7.4 External hardware devices part 2 Mark Scheme

Q1.

(a) (i) *1 mark for an appropriate medium and 2nd mark for justification*

Storage medium	Justification
hard disk;	fast access;
	internal to the machine;
	sufficiently large capacity;
	continuously available to user/on line;

Max 2

(ii) *1 mark for an appropriate medium and 2nd mark for justification*

Storage medium	Criterion
DAT tape;	high capacity ;
	fast write process;
A flash memory	removable medium;

Max 2

(iii) *1 mark for an appropriate medium and 2nd mark for justification*

Storage medium	Criterion
CD-R / DAT tape	off line storage;
	robust;
	sufficient capacity;
For CD-R only	cannot be overwritten;

Max 2

(b) *Any 3 of the following to **Max**:*
Ability to select different print resolutions / high resolution;
Ability to change the thickness of paper used / to accept special photo-paper;
Ability to print directly from a memory card or digital camera;
Ability to print in colour;
Borderless printing;
Individual ink cartridges (to reduce wastage);
Fast dry inks (to reduce the risk of smudging);
Having 6 (> 3) colour inks for 'smoother' tones;
Having pigmented inks for better quality;
A Ability to print on small size of paper (tray)

3

[9]

Q2.

(a) & (b) must be different
(c) & (d) must be different

(a) **Barcode scanner**: scan ID card to register when entering/leaving the room;

1

(b) **Fingerprint scanner**: to login at computer, can not be abused like user name and password;
To register when entering/leaving the room;
To ensure the identity of the student (can not use someone else's) entering the room/logging on;
I fingerprint to check ID card is genuine

Max 1

(c) **Digital still camera**: to produce photos for ID card;
To produce photos for database to help identify students;
To take photos of student entering room;

Max 1

(d) **Digital video camera**: to record/monitor activity in room;
To help identify students if there has been misuse/damage;

Max 1

(e) **Programmable doorlock/turnstile**: admit only authorised persons;
Admit only persons with valid ID card; automatic locking at certain times;
If used when entering and leaving, can record time in room;

Max 1

(f) **RFID tag reader**: if students are issued with a RFID tag instead, the reader will detect their presence without the student having to swipe their ID card through a reader;
Faster process to log student's ID as they enter/leave the room if student is given an RFID tag;
Tracking location of students with RFID tags;
Tag equipment to stop it being taken out of the room;
Scan RFID **BoD**; swipe RFID is **T.O.**
R references to smart card
R tagging unauthorised people

Max 1

[6]

Q3.

Suitable secondary storage media

(a) DVD-R;
(b) Hard disk;
(c) Flash memory / floppy disk / DVD-RW **A** DVD-R

2 correct answers (flash memory & floppy disc) 1
1 correct & 1 wrong – TO
1 not on list – I if correct. TO if wrong

[3]

Q4.

(a) Barcode reader / wand / scanner;

If 2 answers given – TO

1

(b) (i) Less chance of error / greater accuracy; BOD 'No Error'// scanning by device faster;
A Quicker (allow in this case)
R harder to forge

1

(ii) The bars can be read up-side-down/ has vertical symmetry;
A can be read even if not in perfect condition;

1

[3]

Q5.

(a) A non-volatile / stores a permanent copy / not lost when computer switched off; storage medium; that is not directly accessible to the processor / outside main memory;

2

(b) Cache memory

1

[3]

Q6.

(a) (i) To read (or synonym) amount of electronic cash (or synonym) stored on card/to alter (or synonym, e.g. store/topup) the amount of cash (or synonym) stored on card **A** To read debit/credit card to top up the wallet (mush have both point R. to read card);
A Credit / Balance / Money / Value instead of cash

Focus is canteen

1

(ii) To identify a pupil//to check smart card belongs to pupil//to identify staff//for staff to login;
A Converse
R For security reasons

1

(iii) To print a menu/price list.

Required by specification
R Produce menu/ price list
R print summaries/stock lists

1

(iv) To **print** receipts
R Produce receipts
R. Print invoice
A To print end of day summaries;

1

(v) For canteen staff to enter transaction into computer system or equivalent
R when using cash machines
A For pupils to look up menu/prices//staff to create menu/change prices

1

(b) Either marks awarded for (i) The technique (ii) Position detection (iii) Action
Region immediately in front of screen monitored//Beams of infra-red light projected across screen//other methods, e.g. capacitive membrane;
Position of e.g. finger determined (detected)//beam broken at a certain position;
Position matched to an action performed by computer;
R. Heat sensitive technique

Max 2

OR
***A** A screen which allows users to make choices by touching areas of screen;*

Max 1

2

[7]

Q7.

(a) Optical mark reader;
A OMR
R Optical Mark Recognition

1

(b) Touch screen;
A mouse pad

1

(c) Graphics tablet;
R virtual/optical pen, scanner

1

[3]

Q8.

(a)

Typical Capacity	
<2 Mb	Floppy disk
250 Mb	Zip disk
600 – 700 Mb	CDR
17 Gb	DVD

1 correct – 1
2 correct – 2
3 correct – 3

3

(b)

Used for:	Storage Media
Distributing commercial software	CD/R
Storage in digital cameras	Flash memory
Regular system backups	DAT tape
Exchanging small files	Floppy disk

1 correct – 1
2 correct – 2
4 correct – 3

3

[6]

Q9.

(a) Reading credit card details;
R Debit card

1

(b) Printing tickets // printing spectator statistics;

1

(c) Reading barcode (on ticket)//scanning/reading ticket for ticket details // scanning/ reading ticket (barcode) to allow entrance // scanning/reading ticket to check ticket is valid;
R Scanning ticket // scanning barcode
A Scanning ticket...some phrase implying ticket details obtained
R Reading ticket on its own

1

(d) NB Must be spectator
Identifying banned spectator (by iris pattern) // checking ticket holder is ticket purchaser // Photographing spectator to be banned;

1

(e) NB Must be spectator
Photographing spectator for identification (by facial pattern recognition) // checking ticket holder is ticket purchaser // checking season ticket holder is genuine;
R. Photographing spectator on its own

1

(f) Reading details from season ticket holder smart card; Reading credit card details;

1

[6]

Q10.

A People in place of passenger

(a) Reading/Getting credit/debit card details//Reading/Getting staff security pass;

1

(b) Printing boarding pass//Printing ticket//printing passenger boarding list;

1

(c) Reading passenger details from boarding pass (which have been encoded in barcode)//Reading (barcode on) boarding pass(checking boarding pass is OK)//Obtain information from boarding pass//Reading barcode on luggage label//Reading Staff ID badge;
R Reading barcode **A** Reading barcode on boarding pass
A Ticket in place of boarding pass

1

(d) Identifying passenger/staff/people (by iris pattern)//Identifying terrorist (by iris pattern);

1

(e) Photographing passenger's/staff face for identification by (facial pattern recognition)//Double check same passenger when boarding aircraft as went through security control//verify passenger's identity;
R Photographing passenger's face on its own. Answer must relate to some identification purpose
R Photographing luggage

1

(f) Reading details from passport with smart card (for identification purposes)//Reading some details of passenger/staff from a smart card//
For some identification purpose;
Reading credit/debit card details;

1

(g) Reading passport details (for identification purposes)//Reading details from boarding pass/ticket (May be implied, e.g. to check ...);

1

[7]

Q11.

(a) Data bus;
carries data to/from processor / memory / devices /components;
Address bus;
carries addresses / identifies locations;
Control bus;
carries control signals / controls devices;
A by example

Max 1 mark for carries Data / carries addresses / carries control signals

6

(b) Network adapter / network card;
A named example e.g ethernet card generate / understand signals / data (that conform to the LAN protocol) /
Allows (successful) communication / Provides a unique network address;
R connect

2

(c) Faster transmission;

1

(d) Data transmitted longer distance than is possible with parallel / less expensive to cable;
R cheaper

1

[10]

Q12.

(a) *Any two at two each; If entrance method doesn't match exit method mark one wrong and the other correct*
R Voice **R** Written to ticket
Computer system/Printer prints number on ticket at entrance;
Driver types number into system using a keypad at exit barrier;

Computer system encodes number on a magnetic stripe on ticket at entrance;
R Magnetic card
Ticket number read by a magnetic stripe reader at exit//inserted into a magnetic stripe reader at exit; **A** magnetic strip/stripe scanner

Computer system/Printer prints number printed on ticket at entrance;
Number read by an optical character reader/OCR at exit//ticket inserted into an optical character reader at exit;

Computer system/Printer prints number in barcode form on ticket at entrance;
Number read by barcode reader at exit//ticket inserted into barcode reader at exit;

Computer system/Printer at entrance punches holes on ticket which are a coded form of number//Kimbal tag produced at entrance which encodes number;
Number read by sensor (mechanical or optical) at exit//ticket inserted into sensor at exit//Number read by Kimball tag reader at exit;

Computer system/printer prints number using magnetic ink;
At exit MICR reader reads number;

Computer system/printer prints marks (encoding number) on ticket;
At exit, OMR device is used;

4

(b) **R** any other data types. Mark is for field name + correct data type.

NB synonyms for RandomNumber must include Number, e.g. IDNo, TicketNo, Number. **A** RandomInteger, **R** e.g. Vehicle ID **A** VehicleIDNo

A DateTicketWasIssued

```
Record

  RandomNo : Integer;
```

R anything else

1

```
CurrentDate :
    String/Date/DateTime/TDateTime/TDate;
```

1

```
  ArrivalTime :
 String/Integer/Time/DateTime/TDateTime/TTime;
```

1

```
  LengthOfTime/LengthOfStay/TimeStayed : Integer;
```

R anything else

1

```
  Cost/AmountToPay : Integer/BCD;
```

1

```
End;
```

A Alphanumeric for String
R Text **R** LeavingTime **R** Binary,Byte,LongInteger
R Date for FieldName
R Date/Time but don't penalise twice

[9]

Q13.

Method: key-to-disk// explanation, e.g. keyed in and stored on disk;
R. keyed in and stored in database (1)
Justification: not suitable for direct data entry because large volume//often written badly//proposal form needs some interpretation;(1)
OR
OCR//explanation;
R Just scanning or use a scanner
OMR//explanation;
R MICR **R** Voice recognition (1)
Justification: Reduced human intervention//possibly fewer errors//faster to enter data(R. Quicker/faster on their own)//can cope with large volume; (1)

Max 2

[2]

Q14.

(a) *Any two ways at one each*
Barcode;
OCR;
MICR;
Magnetic stripe;
Smart card/Microchip/Memory chip;
R Computer chip
R Chip
R OMR

2

(b) **Either**
Biometric method used locally:
1 mark for what is stored on ID card – one of fingerprint, retina pattern, iris pattern, ear pattern, palm print (NB not DNA), vein pattern, (electronic) stored facial image (but not visible photograph of person) ;
1 mark for capturing the biometric information and comparing with what is on card.
Expectation is of a system that stores this information on card in a way that is hard to tamper with
Or
Biometric method involving checking remote central database:
1 mark for capturing specified biometric information - one of fingerprint, retina pattern, iris pattern, ear pattern, palm print (NB not DNA), vein pattern, facial image;
1 mark for comparing with stored biometric information held in central

database;
Or
1 mark for entering pin number;
1 mark for comparing entered pin number with stored pin number on remote database or stored on card;
Or
Photograph on card scanned//Camera captures image of person// PersonID scanned in//PersonID typed in;
Image compared with image stored on remote database;
R Remote database stores whether card has been lost/stolen – card will have tobe re-issued with same name, address, PersonID
A Remote database stores whether card lost/stolen; – card will have to be re-issued with new PersonID;

2 or nothing

2

[4]

Q15.

(a) Medium: Magnetic hard disk
A Hard Disk (1)
Justification: Random access device;
Sufficiently high data transfer rate;
Sufficiently high storage capacity;
R Magnetic disk is fast enough (1)

2

(b) (i) Processing is faster; **A** System runs faster
Loading on main processor can be reduced;
CODEC has its own processor;
R Faster on its own;
A Faster with justification

1

(ii) Movie needs to be compressed to fit storage capacity of DVD-R;

1

(c) Backing up (data stored on magnetic disk drive);
Archiving (data);
R Storing video once editing complete

1

[5]

Q16.

(a) (i) (Data/address/control/internal/system) bus;
R just a description of a bus
R names of buses which don't exist e.g. memory bus

1

(ii) Store programs and/or data/files when not in use/
When computer is off permanent/long term storage
Of programs and/or data; save programs/data;
R offline/backup **R** ROM **R** temporary storage
A save on magnetic disk/ tape storage;
A information instead of data

1

(iii) (Machine code) instruction/data is fetched from main memory;
A what is fetched or from where
Instruction is decoded;
Instruction is executed (by the processor); **R** data executed

Max 2

(b) (i) Assembly language; mnemonic code; mnemonics; assembly code;
R low level language **A** assembler;

1

(ii) Translated/assembled/converted/decoded; into machine code (instructions);
R compiled **R** interpreted **A** object/target code;
A binary instructions;

2

(iii) Computer executes instructions in programmer defined sequence;
A the programmer tells the computer how to do it;
R user *instead of* programmer

1

(iv) Pascal /Visual Basic/Basic/C/C++/Cobol/Fortran/Ada/Delphi/Lylix/Modula /or any other imperative HLL
R Prolog
R Lisp
R Pop11

1

(v) One statement/instruction/command in a high level language translates into several machine code instructions; 1 to many;

1

(vi) Laborious/time-consuming to write; hard to debug; harder to program; easier to make mistakes; more difficult to understand/ learn; difficult to maintain; different assembler/instruction set for different type of computer; machine dependent; low level programs not portable;

Max 2

[12]

Q17.

CD-ROM or CD-R (Recordable Compact Disk);
R DVD, CD-RW, CD

[1]

Q18.

(a) Magnetic Strip(e) Reader (Not swipe card reader);

1

(b) What: Extra/last digit(**A** number) in borrower code;
Calculated digit;
Why: To detect if data/code has been corrupted;
To check that data/code is valid;
To ensure integrity of data/code;
A To check that number is valid
A To check that data/code is still correct after transmission

R To check that data is plausible

2

(c) Reason: magnetic stripe reader may not be able to read borrower code;
Because magnetic stripe is damaged;
Can phone in code;
Code needs to be entered through a keyboard;

1

(d) Bar code reader/Bar code scanner;
R Scanner
R Light pen

1

(e) (i) Unique field of a record/field used to identify record;

1

(ii) BookCode;

1

(iii) Serial;

1

(f) (i) BookCode;

1

(ii) Reason: Any one for 1 mark
So one pass is possible;
Reduce time taken to update Books file;
Saves time;
Order: Same as Books file/ordered on BookCode;

2

(g) **NB** steps must be clear. **R** a narrative in which steps not made explicit = zero marks

Alternatives:
Compare Current Date with DateBookToBeReturnedBy field;
If = or >= or >; If (LoansStatus = OnLoan);
And TodaysDate >|>=|= ;
; DateBookToBeReturnedBy

Steps:Open Books file;
(Read or idea of going to) each record in turn/
(Read or idea of going to) next record;
Until EOF;
If LoanStatus = OnLoan;
Then
Compare DateBookToBeReturnedBy field with current date;
If = (allow <= and <) ;
Then Write details to OverDueBooksFile;

4 marks

Data:Any three × one each (No T.O.)

BookCode;
BorrowerCode;

DateBookToBeReturnedBy;
ISBN;
Title:
Author;
***R**. any others Candidate must state these accurately*

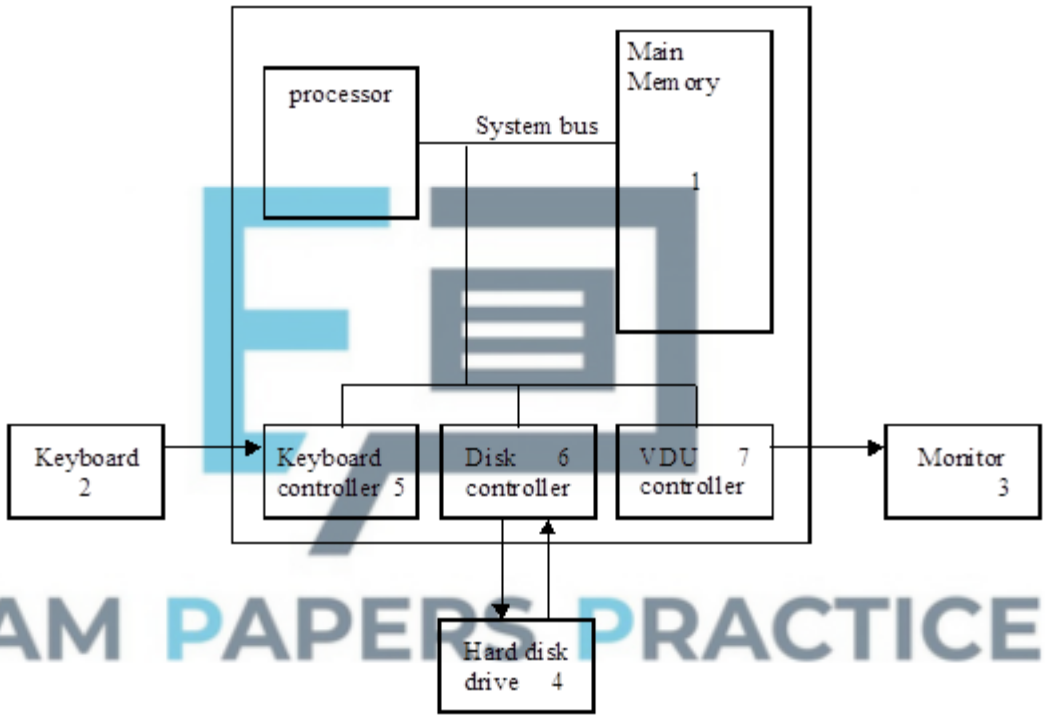
3 marks

7

[18]

Q19.

(a) Correctly placed labels: main memory (1);
Keyboard & keyboard controller (2,5*);*
Disk controller & HD drive (6,4);
Monitor & monitor controller (7,3);



(Allow names instead of numbers)

4

(b) Machine code instructions/program stored in main memory/RAM/IAS; fetched and executed; *(concept)*
Can be replaced by another program any time;
R cache

Max 2

(c) (i) Bits are sent one after another / bits sent one at a time / bits sent singly / along a single wire/line;
R data / character

1

(ii) Bits transferred simultaneously/concurrently / bits sent down many wires at the same time;
A diagram;

R data / character

1

(d) (i) Between devices in close proximity / communication within computer / communication over short distances;

1

(ii) Distance: parallel transmission only operates over short distances; speed: parallel transfer faster than serial;

1

(e) Start bit marks beginning of character to be transmitted / alerts/synchronises receiving device (1)

Stop bit(s) marks end of character to be transmitted / gives time for receiving device to recover; frames the character (1)

2

[12]

Q20.

(a) Optical Mark Recognition/Reading. (Not Optical mark reader)

1

(b) Extra digit added to the transaction code (1)
To detect if data has been corrupted (1)

2

(c) (i) Unique field of a record/filed used to identify record

1

(ii) Transaction code

1

(iii) Not indexed sequential / Serial or Sequential (1)
Because all the records have to be examined (1)

Or

Direct access based on a hash code of the chosen numbers(1)
Only a few records will need to be checked (when collisions occurred)(1)

Max 2

(iv) Random or direct access(1)
Record can be located by simple transformation of transaction code /hashing technique used/algorithm used to store and retrieve records(1)
Indexed sequential with transaction code as key field(1)
Rapid access via the index is possible to find the necessary record(1)

Max 2

(d) *Any 4 points × 1 each*
Ticket scanned/ Read ticket
Check digit used to check accuracy of scanning Ticket validated,
(e.g. not out-of-date, draw not yet made)
Operator informed if ticket does not scan/is invalid
Transaction code sent to central computer
Correct file selected
Ticket's record found/Look up ticket's record/Look up record with given transaction code

Get draw date from transaction record
Get numbers from system (for the correct draw date)
Ticket numbers checked against draw
If a winning ticket prize money determined
Result sent to point of sale machine
Result displayed at point of sale machine

Max 4

[13]

Q21.

Fast memory
Expensive memory
Holds (latest block of data/file index)
Next required data likely to be in cache
Reduces (head movement/access time) for disk reads

Any 3

[3]

Q22.

(a) Census
Multi-Choice Examinations
Lottery
Or any other appropriate

Any 1

1

(b) Any application using plastic cards
Credit Card Application
Rechargeable Card Application.
Or any other appropriate

Any 1

1

(c) Any application using product codes or any other appropriate

Any 1

1

(d) Scanning text
Post Office applications
Meter Reading
Turnaround documents
Or any other appropriate

Any 1

1

[4]

Q23.

(a) Read/write
Direct Access

High Speed
High Capacity
Security

Any 2 + 1 for suitable situation

3

(b) Read/Write
Low Cost
High Speed
Portable
High Capacity
Security

Any 2 + 1 for suitable situation

3

(c) Read Only
Portable
Low Cost

Any 2 + 1 for suitable situation

3

[9]

Q24.

(a) (i) 00000010
AND

1 for mask. 1 for AND

2

(ii) 10000000
OR

1 for mask. 1 for OR

2

(b)

```
Repeat
     Test active
     If active = true then
       Test external motion sensor
       If external motion sensor = true then
            security light: = on
       else
            security light: = off
       endif
       Test internal motion sensor
       Test window contact
       Test door contact
       If ((internal motion sensor = true)or (window contact =
false)or
       (door contact = false)) then
            Alarm: =on
       else
       Alarm off
       endif
     endif
until set = false
```

1 mark for suitable loop including termination.
1 mark for testing set.
1 mark for If correctly used with endif.
1 mark for testing external sensor and handling light.
1 mark for testing all three sensors (and alarm on.)
2 marks for a single if construct, just 1 if there are 3 separate ifs

7

[11]

Q25.

Minimum suitable diagram will show one surface and a track split into blocks (1).
Surface is divided into several concentric tracks (1).
Each track is divided into the same number of blocks (1).

[3]

Q26.

1 mark for a suggestion and one for justification for each of ***input and output***

Input
Touch screen for menu choices – so no need for separate device like mouse
Numeric keypad for input – because more compact than keyboard, so hands off
Voice input / mobile phone (if clearly linked into computer laptop) – *if fully justified*

Output
Small printer – for hard copy that has to be taken into the building
Head up display – **information**, for driver
Speech synthesizer – a reasonable suggestion as to what may be output
Small monitor – not cumbersome

[4]

Q27.

(a) (i) Bar code consists of lines and spacing each of different widths
Movement relative to scanner / reader / wand
Laser/ infra-red beam directed on it
Reflected or absorbed light analysed and converted to (digital) computer readable code.
Check digit re-calculated

1 mark per point

Max 3

(ii) To allow price to be changed without changing the bar code
Price is not a fixed quantity.

1 mark for concept:

1

(iii) As a search code
To retrieve price & description
To update stock levels
To gather statistics on best selling lines
In recording customer preferences in a loyalty scheme,

Up to 2 marks for clear relevant development of an above point

1 mark per point

Max 3

(b) (i) Real time:
Response to some input from an external event
Will affect the external situation immediately
Immediate processing.

(ii) Interactive:
Data processed on entry
User in direct communication with processor

For each, one mark per point
(Points that apply to either, only credited once.)

Max 4

(c) (i) OMR

1

(ii) Because retailers are close together in some areas & spread out in others
Physical geography of the area
Leased line(fixed link) too expensive in rural areas
Satellite link unnecessarily expensive in urban areas.
ISDN/ leased line/fibre optic / cable satellite link

1 for explaining need for more than one type.
*1 mark for each of two media (**NOT** telephone)*

Max 3

(d) Interviews - of key personnel
Requirements / modifications needed for new system
Questionnaires - of staff/ Customers
What they like or dislike in the old system/ would like to see in the new
Observation / use- of old system
Layout / work flow / hold-ups
Examination- of documents to check they fulfil their purpose / are clear to use
OR:
Examination - of records, procedure manuals
How procedures should be carried out
Measuring – operative to find volumes.
Sampling - any reasonable
To confirm information

For each of two techniques 1 mark for target, 1 for information found
(Target and information not necessarily as above)

Max 4

Quality of language

Technical terms used correctly Argument clear and logical Grammar, spelling good	3
Technical terms used correctly in majority of cases Argument understandable Spelling, grammar fair	2

A few technical terms used correctly Argument understandable but Grammar, spelling weak	1
Anything less than this	0

Max 3

[22]

Q1.

In part (a), candidates were asked to choose, from a given list, the most suitable storage medium for different common tasks, and justify their choice. Most candidates made sensible suggestions for the media, but many were unable to give a good justification for their choice of medium.

Part (b) asked candidates to consider the requirements of a printer that would be used to print photographs as well as routine documents. One good answer was as follows. '1. Can choose between print resolutions so can change between settings for documents and photographs. 2. Has a high quality ink cartridge. 3. Is able to use normal A4 plain paper and all types of photo paper.' Other appropriate answers were the ability to print directly from a camera or memory card, the ability to print borderless images and having fast drying inks to prevent smudging.

Q2.

Candidates need to be aware that they should give answers in the context of the question. Just stating the obvious, for example, that a barcode scanner can be used to scan the barcode on students' ID cards is not sufficient to gain a mark. The question also stated that the uses for each hardware device should be different.

The barcode on the ID card might be scanned to record which student is entering a room. A fingerprint scanner might be attached to each computer and provide the means of logging onto a computer, since this method cannot be abused like username and password.

Many candidates suggested using a digital still camera to take pictures for the ID cards, but some candidates did not gain this mark because they only suggested taking pictures for students' ID. Some candidates proposed using the still camera to record at intervals the state of the room, but then found it difficult to suggest a different use for the digital video camera.

Programmable door locks were often not given any more functionality than locking the room out of hours which was insufficient to gain a mark. The better candidates combined it with using an ID card and only allowing authorised students into the room.

RFID tags are still unknown to a significant minority of candidates. This is disappointing since they have been in common use in shops and libraries for some time and candidates should be aware that they can be read from a distance and therefore students would not need to swipe them through a reader, speeding up the process of admitting students into rooms and logging who has entered a specific area. Candidates gained credit for the suggestion of tagging the equipment so that the RFID tag reader at the exit could detect if someone tried to remove college equipment.

Q3.

Most candidates gained full marks on this question. Candidates who suggested a storage medium that was not on the given list, or who suggested two contradictory media for one task lost marks.

Q4.

Most candidates gained the first two marks available for this question but few gave a

creditable answer to the third point. The label was a barcode, which would be read by a barcode reader or bar code scanner. 'Scanner' on its own was deemed insufficient. A few candidates suggested the use of an OMR. The advantages of having the label read by an input device rather than the code being typed in by the shop assistant were speed and accuracy. This was one of the very few occasions when it was decided to give credit to a one-word answer such as quicker or faster.

Candidates were then asked to give one advantage that a bar code has over a character code that makes it suitable for the identification of items in many different situations. Some candidates repeated their answers to part (b)(i), which suggested that they had not read the question carefully. Better candidates knew that the two main reasons for using bar codes rather than character codes are that bar codes can be read from any angle, unlike character codes, and can often be read even though partly damaged.

Q5.

Secondary storage is any non-volatile storage medium that is not directly accessible to the processor. Most candidates obtained one mark for this, mostly for stating that secondary storage is non-volatile. A few candidates defined secondary storage as portable, or as used for backing up data; neither point gaining a mark. Most of the answers that failed to gain even one mark appeared to be the result of a careless error, such as stating that secondary storage was volatile, or non-versatile. Most candidates correctly identified cache memory from the list as not being a secondary storage medium.

Q6.

This question gave candidates the opportunity to show imagination, knowledge of systems, input output devices and their skills in interpreting a specification/brief and designing a system, as specified, for the canteen. The "electronic wallet" of the question was a smart card and many candidates correctly identified this as such. Many candidates correctly interpreted the brief and focussed their responses on the system in the canteen and on its requirements:

- Payment for meals by "electronic wallet"
- Production of menus and price lists for display

Therefore, the expected responses for the smart card reader were to "read the amount of electronic cash stored on card or to alter the amount stored on the card". On this occasion the response "to read debit/credit card to top up the wallet" was accepted even though this task lay outside the brief for the canteen. Candidate lost marks by being too vague, too general or by not thinking carefully enough. Some candidates therefore referred to the smart card reader as the storage device.

In (iii) and (iv) some candidates failed to distinguish between the quality of output from a laser printer and that from an impact printer answering that an impact printer would be most suitable for printing menus and price lists for display. Some candidates failed to gain credit because they answered that the printers could be used to "produce" menus, price lists and receipts. Printers do not produce these on their own. The impact printer with roll was most suitable for printing receipts. Many candidates gave this response but some showed a lack of understanding of output devices in this context and therefore gave inappropriate responses.

Many candidates were able to score marks on (b) by describing two of the following for the principle of operation of a touch sensitive screen:

- The basic technology
- The position detection technique
- The mapping of the detected touch position to an action

However, in some cases candidates' answers for the mapping point were not precise enough for credit to be gained. The examiners were looking for 'position matched to an action performed by computer'.

Q7.

Optical mark recognition is, indeed, the expected method for transferring multiple choice examination scripts into a computer system. However, the input device used for optical mark recognition is an optical mark reader. The point that the Tourist Information System was 'busy' was intended to direct candidates towards fixed input devices such as touch screen or mouse pad, rather than a less secure mouse. The creation of a cartoon character to be used for computer animation would require a device such as a graphics tablet.

Q8.

Most candidates gained full marks in this question. The commonest error was to say that a recordable CD-R had a capacity of only 250 Mb and a read-only DVD a capacity of 600 - 700 Mb. All but a very few candidates could assign the given secondary storage media to an appropriate use in part (b).

Q9.

On the whole this was well answered. "Reading credit card details" was the expected answer for part (a) and the majority of the candidature responded correctly. "Printing tickets" was the expected response for part (c) and this was achieved by many candidates. Some candidates had difficulty responding in a creditworthy manner in part (c). The answer "scan the barcode" shows little understanding and is a permutation of the stem, "barcode scanner". The examiners were looking for "reading barcode on ticket", "scanning barcode on ticket to allow entrance". A very popular acceptable answer was "scanning ticket to check its validity".

Pleasingly, in part (d) many candidates correctly stated "to check identity of a spectator by scanning the spectator's iris and comparing with a database of scanned irises of banned spectators".

Part (e) elicited responses that were connected with identification. The better answers related identification to facial pattern recognition. The latter was connected to season ticket holders and banned spectators. Some candidates applied their answer to staff. Such answers were rejected because the system as described in the stem is about ticketing.

Many candidates correctly related the smart card reader use in part (f) to the season ticket holder's smart card and gained credit for an answer which referenced "reading details from season ticket holder's smart card" in some way.

Q10.

The majority of the candidature was able to score reasonably well on this question with most candidates answering: "reading/getting credit/debit card details" for magnetic stripe reader; "printing boarding pass//printing ticket" for the ink-jet printer.

In part (c) the emphasis was on obtaining information from the boarding pass that had been encoded in the barcode. So acceptable answers were "reading passenger details from boarding pass//Reading boarding pass//checking boarding pass is OK". "Scanning the barcode" was not acceptable because the question stem already supplied the term

"barcode" and the term "scanner". Also "scanning the barcode" refers to an action which by itself does not reflect that the use here is to obtain information presented in machine readable form some of which is presented in human readable form elsewhere on the ticket.

Q11.

(a) The names of the three buses were generally known but fewer candidates were able to explain how they operate. A bus is a device that carries signals around the system. Common misconceptions were that buses store data or send data. Incorrect answers included reference to system buses and/or memory buses and many candidates failed to obtain full credit by not expressing themselves well enough.

(b) The network adapter was well known but candidates failed to obtain full credit by being unable to express themselves adequately when explaining its purpose. The question stated that the network adapter connects the computer system to the local area network. An answer that restates this is not going to obtain any credit.

(c) Many candidates understood that faster transmission can be obtained by using parallel transmission. Some simply stated a definition of parallel communication being many bits simultaneously transferred but failed to state why this might be of benefit.

(d) A substantial number of candidates stated that serial transmission was faster. Many more stated that it was cheaper but failed to give any reason as to why this should be the case. Many marks were lost on this part of the question.

Q12.

Many candidates were able to suggest a suitable method at the exit barrier for submitting the number assigned to the ticket to the computer system. Fewer were careful enough to describe how the ticket was assigned to the ticket at the entrance barrier. The examiners were expecting a printer to be referenced or the action of printing in the case of a barcode, OMR, OCR, MICR and plain text solution for writing a number to the ticket; the action of encoding or writing to the ticket in the case of a magnetic stripe or smart card and the action of punching in the case of Kimball or Kimball-type tags. The better candidates offered such descriptions.

A lack of experience of using a third generation programming language was exposed by part (b). Many candidates gave data types that were lifted straight from Microsoft ACCESS and therefore gained no credit. The question explicitly requested data types that would be available in a third generation programming language. Candidates must understand that their study of this subject must extend beyond products that have been intentionally designed to enable people with no background in Computing, and no desire to be educated in this subject, to achieve practical results in the minimum of time. For very simple practical tasks, this is desirable but as a foundation for more extensive tasks this is a recipe for disaster. Assembling flat-pack furniture is not considered adequate enough to qualify as a cabinetmaker.

Some candidates had difficulty selecting relevant fields and in some cases when they did choose relevant ones lost a mark for poor choice of identifier. For example, several candidates chose *Date* instead of *CurrentDate*. The clue was in the question stem which stated that "the computer system remembers the *Current Date, Arrival Time* and *Randomly generated Number*." A principle of software engineering is that identifiers should be meaningful and reflect the real world entities which they represent.

Q13.

Few candidates were familiar with the key-to-disk method of data input. Many simply answered that the data would be entered through the keyboard, full stop. Implicit in such an answer was that processing took place in real-time. The reality is that it does not as there would be little control over the propagation of transcription errors. If this did happen, as soon as data is processed it could be used elsewhere in the system even if it is incorrect. In a typical data processing scenario, involving entry of data from a large number of paper forms, the data would be keyed in by a clerk and stored on disk prior to processing at a later time. This enables checking of the data to be carried out.

Many more candidates gained credit for answering that the data on the forms could be scanned in and processed using the techniques OCR or OMR.

In the case of both key-to-disk and OCR/OMR many candidates were able to offer acceptable justifications. A very common answer was that often handwritten forms required some interpretation and therefore key-to-disk was appropriate. In the case of OCR/OMR, a very popular answer was data could be entered very quickly if the process was automated.

Q14.

Part (a) was well answered on the whole with barcode and magnetic stripe being the most popular answers. A smart card was another acceptable answer. Some candidates substituted microchip for smart card which was accepted, but chip was not.

Few candidates obtained both marks for part (b) because either they failed to state that biometric information was stored on the card or that a comparison was made with biometric information stored in a central database.

This question and several other questions demonstrated a tendency amongst the weaker candidates to supply answers that left much unsaid. Part (a) asked for a description but several candidates simply wrote one-word answers or acronyms such as MICR. Apart from demonstrating poor examination technique, this could be construed as evidence that the candidate's thinking and communication skills were underdeveloped.

Q15.

Candidates performed well on most of this question. Part (b)(i) was less well answered across the candidature. If the CODEC has its own hardware then the loading on the main processor can be reduced. Consequently, compression and decompression of videos will be faster.

Q16.

(a) (i) Most candidates correctly named one or more buses. The term 'bus' was enough to gain the mark, but some candidates still referred to a 'memory bus' which did not gain credit.

(ii) Very few candidates seem to appreciate that secondary storage is used to save programs and data when they are not in use. Most referred to backup copies, which may well be saved on secondary storage, but is not the primary purpose of such storage.

(ii) The fetch-execute cycle was very well explained by a few candidates, though in too much detail by some others (e.g. by those who had presumably just studied machine architecture for CPT4). The majority of answers involved

fetching data from memory and then executing data which gained no credit. Correct responses stated that an instruction is fetched from main memory, decoded and executed by the processor. At this machine level of operation, the term 'information' is not appropriate.

(b) (i) Assembly languages are second generation programming languages. The term 'assembler' was accepted this time, but candidates should be able to distinguish between the two terms and appreciate that the assembler is the translator, which converts the assembly language program into machine code.

(ii) Many candidates lost a mark by wrongly stating that a compiler or interpreter converts an assembly language program into machine code. The terms 'source code' and 'object code' belong to the translation of high level language programs by compilers and should not be used in the context of second generation languages.

(iii) Very few candidates could explain what the term 'imperative' meant in the context of high level languages. Most thought it meant important or problem oriented. Of those who were on the right track, some then confused the definitions of imperative and declarative languages. A correct response explained that the computer executes instructions in programmer-defined sequence. It was not acceptable to equate a programmer with a user.

(iv) A great many different languages quoted here gained credit. However, Prolog or HTML were not acceptable examples.

(v) Few candidates could state that one high level language statement would translate into one or more machine code instructions. Some candidates denied that there was any relationship.

(vi) This was a well answered question even for middle-scoring candidates, though the answers were sometimes a little vague. 'Hard to learn' and 'debug' were probably the most common answers which gained credit.

Q17.

Most candidates were guided by the storage requirement specified in the question to conclude that the most appropriate medium was a CD-ROM or a CD-R. Several failed to gain credit because they were not precise enough and simply stated CD. Answers that were rejected were 'floppy disk' because of its limited storage capacity and 'hard disk' because it would have been impractical to send a hard disk through the post in this application.

Q18.

A surprising number of candidates had difficulty recognising the two techniques for encoding data referenced in this question and therefore failed to identify the correct reading device. Both are in common use though candidates may have greater experience of the use of barcodes. Barcodes must be a daily feature of most candidates' lives.

Many candidates identified the last digit in the borrower code as a check digit and many candidates explained that it was a calculated digit calculated from the other digits in the borrower code. However, some candidates could not explain precisely enough why it is used. The check digit is there so that corruption of the borrower code can be detected when it is entered into the library's computer system. Several candidates thought that the check digit checked the whole card, i.e. checked that the card belonged to a valid user of the library.

Part (c) was well answered with the most popular answer being to key in the code if the reader fails to read the code.

The term primary key gave few candidates any difficulty. The better candidates answered part (e)(iii) correctly. The Loans file uses serial file organisation.

Part (f) caused some difficulty for the weaker candidates, many answering from the perspective of the layperson. For example, the commonest incorrect answer for sort field for the Books file was DateBookToBeReturnedBy. In part (g), other candidates ignored the Books file altogether and referred only to the Loans file when stating the processing steps. In fact, in many instances the required processing steps were described not stated, the candidates' responses appearing as a narrative that could not have been used to program a computer. Narratives scored zero marks. Previous reports have made reference to this and the advice given has been similar. If a question asks a candidate for the processing steps then a sequence of steps is required. Candidates are advised to use a linear layout that lists the steps in logical sequence. For example,

```
Open Books file
Repeat
              Read next record
              If LoanStatus = OnLoan
                   Then
                   If DateBookToBeReturnedBy < CurrentDate
                        Then Write Details to OverdueBooks File
Until End Of Books File
```

The majority of the candidature was able to correctly identify the data to be extracted – BookCode, BorrowerCode, DateBookToBeReturnedBy. Some candidates lost marks here because they failed to state these fields accurately. Others failed to gain marks because they invented irrelevant fields. ISBN, Title and Author were accepted because these might well have been present in the Books file.

Q19.

Part (a) was well answered, with only a few candidates not taking note of the direction of the arrows in the diagram. Part (b) rarely gained more than one mark. A significant number of candidates thought the stored program concept only referred to programs held in ROM. Many candidates thought programs are run from disk. Those who did say they were stored in main memory gained a mark, but often did not gain the mark for fetching and executing. Many candidates missed a mark by saying "stored in memory" rather than "main memory". In parts (c) and (d) candidates used the word "data" rather than "single bits". A common misconception was "serial data can go one way and parallel can go both ways". Part (d) was either answered really well or poorly. Candidates need to appreciate that parallel transmission deteriorates over distance and therefore can only be used between devices in close proximity. In part (e) there did not seem to be a great understanding of asynchronous transmission and the need for synchronisation. Many candidates did not appreciate that just one character is being transmitted between the start and stop bits, just referring to data. In asynchronous data transmission when no data are being sent the signal transmitted represents 0. This ensures that the first signal received is always a change from 0 to 1. This change in voltage can be used to start the clock of the receiving device. The receiver will then read the 8 data bits. The stop bit ensures that the receiving device has time to recover and the next start bit will be recognised.

Q20.

Many candidates correctly identified the method as Optical Mark Recognition. Candidates who answered "Optical Mark Reader" referred to the device, not the method, and so were not rewarded. Some candidates answered incorrectly that a check digit checked that the

chosen numbers were unique. An answer that stated that a check digit is an extra digit added to the transaction code obtained a mark. The mark scheme allocated a second mark to an answer that stated that the check digit was used to detect if data was corrupted. The emphasis was on error detection, hence the non-specificity in stating what was being corrupted. Several candidates went into detail and described how the check digit is calculated using a modulo- II method. This was really answering more than was required for one mark, as this response described both what it is and how it is generated.

The majority of candidates correctly defined the term 'primary key'. However, several of these candidates then incorrectly identified "Point of Sale Identification Code" as the primary key for the transaction records instead of "Transaction Code". These candidates appeared to lack an understanding of the term 'transaction'.

In part (c) (iii) the better candidates realised that all the records have to be examined to find the ticket(s) with the winning numbers. These candidates then showed good knowledge of file organisations by answering "serial". Weaker candidates seemed to be unfamiliar with the term 'file Organisation', responding with answers such as "use a database or spreadsheet". Other successful candidates answered that if each transaction's chosen numbers were hashed, then the generated address could be used to store each transaction's details. After the draw, the winning numbers could be hashed to locate the transaction(s) that had won.

In part (d) many candidates did not appreciate the detail of the processing steps that have to take place if the computing system is to check if the ticket is a winning ticket. These candidates showed a distinct lack of insight into the operation of the computer. Their answers were superficial and from the perspective of the ticket holder not the computer system. The better answers were on a different analytical plain. These answers used appropriate technical terms e.g. ticked "scanned", "check digit" used to check accuracy of "scanning", "transaction code" sent to "central computer", correct "file" located/ "record" with given "transaction code" found or "transaction code" compared with winning "transaction codes", etc. Compare this with an answer pitched at the level of a ticket holder. "The numbers on the ticket are entered. The computer system checks if these are the winning numbers. The user is informed". Such an answer gained no marks.

Q21.

Most candidates gained at least one mark on this question and some excellent answers were seen. However the vast majority of candidates wrote down all they knew about cache in general rather than properly addressing the question which was about *disk cache* and the flow of data *from a disk drive.*

Q22.

Generally a high scoring question but answers were often weak in that they failed to identify an application. At this level a candidate should not be stating that bar codes are used in a shop with no explanation as to how they might be used. There was also some confusion between a magnetic strip and the security devices attached to books in libraries and items in shops.

Q23.

Most candidates were able to score on this question but few obtained full marks. In many cases it was due to misconceptions about the devices. Candidates were often unaware of the comparative speeds and capacities and were only able to compare devices with floppy discs. The CD was often described as having an enormous capacity and operating at high speed. It was also described as being the only medium capable of storing multi-media.

Q24.

A minority of weaker candidates made no attempt to answer this question. In part (a) the general principles of masking to read or set individual bits without changing others seemed not to be known by many candidates. Even when the masks were correct the logical operators were sometimes wrong.

Masks were not actually required for the algorithm in part (b), credit was given for simply stating the bits to be tested and the action needed. Where masks were given they were credited. Very few candidates bothered to check that the system was active. The vast majority neglected to provide any kind of loop to allow for continuous monitoring. Another common error was to use an ELSE clause in a way that resulted in testing the internal motion sensor and door and window contacts only when the security light had been activated. Others required both the door and window contacts to be broken before activating the alarm. Credit was given for appropriate use of a loop and IF THEN (ELSE) ENDIF constructs within the algorithm.

Answers tended to suffer where candidates failed to indent correctly. Where identifiers are used they should be explained. Many candidates might have gained more marks if they had added comments to explain what they were trying to do.

Q25.

The diagrams produced by many candidates left a lot to be desired. Spirals rather than circular concentric tracks were far too common. The candidates far too often assumed that the Inter Block Gaps found on tape also apply to disc. The number of blocks (sectors) on each track appeared to vary as the tracks got smaller in many diagrams.

Q26.

This was an application question in which context was very important. The best answers chose input devices which were convenient in the restricted space of the cab of a fire engine, usually voice input or a touch pad of some kind. The best output devices were justified by reason, e.g. “Printer (small) so that maps, notes could be taken into the building”. There were many solutions which were well thought through and innovative. Too many candidates could not distinguish between input and output devices.

Q27.

Although in part (a) most candidates understood the principle of the scanning of a bar code, few were able to express it cogently, and there was a frequent lack of precision in their answers.

Too many candidates identified grocery items with fruit and vegetables alone, and therefore said that price was determined by weight. Most were able to gain some marks on how the bar code can be used once in the system.

In part (b), real time was reasonably well defined by many candidates, although few gained both marks. Many then confused interactive with batch processing, with data being entered at a terminal and being processed later.

Although in part (c) most candidates correctly gave an Optical Mark Reader, or less satisfactorily, Optical Mark Recognition as the device used to read a lottery ticket, other suggestions included Optical Character Recognition, a Bard Code Reader, a Scanner and even MICR. Few candidates could explain why no one system could cover the whole of the UK. Contrary to popular belief, cables can cross water.

In part (d) many candidates gained good marks, although there was too much repetition, either of the target or the useful information elicited. Customers are not usually consulted by a systems analyst on what they would like to see in a new system. Candidates also suggested feasibility studies, and looking at other similar systems, instead of the old system as specified.

Quality of Language

Candidates mostly managed to convey their arguments satisfactorily. Section B is supposed to be written in continuous prose. This is a technical subject and candidates are expected to be comfortable recognising and using appropriate technical terms.