4 if completely correct]

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22 *Third normal form* means that data items are dependent on the whole key and nothing except the key (or the key, the whole key and nothing but the key). (**Idea of whole needed**) 1

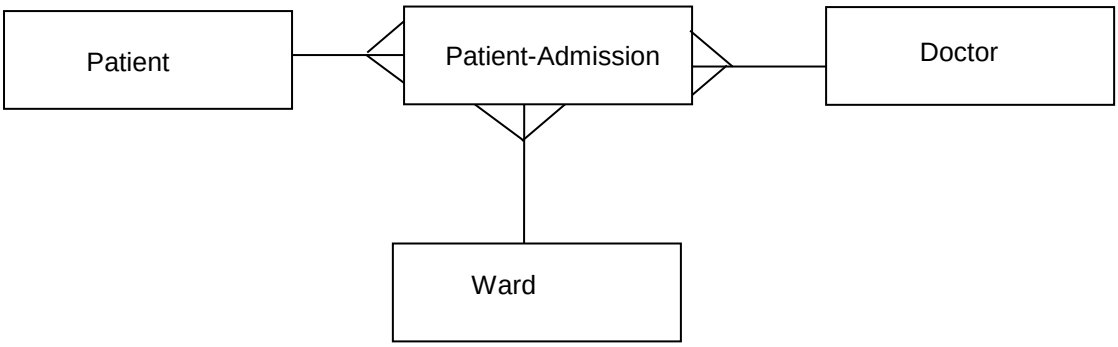
***Or* (accepted not expected)** Third normal form is achieved when relations (tables) contain no partial or transitive dependencies.

Any 3 of:

- Normalising data usually reduces data duplication/redundancy
- Avoids danger of inconsistency / maintains integrity 3x1
- Avoids danger of data being lost during update
- Avoids wasting storage space / processing time

---

23 [**Marking**: Diagram 3 marks - each error minus 1 mark] 3



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24 One approach (surrogate key)

PATIENT (PatCode, PatName, PatDoB)

WARD (WardName, NumBeds)

DOCTOR (DocCode, DocName, DocPager)

PATIENT-ADMISSION (AdmCode, PatCode, WardName, DocCode, AdmDate)

Alternative approach (non-surrogate key)

PATIENT (PatCode, PatName, PatDoB)

WARD (WardName, NumBeds)

DOCTOR (DocCode, DocName, DocPager)

PATIENT-ADMISSION (PatCode, AdmDate, WardName, DocCode)

[**Marking**: Four suitably named tables: 1
Each table with suitable Primary Key shown (2 or 3 correct = 1 mark) 2
One mark for each foreign keys (don't need to be identified as such) 3
-1 mark for any number of additional bad FKs
Ignore extra irrelevant fields etc]

25

		Marking	
1	declare Reading array(1..999) of integer (*or real*)		
2	set Total = 0	Initialise and first input	1
3	set Max = 0 *(or any integer < 0)*		
4	set NumHighs = 0		
5	input NumReadings		
6	for Count = 1 to NumReadings	Loop structure	1
7	input Reading(Count)		
8	set Total = Total + Reading(Count)	Input and two updates	1
9	if Reading(Count) > Max then set Max = Reading(Count)		
10	endfor		
11	set Mean = Total / NumReadings		
12	for Count = 1 to NumReadings	Loop structure	1
13	if Reading(Count) > Mean then set NumHighs = NumHighs+1		
14	endfor	Update	1
15	output “Mean Reading = ”, Mean		
16	output “Number of readings above mean = ”, NumHighs	Calculate mean and three outputs	1
17	output “Highest reading = ”, Max		

[**Marking**: Other approaches are possible and will be given full credit if correct.
No marks are given for brevity/efficiency/elegance]

26

- A CASE tool is a software tool which provides a number of functions which assist with the design and testing of a computer system / program.
- provides a data dictionary
- includes a graphics / diagram production feature
- may provide repositories of reusable code
- may provide project management tool(s)
- may incorporate version control
- may carry out report generation
- may include prototyping tool **- accepted but not expected**

- An application generator is a software tool which is used to assist and speed-up the creation of a (complete) system.
- provides a complete environment to support the programmer
- may include source code generator, compiler, etc
- usually creates code automatically
- may include an interface generator
- may include a debugger
- may be part of an integrated development environment **- accepted not expected**

- A compiler is a software tool which is used to translate a program (written in a high-level language) into a low-level program ready for execution on the computer.
- It has various stages: lexical analysis, syntax analysis, semantic analysis, code generation, optimisation (**1 mark for just naming at least 3**)
- During Lexical Analysis, input stream is broken into tokens, spaces etc, removed
- During Syntax Analysis, symbol table is produced, tokens are checked for fit to grammar
- During Semantic Analysis, a check is made that all variables are declared, and operations are legal eg real values are not being assigned to integer variables
- During Code Generation, machine code is generated
- During Optimisation, the code is improved if necessary to make it more efficient / faster / less resource greedy
- Produces error messages at any stage when needed (**once only for complier**)

- A debugger is a software tool used to detect, locate and correct faults in a program
- program trace/step-through/step-into: 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
- post-mortem routines: enables programmer to see the values of variables at the point where the program failed - **accepted not expected**

Note: if only **name** various facilities e.g. trace, break point, variable watch, worth 1 only 10

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

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

5-7 Candidates describing and explaining a range of at least two of the areas, but responses lack clarity. There are a few errors in spelling, punctuation and grammar.

0-4 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.

[Note: Max of 8 if all only 3 of the 4 sections attempted
Max of 6 if only 2 sections attempted
Max of 4 if only 1 section attempted]

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