

**BCS THE CHARTERED INSTITUTE FOR IT  
BCS HIGHER EDUCATION QUALIFICATIONS  
BCS Level 4 Certificate in IT**

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**EXAMINERS' REPORT**

**Computer and Network Technology**

**General comments on candidates' performance**

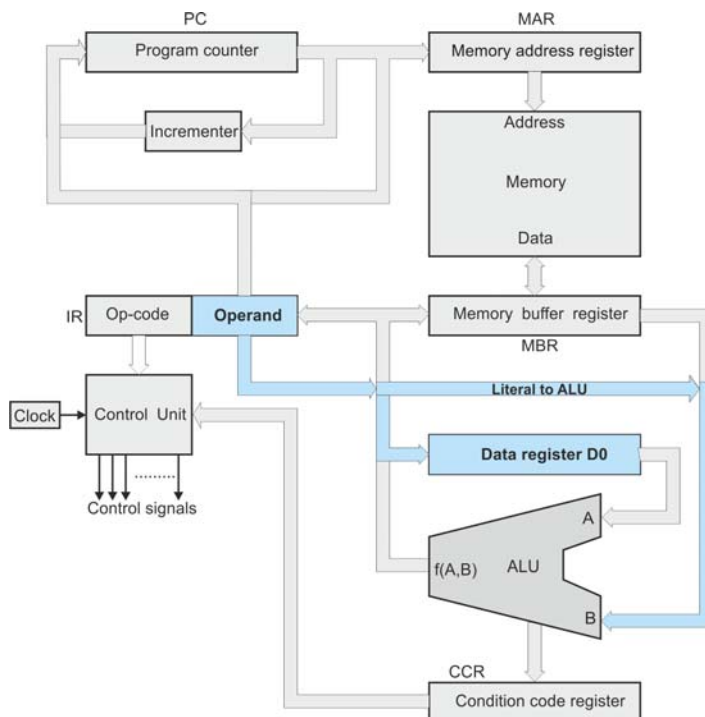
The standard of attempts has improved. There has been an improvement in section A answers. As in previous sittings, many candidates did not write sufficiently in-depth answers for 30 marks awarded for section A. Centres need to provide guidance and support to candidates so that they are prepared to write sufficiently in depth answers in section A. Candidates attempted section B questions well.

**Section A**

**A1**

**Indicative Answer Points**

a) The figure below describes a generic CPU. The CPU consists of a set of registers (one-word data stores) linked by buses. Data can be moved from register to register, from registers to the ALU where arithmetic and logical processing takes place, and from the ALU to registers where results can be stored. There are also data paths between registers and external memory.



b) An instruction is executed in two phases. In the fetch phase, the address of the next instruction in the program counter is transferred to the memory address register and the corresponding op-code looked up in the main memory. The op-code is fed to the memory buffer register and then the instruction register where it is decoded. The PC is fed to an incrementer where it is incremented to point to the next instruction.

During the execute phase, the instruction in the instruction register is decoded and that generates the signals necessary to access memory or route data to the ALU when a data-processing operation is performed.

Note that the ALU can receive data from memory or the instruction register to allow the use of a variable operand or a literal, respectively.

The PC can receive data from itself (after incrementing) or from the instruction register (to implement a branch operation).

c) Candidates may have assumed any computer model. Here, an ARM type processor has been used as an example:

```
ADR r0,x      ;This loads register r0 with the
               ;address of variable x
LDR r1,[r0]    ;Get variable x in register r1
               ;The addressing mode [r0] indicates
               ;"pointed at by r0"
CMP r1,#4      ;compare r1 (i.e., x) with literal value 4
BNE Exit       ;if not 4 then exit (nothing else to do)
ADR r4,p       ;r4 points to p
LDR r2,[r4]    ;get p in r2
ADR r4,q       ;reuse r4 to point to q
LDR r3,[r4]    ;get q in r3
MUL r3,r3,r2   ;evaluate p.q
ADD r1,r1,r3   ;evaluate x + p.q
ADD r1,r1,#4   ;evaluate x + p.q + 4
STR r1,[r0]    ;save x in memory
Exit  continue here
```

Candidates were required to demonstrate a simple IF THEN construct.

d) RISC processors have a load and store (also called register-to-register) architecture. They support only memory accesses that load a register from memory or store a register in memory. All data processing operations (logical, arithmetic, shift) are applied to registers. RISC processors invariably have a 32-bit (or longer) 3-operand format like ADD r1,r2,r3 or AND r3,r3,r6.

RISC instruction sets tend to be regular with a relatively small number of instructions. Moreover, the encoding format of instructions is regular and all instructions are the same length.

CISC processors grew out of 8-bit processors and adopted variable length instructions; for example, an instruction might be 16 bits or 32 bits long. Memory to register operations are permitted; for example ADD D0,1234 (add the contents of register D0 to the contents of memory location 1234).

Some CISC processors have very complex instructions.

### **Examiners' comments**

This question was popular amongst candidates. Answers for parts a), b) and d) were well written. Part c) was poorly attempted across candidates/centres. Candidates need to review this area of the syllabus and cover machine level topics.

### **A2**

#### **Indicative Answer Points**

Candidates were expected to cover the following topics:

Programmed I/O involves a polling loop such as:

```
REPEAT
  Test port
UNTIL ready
Transfer data.
```

Such programmed I/O treats an input or output operation as a memory transaction. However, it is very inefficient because no useful processing takes place in the polling loop. Programmed I/O might be used by a microcontroller in a toy or a device like a washing machine.

Interrupt driven I/O is more complicated. When a peripheral is ready for a data transfer, it signals the processor. The processor stops its current activity, saves the machine context and invokes an interrupt handler to deal with the cause of the interrupt. This process requires a complex interaction between hardware (the interrupt mechanism) and software. Interrupt processing is handled by the operating system.

The advantage of the use of interrupts is that no time is lost to polling; it is data transfer on demand. Consequently, it is an efficient form of I/O. Under certain circumstances when there are many I/O sources, it is possible that high-priority devices may occupy all the I/O bandwidth and some slower devices left to wait for attention.

Direct memory access, DMA, is a hardware-based technique where a peripheral directly reads data from memory or puts data in memory. DMA is operated by forcing the CPU to give up the bus (or by interleaving I/O and CPU memory cycles). This requires complex hardware capable of arbitrating for the bus and controlling all bus drivers. However, it provides the fastest form of I/O.

### **Examiners' comments**

This question was not popular amongst candidates. Those who attempted this question did not cover the various topics. These are fundamental concepts in computer technology and need to be fully understood.

### **A3**

#### **Indicative Answer Points**

a) Viruses – probably the oldest and most dangerous threat. Viruses replicate via direct transportable media (once floppy disk and now flash media), or through the internet. A virus can carry a payload that may cause an arbitrary amount of damage to the computer.

Trojan horses - A Trojan horse is an example of malware that hides in a legitimate program. Trojan horses are sometimes found in programs that are distributed; for example, with freeware and shareware.

Worms - A worm is a message that is designed to replicate itself. It has some characteristics of a virus, but is usually intended to replicate to the extent that data channels become clogged by the endless repetition of worms. It is used as a means of service denial.

SPAM - Although not malware in the sense that it causes physical harm, SPAM is a form of soft malware that consumes memory space, bandwidth, and (most importantly) the user's time. It is potentially dangerous because too much SPAM may cause legitimate messages to be lost or to be filtered out by SPAM detectors.

Spyware Programs that monitor a system and report back to a third party are called spyware. They may be relatively harmless (reporting shopping habits back to an on-line supplier) or malicious (reporting valuable information such as passwords and financial data).

b) Candidates were expected to discuss two topics: prevention by means of good practice and detection by means of special purpose software.

Good practice involves understanding how to use the computer (setting appropriate levels of prevention), and accessing only legitimate or trusted sites. Software must always be obtained from trusted sources and all forms of "free" or "pirated" software shunned. In a large organization it will be necessary to provide those using computers with malware awareness training.

It is also necessary to provide security by preventing unauthorized access to the computer. Practical prevention techniques involve antivirus software and firewalls.

c) This was an open-ended question. Candidates were expected to discuss the role of computer societies in setting professional codes of behaviour (emphasizing the professional responsibility of practitioners), and increasing the awareness of malware within the general public.

### **Examiners' comments**

Answers to this question were good in general. Candidates covered a range of malware and explained how these enter computer systems. They were also able to discuss a range of prevention issues. Some candidates clearly explained the role of the BCS in combating malware.

### **A4**

#### **Indicative Answer Points**

a) The International Standards Organization (ISO) model for Open Systems Communication is not an actual protocol for a real system but a framework for the development of communications protocols. It served to provide a template for all future designers by incorporating "best practice" in the design of communications systems. In particular, it separates architecture and implementation.

The ISO model for OSI has seven layers. Each layer performs a specific function and communicates only with the layer above it and below it (except the bottom layer that provides the physical communications path) and the top layer that represents the application.

The advantage of the layered protocol is that the implementation of a given layer can be carried out in many different ways without a need to change layers above and below it.

Another important aspect of the OSI model has been its effect on education, computer scientists and promoting good practice in the design of complicated communication networks.

The OSI layers are:

Layer 1 physical layer. This layer provides the actual communications path between two points in the network. It may be a cable, optical, or wireless link (or any combination of technologies). The physical layer provides a point to point (not end to end) service and a best effort delivery. That is, it is not required to be error free. Higher level layers perform that function.

Layer 2 data link. The data link layer uses the physical layer below it to transport data. This layer is responsible for moving data from point to point. It can provide error free transmission by using error detecting and correcting codes or by requesting retransmission.

Layer 3 network layer. The network layer uses the data link layer to pass data between a source and a destination node (that is, the data link may include multiple hops and several networks). The network layer provides routing functions across the network.

Layer 4 transport layer. The transport layer uses the network layer to provide end to end communications

Layer 5 Session layer. The session layer is rather different to those below it. It is not directly concerned with passing messages but with setting up the communication and eventually ending the communication. It is the manager of the communications process.

Level 6 The presentation layer. The presentation layer is concerned with formatting the data. For example, end to end text or video or audio.

Level 7. The uppermost level is the applications level that interfaces with the user. This is the actual application.

b) One of the best known protocols is TCP/IP (Transmission Control Protocol and Internet Protocol) that is used for communications over the Internet.

The TCP/IP covers the bottom two layers of the internet (the physical transport is provided by Ethernet that covers the physical medium – cable and the data link layer). TCP is responsible for point-to-point transmission at the bit level. The IP (internet protocol) is responsible to moving packets of data from node to node.

The TCP/IP protocol includes the transport and network layers of the OSI model.

TCP/IP was developed to support the UNIX operating system and had become a de facto standard (i.e. it is a standard created by its widespread use rather than planned by a committee).

Note that TCP/IP assigns a unique address to every computer. The IP address is a four-byte value that is conventionally represents as four decimal numbers; for example, 120.150.12.123

The top three OSI layers (session, presentation and application) are not provided by the TCP/IP protocol and are effectively incorporated into a single application layer.

### **Examiners' comments**

Candidates answered this question well. Most answers included detailed and accurate descriptions of the OSI model. Candidates found part b) a bit difficult and did not cover TCP/IP in sufficient depth.

## **Section B**

### **B5**

#### **Indicative Answer Points**

RAM – Random Access Memory stores data temporarily.

The two types of RAM differ in the technology they use to hold data, with DRAM being the more common type. In terms of speed, SRAM is faster. DRAM needs to be refreshed thousands of times per second while SRAM does not need to be refreshed, which is what makes it faster than DRAM.

DRAM supports access times of about 60 nanoseconds, SRAM can give access times as low as 10 nanoseconds. Despite SRAM being faster, it is not as commonly used as DRAM because it is so much more expensive. Both types of RAM are *volatile*, meaning that they lose their contents when the power is turned off.

### **Examiners' comments**

Most candidates who attempted this question were able to briefly explain the difference between DRAM and SRAM. Answers could have been in more depth with examples.

### **B6**

#### **Indicative Answer Points**

Server – the main device in the network which usually acts as a 'host to clients'. It provides services to clients on the network. These include authentication and access, sharing of hardware and data

Router – device whose primary function is to 'route packets of data' from one client to another on the network.

Switch – acts as a hub to lots of devices for connection purpose. This device does not have a 'forwarding' capability but simply acts as a connection point to lots of devices/nodes.

### **Examiners' comments**

Candidates were able to differentiate between the various networking devices. Answers were clear and sufficiently in depth.

## **B7**

### **Indicative Answer Points**

- Laser printer able to produce high quality output fast; uses a combination of laser beams and toner to produce output.
- 32 Mb on printer enables the temporary storage of output before being transferred onto paper.
- Print resolution refers to the quality of output produced by the device, the higher the resolution, the more accurate and precise the output will be.
- The printer is able to print 18 pages per minute. This is particularly important when a large volume of output needs to be produced.
- Eco print implies that the device is built to produce output with minimal ink usage and ink with a reduced impact on the environment.
- USB 2.0 Wifi interface enables the printer to be accessed wirelessly from different locations.

### **Examiners' comments**

Candidates were able to provide brief explanations of each technical point of the printer as an output device. Some candidates were not clear about 'eco print' and provided confusing answers.

## **B8**

### **Indicative Answer Points**

Kernel – the main part of the operating system which loads first and remains in the main memory. It provides services to the other parts of the operating system and applications which run on the computer. The kernel provides services related to tasks management, disk management and process management.

Multiprocessing – The operating system is able to handle various tasks on more than one processor. Programs run concurrently. In a multiprocessing environment, the operating system must allocate resources to the various processes.

Scheduler - this is the part of the operating system which provides services with regards to resource coordination. The scheduler ensures that resources are accessed and serviced when requests are made in an efficient manner.

### **Examiners' comments**

This question required candidates to discuss the fundamental issues around operating systems. Candidates were able to write good answers on multiprocessing and scheduler. Kernel seemed to be an unclear topic and candidates provided sketchy answers.

## **B9**

### **Indicative Answer Points**

Cloud computing is the technology which enables computing resources to be shared virtually among lots of users across a network. It enables access to hardware, software and data to be stored 'remotely'. The technology minimizes the need to purchase, for example, storage devices. These can be accessed from companies which provide cloud services. Organisations can also 'subscribe' to services such as software and backup facilities. These may be public or private services.

Cloud computing is becoming popular and many organizations are finding the technology a means to cut down costs of buying and maintaining hardware and software.

### **Examiners' comments**

As this topic becomes popular, it was good to note that many candidates were able to discuss a range of issues on cloud computing. Answers included explanations of the technology and uses of the platforms.

## **B10**

### **Indicative Answer Points**

An intranet is a computer network which is developed, used and managed internally to an organization. This means that only internal authorized users are allowed to access an intranet.

An extranet enables both internal and limited external users access information found on the network. These include an organisation's customers, suppliers and other partners.

Both intranet and extranet use the same internet based protocols. This enable internet related data to be kept and accessed on both intranet and extranet.

Intranets and extranets are used for a range of purposes such as providing information on organisations' products and services, communication with staff, customers and suppliers.

### **Examiners' comments**

Most candidates were able to differentiate between intranet and extranet. They were able to provide details of technologies used by each type of networks. Good answers included coverage of suitable uses of both the intranet and extranet.

## **B11**

### **Indicative Answer Points**

Magnetic storage is based on data being stored on a surface coated with magnetic material. A magnetic disk is usually made of concentric tracks which are divided into sectors. Data are stored as block. An example of magnetic storage is the hard disk. A disk drive is used to write data to and read data from the disk.

Optical storage medium use light as a medium to store data. Examples of optical devices are the CD or DVD. Data are recorded on the surface of these disks by 'burning holes' on the surface. Optical storage devices have higher storage capacities than hard disks.

### **Examiners' comments**

This question covered the main data storage devices in computing. Candidates were able to provide good answers on storage devices. Descriptions were relevant and clear.



**Indicative Answer Points**

Encryption is used to ensure that data can only be visible to authorized users in particular the sender and the receiver. Various encryption techniques and algorithms are available to codify data in a format which is not readily accessible during data transfer.

HTTPs – this is a widely used communication protocol for secure communication over a computer network. It is used during internet communication to authenticate websites and associated web servers. It also provides bidirectional encryption of communications between a client and a server.

**Examiners' comments**

Candidates were expected to explain encryption and give suitable examples of encryption methods. Answers were relevant and most candidates were able to write sufficiently in depth. Data security methods such as HTTPs were not clear to many candidates. Centres are advised to provide more guidance on how data transmission and internet security can be achieved.