

BCS HIGHER EDUCATION QUALIFICATIONS
Level 4 Certificate in IT
March 2014

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. Candidates attempted section B questions well. Centres must provide guidance and support to candidates so that they are prepared to write sufficiently in depth answers in section A. The most popular question was 7 and the least popular was 1.

Section A

A1

Answer pointers

- a) A high-level language allows a programmer to express an algorithm in an (almost) human-readable form; for example, the meaning of the construct REPEAT ... UNTIL is self-evident to most readers. A high-level language is designed to increase programmer productivity, help protect against errors (e.g., via strong typing), and be self-documenting. Most importantly, a high-level language is portable in the sense that a program written in a high-level language can be run on any computer (after first being compiled into the appropriate machine language for the target computer).

An assembly language (or low-level language) is a human-readable version of a computer's native machine-code. Operations expressed in a low-level language are primitive and permit operations on memory locations and registers. Operations are typically arithmetic, logical and shifting. All low-level languages provide simple conditional branches. It is very difficult to write complex programs in a low-level language because of the verbosity of the code, the difficulty in reading it, and the complexity of testing it. One programmer can rarely read another programmer's machine-level language. However, low-level languages give you direct access to a processor's resources and, in principle, you can write optimum (i.e., fast) low-level code.

- b) Although low-level languages are no longer used to write large programs, they can be used to implement functions where the greatest possible speed is required (e.g., in graphics or an operating system core). Moreover, when debugging real-time applications it may be necessary to trace the execution of a program instruction by instruction.

Assembly language programming is still taught because it is necessary for programmers to understand how computers operate in order to make best use of them (e.g., an understanding of a car's gear-box can help optimize fuel consumption). A good example is an understanding of machine architecture can help with writing high-level software for numerical operations, or games applications, or array processing.

- c) The following is one possible solution. Any machine code (real or hypothetical) is acceptable as long as it conforms to the basic patterns of typical RISC or CISC architectures. In the following, I give the original pseudocode and use // to indicate a comment field (ignored by the assembler)

```
// Sum = 0
MOV r0,#0 //move literal 0 into register r0 (r0 is sum)
i = 0
MOV r1,#0 //move literal 0 into register r1 (r1 is i)
LDA r2,X //this loads pointer register r2 with the
           //address of the array/table of numbers
// REPEAT
// Read number xi
Next LDR r3,[r2] //load register r3 with the number
           //pointed at by register r2
MUL r3,r3,r3 //square the value read
// Sum = Sum + xi2 + 3
ADD r0,r0,r3 //add this to the running total sum
ADD r2,r2,#4 //increment the pointer register
ADD r0,r0,#1 //increment the counter
// i = i + 1
CMP r0,#20 //test for end of series
// UNTIL i = 20
BNE Next //repeat until all done
```

Examiners' comments

This question was not well attempted. Candidates did not show a good understanding of low level languages. Those who attempted this question were unable to produce pseudocode. Some candidates used a high level language to write the pseudocode. Candidates should be able to write brief statements in a low level language.

A2

Answer pointers

The purpose of this question is to test the student's appreciation of a computer's specification and the significance of parameters.

1. Type Personal computer
Personal computer indicated the class of machine (i.e., not tablet and not workstation)
2. Form Factor Mini tower
The form factor gives the general shape of the computer. A mini tower has a tower-like structure and fits on or under a desk. It is contrasted with the box shape (used on-desk) and the full tower (used for more professional and demanding operations).
3. Processor 1 x Intel Core i5 (3rd Gen) 3.2 GHz (Quad-Core)
The processor defines the CPU and, to some extent, the processor's ultimate computational power. It defines the manufacturer, part number (Core i5) which lets you look up the specifications, the clock rate, and indicates that it is a multiprocessor with four cores/CPU's
4. Cache Memory 6 MB L3 Cache
This indicates the amount of Level 3 cache memory used to store frequently accessed data. The more cache the better (up to a point).
5. RAM 4 GB (installed) / 8 GB (max) - DDR3 SDRAM
The RAM defines the size of the main memory composed of DRAM. This is 4GB which is at the low end for high-performance PCs today. The maximum that can be installed is 8 GB (if you buy another 4GB at a later date).
6. Storage Controller SATA
This defines the hardware and software interface to the disk drives. SATA is a modern high speed serial interface.
7. Hard Drive 1 TB - SATA-300
This indicates that there is a 1 TB hard drive. 1 TB is 1,000 GB and represents a reasonably large amount of storage.
8. Optical Storage DVD±RW
The optical storage drive can read or write optical media. In this case, it can both read and write to CD and DVDs (but not Blu-ray)
9. Monitor 22" LCD with DVI input
The monitor is a modern non-CRT liquid crystal display. The size is 22 inches diagonally. The DVI indicates digital video which is more modern (faster) than earlier systems.

10. Graphics Controller PCIe x16
This indicates the slot (or actual device) of a graphics controller card. PCIe indicates a modern PCI express bus interface and the x16 indicates that it has 16 parallel high-speed data paths.
11. Video Memory 1 GB
The 1GB indicates the amount of memory on the video display card. By being on the display card, it does not have to be shared with the CPU.
12. Audio Output Integrated - 5.1 channel surround
This describes the external audio interface. The 5.1 indicates that surround sound (front and back speakers) can be used. Integrated indicates that the electronic interface is on the motherboard rather than being a separate plug-in card.
13. Networking Gigabit LAN, 802.11b, 802.11g, 802.11n
Networking describes the computers external interface to the web and other computers/peripherals. In this case Ethernet is provides capable of operating at 1GBs. The three 802.11 figures describe three WiFi specifications and indicate that the system can operate with devices conforming to these standards.
14. USB 2 x USB 2.0, 3 x USB 3.0
USB is the serial bus interface. This indicates that there are two USB 2 ports and three of the newer and much faster USB 3 ports.
15. Power AC 120/230V (50/60 Hz), 1W standby, 47W idle, 225W active
Power indicates the processors power requirements. In this case the computer will operate from 120 to 230 volts (which covers the USA, Europe, and much of Asia), and 50/60 Hz indicates the power line frequency (typically 60 Hz in the USA/Asia and 50Hz in Europe).

The three power values indicate power when on standby (asleep but not off). Idle (not performing significant computation) and active (performing a task such as playing multimedia).

Examiners' comments

Candidates were required to 'define' and 'explain' each of the terms. Many answers did not provide suitable details of the terms. Candidates were not able to clearly show an understanding of the terms. Candidates should have paid careful attention of the values quoted and explained their significance.

A3

Answer pointers

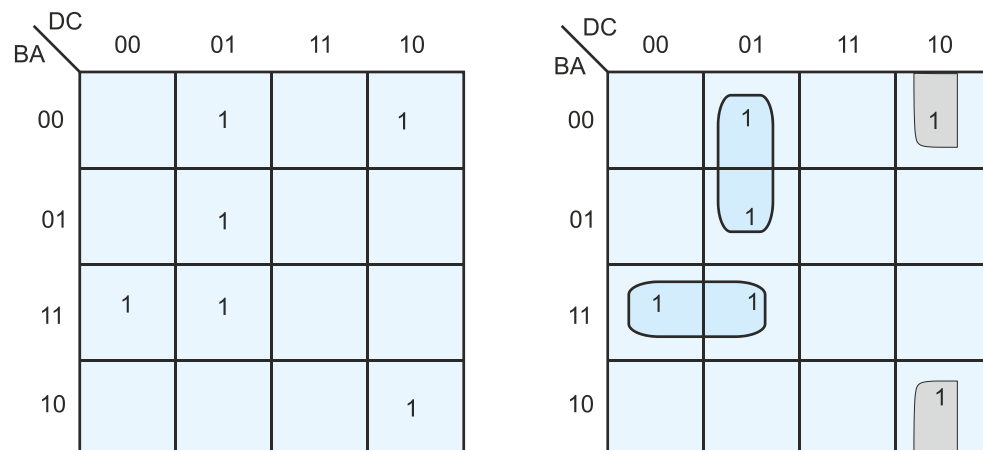
a) The truth table

D	C	B	A	Number	Comment	Output F
0	0	0	0	0		0
0	0	0	1	1		0
0	0	1	0	2		0
0	0	1	1	3	3 to 5	1
0	1	0	0	4	3 to 5	1
0	1	0	1	5	3 to 5	1
0	1	1	0	6		0
0	1	1	1	7	7 to 8	1
1	0	0	0	8	7 to 8	1
1	0	0	1	9		0
1	0	1	0	10	10	1
1	0	1	1	11		0
1	1	0	0	12		0
1	1	0	1	13		0
1	1	1	0	14		0
1	1	1	1	15		0

b) the Boolean function is obtained by adding (ORing) the 1 terms. **Note that the postfix operator ! indicates NOT as in NOT A = A!**

$$F = D!.C!.B.A + D!.C.B!.A! + D!.C.B!.A + D!.C.B.A + D.C!.B!.A! + D.C!.B.A!$$

c) the simplified Boolean function can be obtained by plotting the terms on a Karnaugh map and regrouping them.

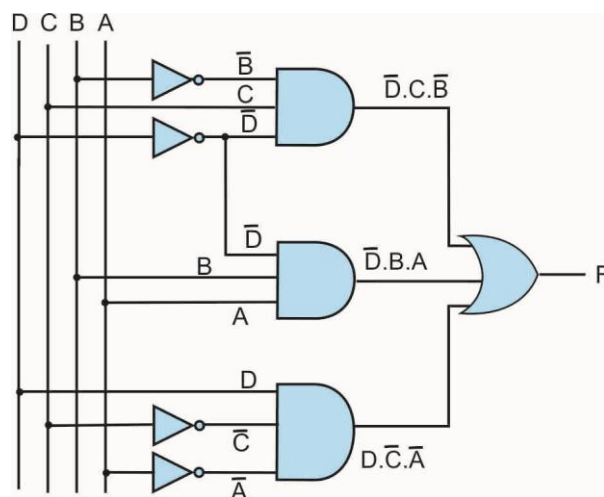


The simplified function is $F = D!.C.B! + D!.B.A + D.C!.A!$

DC \ BA	00	01	11	10
00	x	1		1
01	x	1		
11	1	1		
10	x			1

DC \ BA	00	01	11	10
00	x	1		1
01	x	1		
11	1	1		
10	x			1

d) The circuit is:



e) If we plot the impossible conditions as Xs, they can be used to create larger groups to obtain the simplified expression

$$F = D\bar{B} + D\bar{A} + CA$$

Examiners' comments

This question was well answered. Candidates showed a good understanding of this topic with the exception of part e) which was poorly attempted.

A4

Answer pointers

An operating system is a layer of software that stands between the machine's hardware and its application level software. The purpose of an operating system is two-fold. It provides a user interface (today the term 'user interface' frequently indicates a graphical environment – graphical user interface – GUI - like Windows, although text or command line interfaces are possible). Second, the operating system provides a set of functions to control the system hardware such as input/output, storage, and communications.

An operating system's GUI is often simple and intuitive and reduces the learning curve experienced by new or non-expert users. Some commands that would require the knowledge of a complex syntax in a text command line interface can be done by simply clicking a mouse or tapping the screen in a GUI.

First-generation operating systems ran on main-frame computers and used punched to control the sequencing of programs or jobs (the user would have to specify where individual compilers or assemblers were).

Later operating systems provided more sophisticated support such as handling errors and recovering from errors (and providing libraries of functions). Real-time operating systems were developed for process control where sequencing and timing was important. Time-sharing operating systems were developed to control computers remotely (via teletype).

The development of the personal computer, cheap I/O devices, the Internet led to the development of operating systems with GUIs such as Windows and its unix/linux equivalents.

A key function of most operating systems is memory management. This is a technique that maps logical addresses from the computer onto physical addresses in memory. It frees the programmer from having to know where programs are to be located. Physical DRAM memory is automatically managed – programs and data are swapped between DRAM and disk automatically. Protection mechanisms ensure that one program cannot corrupt another program or that a user cannot access the operating system.

The operating system can also manage extended storage including disks, optical storage, remote storage, and even cloud storage. All this can be made transparent to the user.

The range and scope of operating systems has expanded since their introduction. Even digital cameras now have an operating system (although most users are not aware that the controls of their cameras are really operating system inputs).

Operating systems are used on non-PC computers such as games consoles, cell phones, and tablets. These have carried the GUI concept even further and rely on touch, voice input, and even gestures and facial expressions to control a system.

In the realm of the PC, operating systems are incorporating more and more system functions that were not originally associated with the operating system; for example, Internet browsers, network security and malware detection.

Examiners' comments

This was a popular question. Most candidates were able to provide good answers. Some candidates did not pay attention to each section of the question and merely wrote generic answers. Answers could have been improved through relevant examples/illustrations of suitable operating systems.

Section B

B5

Answer pointers

- a) Temporary memory storage – memory which does not store data/information permanently; also known as Random Access Memory (RAM); essential in a computer system to perform a range of tasks; Size of RAM is important and getting larger as applications and computer processes require more storage; e.g. 8 GB RAM.
- b) Permanent disk storage – required so that all applications and data are permanently stored on the computer system; does not lose its contents when the computer is switched off; examples include hard disk, CD, DVD; essential storage since computer systems will not function properly unless all software and data are fully available; size of permanent disk storage is also increasing due to complex applications available.

Examiners' comments

Candidates showed a good understanding of computer storage. They were able to explain the difference between temporary and permanent storage. Good answers included various features such as capacity and uses.

B6

Answer pointers

- a) Bluetooth uses special radio frequency to transmit data wirelessly. It is used to connect a range of devices such as mobile phones, laptops and other similar devices. The main issues with Bluetooth are distance and that it does not require any cables.
- b) WiFi is based on wireless technology or 802.11 and is used to connect computers and other devices such as printers. WiFi technology has become very popular and is increasingly used to connect devices across offices and other WiFi hotspots.

Examiners' comments

This was a popular question. Some candidates were able to score maximum marks in this question. Most candidates showed a reasonable understanding of Bluetooth, its functioning and operation.

B7

Answer pointers

- a) Desktop computers have become 'general purpose'; specs of these computers are suitable for a range of uses in the office as well as at home; high memory and hard disk available on these computers
- b) Laptops – have become very popular; suitable for 'working anywhere'; high specs for a range of uses; Wifi
- c) Tablets – smaller than laptops; have become very popular for accessing the internet via Wifi facility; use for social media such as Facebook; also used for online shopping

Examiners' comments

The purpose of this question was to test candidates' knowledge of how computers have developed. Overall, some good answers were produced. Some candidates confused a laptop with a tablet. Candidates should have stressed that the latter has limited processing and storage capacity.

B8

Answer pointers

- a) I/O management – OS handles input as well as output devices; provides interface between the computer and input devices; provide various controls when CPU transfers information to output devices.
- b) Device driver – utility software needed to enable the computer to interact with various devices; example provided - to successfully use a printer, the manufacturer provided a device driver which is installed on the computer; the driver provides facilities to configure the device for effective use.
- c) A router is a device used in computer networks to 'route' data to its correct destination. This is done via a routing table. A router is an intelligent device compared to a switch. There are different types of routers such a Cisco router. Routers are also used for wireless networking.

Examiners' comments

Candidates showed a good understanding of these topics. They were able to cover suitable issues around these key computing and networking topics. Answers on 'routers' and how these are used were particularly good.

B9

Answer pointers

- a) HDMI monitor – HDMI standard is a set of guidelines for creating high bandwidth connections between digital devices. HDMI ensures all data being transferred between devices are more accurate and of high resolution.
- b) Ink jet printer – produces 'hard copy' output using ink; the technology has developed over the past few years and now produces excellent quality output; expensive to run and maintain.
- c) Data projector – widely used to produce output from a computer to an 'audience'; quality of output is the same as a VDU; used for presentations; is increasing in popularity as costs of the device decrease.
- d) Scanner – used to read images using optical recognition technology. Images are then converted into data items and stored on the computer. There are different types of scanners such as flatbed and handheld ones.

Examiners' comments

This question was well attempted. Candidates were able to cover a range of issues on these devices. Weaker answers did not include how these devices are used in an IT environment.

B10

Answer pointers

- a) Fingerprint reader - This is a device which is used to read a user's finger prints via biometric technology. The finger print patterns of a user are scanned and stored in a computer system. When accessing the system, the fingerprint reader will detect a user's finger prints and match these against those already stored.
- b) Cookie - A cookie is used to store data about a web application. The cookie allows the tracking of sites that have been accessed by the user. This can allow for building a history of websites visited.
- c) Access Control List (ACL) operates at server level to ensure that certain activities from users and websites can be restricted on a computer system. Accordingly, unauthorized access can be stopped. The ACL can be configured and changed as needed to stop and allow access to the computer system.
- d) Pop-up blocker - utility software which is to stop any unwanted 'pop up' applications. The pop-up blocker should be properly installed on the device and active. It is usually available in the anti-virus software of the firewall.

Examiners' comments

Some candidates were able to score 12 marks for this question. Candidates showed good understanding of these malware related techniques. Good answers also included relevant uses of these.

B11

- a) Wireless technology operates on the principle that cable (wired) connection is not required. A wireless network usually consists of a wireless router. Devices such as laptops, printers and smartphones have in-built wireless cards. Common technologies are 802.11. Through 'wireless signals, devices used the wireless technologies to connect to the router.
- b) Typical uses include connection of PCs, laptops, printers, smartphones. Wireless hotspots are also available to enable connection.

Examiners' comments

Most candidates were able to describe wireless technology. Good answers included how wireless technology functions. Weaker answers did not include suitable uses.

B12

Answer pointers

The four layers of the TCP/IP are:

- 1) Layer 4 – Application
This layer is responsible for all the applications that use network services. These include web browsers, web servers and mail servers and when a client requests services from servers; e.g. a browser requesting a page from a web server.
- 2) Layer 3 – Transport
This layer accepts all requests from the application layer and tries to organize the transport of those requests across the network. Files are broken down into segments. The transport layer is also responsible for determining the source and destination of the data.
- 3) Layer 2 – Internet
This layer is responsible for finding the best path for the data. Routers operate at this layer. Packets of data are processed at this layer.
- 4) Layer 1 - Network Interface
This layer (similar to the physical layer of the OSI model) is responsible for 'encoding' data received from the previous layer and converts these into bits. These travel through the media to reach the recipients.

Examiners' comments

Good answers covered the TCP/IP model in depth. Weaker answers only included some of the layers. Some candidates confused TCP/IP model with the ISO's OSI model. Candidates should be able to compare the 2 models and understand how these are related.