

7.4 External h	ardware	Name:	 	
devices part 1		Class:	 	
		Date:	 	
Time:	276 minutes			
Marks:	235 marks			
Comments:				

#### Q1.

Cameras within a taxi take still images once every second for security purposes. The images are compressed using run-length encoding and stored on a flash memory card within the camera.

Describe how a digital image could be captured by a digital camera and compressed using run-length encoding.



(Total 6 marks)



Employees at a bank use client computers to access data that is stored on a database server.

The database server uses software to query and modify data stored in a database on hard disk drives. It returns the results of these queries to the clients over the bank's computer network.

The performance of the system is unsatisfactory: the time-delay between a client sending a query to the server and the client receiving the results is unacceptably long.

Explain how the performance of the system might be improved. You should consider the following factors that might be affecting the performance:

- the hardware of the server
- the design of the computer network
- the database and software running on the server.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response.

(Total 12 marks)

### Q3.

Describe the principles of operation of an optical disk drive that is used to read data from an optical disk such as a CD-ROM or DVD-ROM.

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		_												
						_								
					_									
				_									(Total 6	marks)
Q4	•													
	USB Fla	sh Drive	es (a ty	/pe of S	SSD) a	rear	nore po	pular c	hoice	for trar	nsferri	ng files	such as	
	images a	and wor	d proc	essed	docum	ents f	rom one	e comp	outer to	o anoth	her tha	In CD-R	s (a	
	type of c	plical u	13N).		_					_				
F	Explain	why this	is the	case.	D	= 6	20	D	D	Δ(	٦Т	'IC	F	
													· Illum	
													(lotal '	1 mark)
~ -														
Q5	•													
	A laser p	orinter h	as a re	epreser	ntation	of an	Images	stored	in its r	nemor	у.			
	Describe	e how it	prints	this im	age on	to a p	piece of	paper						



#### Q6.

Explain the principles of operation of a laser printer.



## EXAM PAPERS PRACTICE

#### (Total 6 marks)

## Q7.

A well-established use for robots in industry is the spraying of car bodies on a car production line.

A robotics researcher is investigating the feasibility of developing and installing in a car a computer-based control system to take over completely the driving of the car on public highways.

She has identified some of sources of inputs into the control system already:

- high resolution video camera
- stereoscopic digital camera

- long range radar
- short range radar
- Global Positioning Satellite receiver.

And some of the outputs:

- position of steering wheel (in degrees from the vertical)
- forces on accelerator and brake pedals.

Discuss why automated car control is a harder programming problem to solve than developing programmed control of a robot for spraying car bodies on a car production line, and what processing of input data will be necessary and why to obtain sufficient information to safely and reliably control the driving of the car by computer. Include in your discussion the sources of input that you have used and the information derived from these by processing.

#### (Total 9 marks)

#### Q8.

A flight recorder is an electronic recording device placed in an aircraft for the purpose of facilitating the investigation of aviation accidents and incidents. The image below shows an example of a flight recorder. It is a requirement for every commercial aircraft to have a type of flight recorder called a cockpit voice recorder.



© Thinkstock

(a) Current cockpit voice recorders use solid-state memory chips to store the digital audio data. Alternatively, the data could be stored on a traditional hard disk drive.

Give **two** reasons why cockpit voice recorders store data using solid-state memory instead of using a traditional hard disk drive.

(b) Audio from the cockpit is sampled at a rate of 8000 Hz and 16 bits are allocated to each sample.



A burglar alarm system is to be implemented that has the following sensors:

- a door sensor D that outputs TRUE when the door is open and FALSE when the door is shut
- a pressure mat sensor **M** that outputs TRUE while a weight is detected on it and FALSE when no weight is detected on it.

The alarm also has a key  $\mathbf{K}$  that turns the alarm on and off.  $\mathbf{K}$  outputs a TRUE signal when the alarm is switched on and FALSE when the alarm is off.

The alarm output A sounds a bell. It should be TRUE if:

- the alarm is on AND
- either of the sensors **D** or **M** are set to the value TRUE.
- (a) Draw a logic circuit that will behave as described above for the inputs **D**, **M** and **K** and the output **A**.



Q10.

The phrase "Internet of Things" is used to describe the connection of many everyday devices such as home heating controls, utility meters, cars and environmental sensors to

the Internet. It is believed that tens of billions of devices will be connected to the Internet of Things by the end of the decade.

One anticipated use of the Internet of Things is to monitor the food that consumers have inside their fridges. This data could be gathered automatically from consumers' devices by retailers who sell food. Retailers could use the data to analyse consumer consumption habits or automatically prepare deliveries for customers.

In the context of an Internet connected fridge, discuss the technologies that will be required to make the Internet of Things work.

You may wish to consider how the data might be captured, how networking technologies are changing to provide the necessary infrastructure, and how the data gathered by retailers could be stored and processed, from a hardware and software viewpoint.

(Total 12 marks)

(3)

#### Q11.

(a) A school has given RFID (radio frequency identification system) tags to each student as a security measure. At each external door there is a reader device against which the student holds the tag to gain entry.

Describe the principles of operation of both the reader and the RFID tag when reading the tag.



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- (b) Four statements are given below that relate to the operation of printers.
  - 1 Ink is squirted onto the paper to form characters.
  - 2 Pins are fired against a ribbon to form characters.
  - **3** Toner is attracted to the paper and then fused onto it.
  - 4 A pen is lifted up and down to create the image.

In the table below, write the corresponding number for **one** of the possible statements that best describes a principle of operation for the given device.

Device	Statement Number
Laser Printer	
Inkjet Printer	

(c) External hard disk drives and CD-ROMs make possible both storage and transport of data.

A difference between the two is that more data can be stored on a typical hard disk drive than on a CD-ROM.

						<u>_</u>
						(Total 8
		- 6				
supermarket	uses many ha	ardware device	es as part of i	ts daily operat	ions.	
key compone	nt at the chec	kout area is th	ne bar code r	eader (scanne	r).	
a product's ba ve to enter th	ar code canno le bar code m	t be read by tl anually.	ne bar code r	eader the che	ckout opera	ator will

Device 2\_\_\_

(b) Most supermarket product bar codes follow the International Article Number standard

which has 13 digits: 12 of these digits are for data and the last one is a check digit.



Describe the principles of operation of a bar code reader **and** how the software in the bar code reader will use the check digit when processing a product.

In your answer you will also be assessed on your ability to use good English, and to organise your answer clearly **in complete sentences**, using specialist vocabulary



(6) (Total 8 marks)

#### Q13.

Secondary storage devices include:

Fixed internal hard disk drives, Magnetic tape drives, DVD-R drives and USB flash drives.

For each of the scenarios below, identify the **most appropriate** device from the list above and also explain why this device is appropriate.

You should **not** use the same device more than once. You should **not** give the same reason more than once.

To transfer a 100 KB word processed document from one computer to another.

Device \_\_\_\_

Reason	
To store a backup of the 700 GB of user data stored on a school server.	
Device	
Reason	
To produce copies of a software executable for distribution to customers.	
Device	
Reason	
	 (Total 6 marks

## Q14.

A school robotics club has recently purchased a robotics kit after the teacher in charge saw an advert in a magazine. The advert is reproduced below.



(a) Using the XMODEM protocol, students at the robotics club can copy a RobotC program prepared on a desktop computer to the robot.

built-in interp	program that has been copied to the robot can be executed by the preter.
How does a	high level language interpreter work?
The robot pr computer, bu	rocessor is different in some ways from a processor in a desktop ut it still follows the stored program concept.
The robot pr computer, bu What is mea	rocessor is different in some ways from a processor in a desktop ut it still follows the stored program concept. nt by the term <i>stored program concept</i> ?
The robot pr computer, bu What is mea	rocessor is different in some ways from a processor in a desktop ut it still follows the stored program concept. Int by the term <i>stored program concept</i> ?
The robot pr computer, bu What is mea	rocessor is different in some ways from a processor in a desktop ut it still follows the stored program concept. Int by the term <i>stored program concept</i> ?

The motor driver uses memory locations to store the current speed of each motor. The left motor speed is stored in memory location 21 and the right motor speed is stored in memory location 22.

The following set of three assembly language instructions can be used to take basic control of the motors:

- LOAD XX load a value from memory location XX into the accumulator
- ADD XX add the value stored in memory location XX to the accumulator
- STORE XX store the value in the accumulator in memory location XX

Selecting from the set of three instructions above, write a sequence of instructions that will swap the current left motor speed with the current right motor speed. Your program may use memory location 23 for temporary storage.

(e)	that t	students develop a program that can sort coloured balls into piles but it is found he program is not very effective.
	With such relati	regards to touch and vision, state <b>three</b> factors why a robot may find a task, as sorting coloured balls, a hard task whereas for a 4-year-old child it is a vely easy one.
	Facto	or 1
	Facto	or 2
	Facto	or 3
(f) <sup>-</sup>	The ro	bobot identifies the colour of the balls using a digital still camera component.
(f) <sup>–</sup>	The ro	bobot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f) -	The ro (i)	bobot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f) -	The ro (i)	bobot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f) -	The ro (i)	bobot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f)	The ro (i)	obot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f)	The ro (i)	bbot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera.
(f) -	The ro (i) AI	boot identifies the colour of the balls using a digital still camera component. Describe the principles of operation of a digital still camera. <b>PAPERS PRACTICE</b>

## Q15.

In 1995, a high capacity hard disk drive had a storage capacity of 512 megabytes. In 2012, a typical hard disk drive of the same physical size had a capacity of 1 terabyte.

(b)	How many times greater is the storage capacity of a 1 terabyte hard disk drive than that of a 512 megabyte hard disk drive?
EX	Show each stage of your working.
	(
	Final answer (
(c)	Give <b>one</b> development in the design of hard disk drives that has enabled this increase in storage capacity.
	(
(d)	If you are considering purchasing a high-end desktop or laptop you might be offered

(a) Describe the principles of operation of a hard disk drive.

the option of a solid-state drive (SSD) rather than a traditional hard disk drive.

A solid-state drive is a data storage device that uses solid-state memory, similar to that in USB flash drives (memory sticks), to store data that is accessed in a similar way to a traditional hard disk drive.

Ignoring any differences in price and assuming that both drives have the same capacity, state **two** reasons why you might choose the solid-state drive.

Reason 1	 	 		 ,	 
Reason 2	 		 		 

(2) (Total 9 marks)

#### Q16.

(a) Here is a list of input devices:

smart card reader, Radio Frequency Identification (RFID) reader, flatbed scanner, touch-sensitive screen.

For each of the situations below, state the name of the most appropriate input device from the list above. You should **not** use the same device more than once.

(i) Information kiosk at a railway station

(1)

(1)

## (ii) Payment for food at a school canteen EXA PAPERS PRACTICE

(iii) To identify a book being removed from a library without authorisation

(1)

(b) Describe the principles of operation of a flatbed scanner.

_		 	 	 	 	 	
-							
-							
-		 	 	 	 	 	
(4							
(							
marks	(Total 7						
mark	(Total 7						

## Q17.

There are various formats of optical storage media currently available.

(a) Choose the most appropriate medium from the list below that would be best suited to the purpose given. Write your answer in the Medium column in the table below. You must **not** use the same medium more than once.

Purpose	Medium
To distribute 300MB of commercial software	
To store a 20GB high definition movie file	
To use for a 3GB archive of the data on a school server	
To create a copy of a 60 minute audio music album	
	(4)

#### CD-ROM, CD-R, CD-RW, DVD-R, DVD-RW, Blu-Ray

(b) Describe how data is written to and read from a CD-R disk.

## EXAM PAPERS PRACTICE

(c) A series of word-processed documents have been archived onto CD-R.

State **two** reasons why in 20 years' time it might be impossible to open up these documents.

Reason 1: \_\_\_\_\_

Reason 2: \_\_\_\_\_

(3)

### Q18.

(a) The table below lists the approximate storage capacities of various secondary storage media.

Complete the table below, indicating which of the storage media from the list most closely matches the given storage capacities. You should **not** use the same medium more than once.

Blu-ray, Magnetic Hard Disk, Flash Memory Card, DVD+R, CD-R.

Typical Capacities	Storage Medium	
40 gigabytes – 2 terabytes		
4.7 – 8.5 gigabytes		
512 megabytes – 128 gigabytes		
600 – 800 megabytes		

- (b) Explain why a customer may prefer to buy software on DVD medium rather than downloading it.
- EXAM PAPERS PRACTICE (2)
  - (c) DVD disks are the same physical size as a CD.

Why is the storage capacity for a DVD disk far larger than that of a CD?

(1)

(4)

(d) An online booking system uses Digital Audio Tape (DAT) as a backup medium and a magnetic hard disk for interactive booking.

Why is DAT not suitable for the interactive booking?

#### Q19.

Compare the principles of operation of a laser printer and an inkjet printer when printing. Do **not** include information about how the data is transferred from the computer to the printer.

In your answer you will be assessed on your ability to use good English, and to organise your answer clearly in complete sentences using specialist vocabulary where appropriate.

(Total 8 marks)

#### Q20.

Some European governments are introducing electronic passports for their citizens. An electronic passport stores data about the passport holder using a Radio Frequency Identification (RFID) tag.

(a) An electronic passport stores data about some biometric properties of the passport holder.



(Total 4 marks)

#### Q21.

CD-ROM, CD-RW, Flash Memory Card and Magnetic Tape are all different types of storage media.

Complete the table below, indicating which of these storage media would be the most suitable to use in the situations described. You should not use the same medium more

than once.

Situation	Suitable Medium
Storing photographs in a compact digital camera, as they are taken	
Making a backup copy of 1,000 gigabytes of data, stored on a network file server	
Distributing a software package to home computer users	

(Total 3 marks)

#### Q22.

A supermarket uses a computerised stock control system. Each product is identified by a unique product code which is printed on the product as a bar code. The bar codes are input into the stock control system at the till using a bar code reader. One of the digits in the bar code is a check digit.



(a) Describe the principles of operation of a bar code reader, **excluding** the use of the check digit.

## EXAM PAPERS PRACTICE

(4)

(1)

(b) Explain the purpose of the check digit.

(c) Some unpackaged items such as loose fruit and vegetables do not have a product

code printed on them.

Name an input device that the till operator could use to enter details of these items.

(1) (Total 6 marks)

#### Q23.

Peripherals can be classified as input, output or input/output (I/O) devices.

(a) Explain what a peripheral is.

(1)

(b) The table below lists two peripherals.

Put **one** tick in each row to identify each peripheral as either an input, output or I/O device.

Peripheral	Input	Output	Input/0	Dutput (I/O)	
Mouse					
Laser Printer					
					(Total 3 mar
					,
Give <b>two</b> differ	ences betwee	en primary and	secondary	storage.	ICE
Give t <b>wo</b> differ 1	ences betwee	en primary and s	secondary	storage.	ICE
Give two differ 1 2	ences betwee	en primary and s	secondary	storage.	ICE

(b) Explain the principles of operation of a hard disk drive.

Your answer to this question will also be assessed on your ability to organise your answer clearly and coherently in complete sentences, using specialist vocabulary where appropriate.

<b>Q25.</b> (a)	(Total 8 m Write in the appropriate cells in the table below, the names of the secondary storage media listed below that most closely match the given typical storage capacities. You may use each medium more than once.	(6) harks)
EX	cartridge Typical Capacity DER Storage Medium CTCE	
-	10 Gigabytes – 2 Terabytes	
-	10 Gigabytes – 800 Gigabytes	
-	128 Megabytes – 8 Gigabytes	
-	2.8 Gigabytes – 4.7 Gigabytes	
	600 Megabytes – 700 Megabytes	
(b)	Which of the <b>above</b> storage media would be most suitable to (i) distribute software?	(5)

(ii) backup large data files? \_\_\_\_\_

#### Q26.

A Radio Frequency Identification (RFID) system is made up of a transponder built into an RFID tag and an interrogator or reader. One example of use is to detect unauthorised removal of library books from a library.

Explain the principles of operation of this RFID system.

(Total 2 marks)

#### Q27.

(a)

The figure below shows the address bar of a web browser.

This is used to access various websites.

(i) What does 212.219.90.65 represent?	
(ii) Another way to access a website is to key a URL into the address bar. What does URL stand for?	(1)

(1)

(2)

(b) Name and describe **two** features you would expect to find on the browser's menu or toolbar which are specific to browser software.

1	 	 	 	 	
Description:	 	 	 	 	
2	 	 	 	 	
Description:		 		 	

(c) AQA Wanderers are a local soccer club which has a website. The club's players and members frequently access this website using the URL:

http://www.footyhosting.co.uk/aqawanderers/home.asp

	(i)	What is the <b>domain name</b> of the website being accessed?
	(ii)	Explain from the URL shown, how the company may have organised the storage of the pages for all the clubs it manages on its web server.
(d)	The for A	soccer club's own computer is used to manage and upload the page content AQA Wanderers and is done using a broadband connection.
	Sele usin	ect from the list below <b>the most probable value</b> for the <b>transfer rate</b> of the data g the broadband connection. Put a circle around your answer.
	20 N	IB 1.6 GHz 200 bps (bits/sec) 2 Mbps 128 Kbps
(e)	The	website for a single soccer club takes up approximately 5GB of storage space.
	Foot the e	ty Hosting Ltd currently has 500 clubs as customers and hopes to double this by end of 2009.
	(i)	What type of secondary storage is used for a web server?
	(ii)	Select from the list below <b>one</b> value for the minimum size of web server required to host the sites for all clubs (including the proposed expansion in
Y	Δ	business). Put a circle around your answer.

#### Q28.

A large local hardware store is introducing self-checkouts for customers. The store sells a wide range of products of all shapes and sizes and with different packaging.

The designers of the system are considering the following input and output devices. For each of the following, give **one** reason why it might be used in this system. Two answers have been started for you.

Bar Code Reader; To read the bar code in order to

Credit & Debit Card Reader; To read the chip (or magnetic strip) in order to

Touch	Sensitive	Screen;
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Numeric Keypad;

#### Speech Synthesizer;

Printer;

#### (Total 6 marks)

#### Q29.

You come across a batch of old CD-Rs which contain old digital photographs of your family.

The CD-Rs have clearly been well looked after and do not have any scratches or other physical defects.

It is the year 2050. Why might you be unable to display the photographs on your computer? Give **two** reasons.

 		_		 		
					(Total 2	mark

# EXAM PAPERS PRACTICE

A student has word-processed the first draft of his essay and printed a copy. He then lost the file into which he saved the essay. He is about to spend time typing the essay again. You suggest he should scan the printed copy instead.

(a) Explain the sequence of steps the **scanner** goes through when it scans the printed document to produce an image of the document.



(b) What software is required to convert the scanned image into wordprocessor useable text?

(1) (Total 5 marks)

(4)

#### Q31.

You want to improve the performance of your PC by upgrading certain components, whilst retaining the same motherboard.

What upgraded/additional components would bring about the following improvements? Your components for parts (a), (b) and (c) **must** be different.

(a) Increasing the speed at which application programs are executed.

Component:	
Explanation:	
	(2)
(b) Avoiding the need to continually archive picture and music files to CD storage.	
Component:	
Explanation:	
XAM PAPERS PRACTICE	(2)

(c) Having several additional devices connected at the same time to your computer. For example, a digital camera and memory card reader.

Component: \_\_\_\_\_\_

(2) (Total 6 marks)

(1)

#### Q32.

E)

(a) What is secondary storage?

- (b) These are examples of secondary storage media:
  - DVD-R
  - flash memory
  - floppy disk
  - magnetic hard disk
  - magnetic tape cassette.

Select **one** medium from this list for **each** of the following purposes, and explain why your choice is the **most** appropriate.

Your three media should be different.

(i) Storing about 226 Megabytes of files that are accessed and edited regularly, both at work and at home.

	Medium
	Why appropriate
(ii)	Storing about 650 Megabytes of digital photographs of a family wedding, for distribution to family members.
	Medium
	Why appropriate
	Storing software in use on a set of PCs in a school.
	Medium
	Why oppropriate

(Total 7 marks)

### Q33.

E)

The checkout terminals at a garden centre are used to carry out the following tasks:

- record the purchased items
- record the method of payment to be used
- validate the payment if made by credit or debit card.

The terminals also prompt the sales assistant at various stages during a transaction and produce a customer receipt.

Space at the checkout desks is limited, so input and output devices have been chosen to take up as little space as possible. For instance, there are no keyboards.

Name **three** input devices that might have been chosen for these terminals which will satisfy the requirements of the system. For **each** device, explain its role in the system.

Device I			· · · · · · · · · · · · · · · · · · ·						·		
Role											
Device 2								·	·		
Role											
Device 3									·		
Role											
										(Total 6	mark
			_								
<b>34</b> .											
Radio free	quency ident	tification (	(RFID) is	an autor	matic id	entifica	ition m	ethod.	. Tags	attached	

remote retrieval.

A tag consists of a small chip and an antenna which enables it to receive and to respond to radio frequency signals from a reader device. Tags can be 'read' by supermarket shelves, microwave ovens, fork lift trucks and so on.

Each reader is typically connected to a server via a network. A server can look up the code read from the tag in a database to identify the tagged item uniquely and then take appropriate action. Tags do not need to be in line of sight to be read, and they can be read even if they are in your pocket!

Examples of the use of RFIDs include:

- inserting a chip under the skin of a pet
- tagging airline passengers' luggage
- tagging containers that are used to transport goods around the world
- tagging euro notes
- inserting tags inside clothes and other retail goods
- (a) Using only the applications listed above, give **two** benefits of RFIDs to organisations that might use them.

1	_			 		 	
2		 	 	 			

(b)	Using only the applications listed above, give <b>one</b> benefit of RFIDs to a member of the public.	
		(1)
(C)	about the use of RFIDs.	
	(Total 4 n	(1) narks)
235.		
An a com clier	architect has been asked to design a 'smart' home using components of a puter-controlled home automation system, for a client who uses a wheelchair. The nt cannot stand easily and has limited use of their arms.	
The	architect has the following components to choose from:	

- Radio-frequency remote controls
- Programmable switching units to control appliances
- Movement detectors
- CCTV (Closed Circuit TV)
- Fingerprint door locks
- Climate control system
- Motors to operate doors/curtain-rails/shutters Voice recognition system

For **three** of the above devices, state the device and explain its use for a home automation system and why it would help the client.

Device 1:	 	 	 		
Use:	 	 	 	 	
Why:	 	 	 	 	
 Device 2:	 	 	 	 	
Use:	 	 	 	 	
Why:	 		 	 	

CE

Device 3:	 	 	 	_
Use:	 	 	 	_
Why:	 	 	 	-
	 	 	 	(6)

(Total 6 marks)

