BCS HIGHER EDUCATION QUALIFICATIONS
Level 4 Certificate in IT

September 2012

EXAMINERS' REPORT

Computer & Network Technology

General comments on candidates' performance

Once again many candidates did not write sufficiently in-depth answers for 30 marks awarded for section A questions. Candidates attempted section B questions well.

A1

{please include question}

Indicative answer pointers

a) The optical storage device uses a disk (platter of plastic). This platter is removable (unlike HDDs) and therefore optical storage offers portability. Instead of a magnetic read/write head, a laser assembly is used to focus a beam of line on a surface (or layer) inside the disk. The recording medium uses "bumps" in the recording layer that change the reflectivity of the surface to determine whether the data is a 1 or 0. Optical storage is generally read-only (i.e., fabricated by the manufacturer). Read/write operation is possible by using a more powerful laser pulse to burn a hole in a dye layer or to change the optical properties of the reflecting layer (phase change operation).

   Unlike a magnetic disk, optical disk store data along a spiral rather than in one of many concentric tracks.

   Magnetic storage is the traditional secondary storage of computers, holding programs and data not currently in memory. Modern drives have capacities of up to 3 TB (3,000 GB).

   Optical storage is both slower (access time) than magnetic storage and has a lower capacity. The capacity of optical storage is determined by the technology (CD, DVD, Blu-ray) and number of recoding layers. This varies between about 600 MB (CD) and 128 GB (4-layer Blu-ray).

   Optical storage is used mainly to transport data – typically programs and movies. It can also be used to back up data. It cannot easily be used for read-write storage line HDDs.

   A diagram of each type of storage may be helpful to support the descriptions.

b) The reason that the demand for faster and faster memory continues is twofold. First, the speed of a computer is critically dependent on the speed of its memory. This is largely because the speed of main store, DRAM, has lagged behind that of processors. Over the years, the ratio of processor to memory speed has increased. Consequently, memory has to "catch up".

Second, the requirements of applications continue to increase. This is particularly true in computer graphics, games and multimedia. The need for real-time processing of high definition video has also increased the demand for high speed memory.

The need to load programs rapidly (and also reduce boot-up and shut-down times) has created a demand for faster secondary store. Since it is not possible to dramatically increase the speed of magnetic and optical storage devices, solid state drives (SSDs) have been introduced to partially replace hard disk drives (at the moment SSDs are relatively small – typically 256 GB).

Recent trends: optical storage and HDDs have not become very much faster over the years. However, their storage capacities have increased. DRAM has become faster with the change from DDR to DDR2, DDR3 and (soon) DDR4. Cache memories have increased in size and are normally part of the processor's silicon.

Examiners' comments

Most candidates were able to explain the basic principles of magnetic storage. Answers included a detailed coverage of the various types of optical storage. Part (b) was poorly answered. Candidates provided vague answers on why computer systems require more memory.

A2

{please include question}

Indicative answer pointers

a) A diagram of CISC architecture is required. Using the diagram, the program counter (PC) contains the address of the next instruction to be executed. This address is passed to the memory address register, MAR, where it is used to access memory.

The data element pointed at by the MAR (i.e., the instruction pointer from the PC) is read into the instruction register. This element is the op-code of the next instruction to be executed. The control unit reads the bits of the op-code and interprets it. That is, it generated the appropriate signals to cause the corresponding instruction to be executed or interpreted.

Suppose that an instruction is LOAD D0,1234 where 1234 is a memory location. The value 1234 (the address part of the instruction) is fed to the MAR where it is used to access memory to fetch the desired operand. That operand is loaded into the MBR and then copied to data register D0. If the instruction had been ADD D0,1234 (add the contents of memory location 1234) to register D0 and put the result in D0, the contents of 1234 would have been read as we described and the moved to port B of the ALU (arithmetic and logic unit). The contents of register D0 would be fed to the A port of the ALU and the op-code used to select the addition function. The result at the C output of the ALU would be clocked into the D0 register.

b) This problem may be attempted in many ways. It consists of a simple loop that accesses successive memory locations using indexed (or pointer based) addressing. Students may use any form of assembly language as long as they are able to construct a loop and use indexed addressing. In this level pseudo code, this is:

```
Initialize loop counter to 100
Initialise sum to 0
Initialize memory pointer
REPEAT
   Get element
   Point to next element
  Add element to sum
UNTIL all elements have been accessed
```

This can be coded as

```
        MOVE  #100,D0       ;load counter register with 100
        MOVE  #0,D1         ;clear sum in D1 by loading it with 0
        MOVE  array,A0      ;load pointer register A0
Loop    MOVE  (A0),D2       ;access the element pointed at by A0
        ADD   #1,A0         ;increment the pointer
        ADD   D2,D1         ;add new element to previous total
        SUB   #1,D0         ;decrement the counter in D0
        BNE   Loop          ;branch if not zero to Loop (i.e. repeat)
```

The two important aspects of this code are the sequences

1. SUB #1,D0 and BNE Loop that decrements a counter and branches back until the counter reaches zero
2. MOVE (A0),D2 and ADD #1,A0 that loads the memory element pointed at by address/pointer register A0 and ADD 1,A0 that increments the pointer to point at the next element.

Examiners' comments

This was the least popular question. Part a) was reasonably well answered. Candidates were able to produce derailed answers of the structure of a digital computer. Candidates were not able to produce satisfactory answers to part b) of the question. They were not able to cover assembly language instructions.

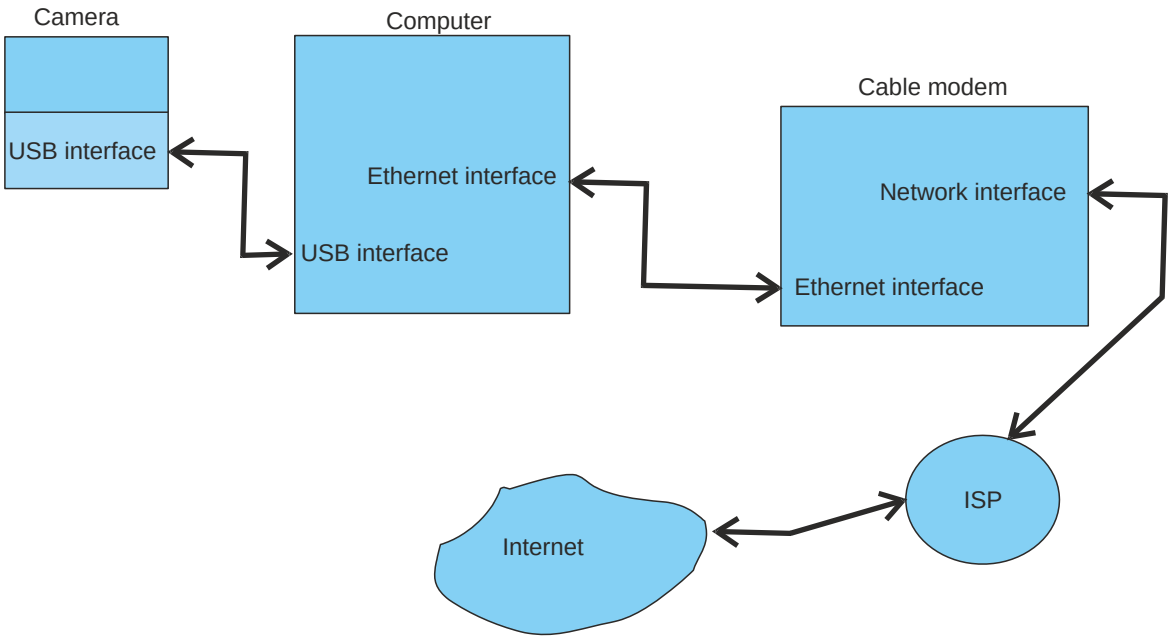
A3

{please include question}

Indicative answer pointers

a) The figure below shows one end of the connection. The camera is connected to the computer by the USB bus/WiFi. This bus is controlled by the computer's operating system acting as a client to the application (e.g., SKYPE). The host computer uses a communication program that converts the data to be transmitted into packets that are

transmitted to the network connection (cable modem or telephone modem) via, typically, an Ethernet link.



The modem connects the system to the ISP via either a telephone line of fibre optic link.

b) All data transmission systems are capable of losing or corrupting individual bits. There are two fundamental ways of dealing with this problem. The first is to use an error-detecting code. That is, the transmitted data is encoded so that an error can be detected; for example, a parity code adds a bit to make the total number of bits set to 1 even (or odd). If the source word is 11100011 the encoded word is 111000111 with the parity bit on the right. When this is received, the number of 1s is counted and an error assumed if it is an odd value. This is a primitive error-checking mechanism and works only when errors are highly unlikely and never occur in groups (because two errors can't be detected). Fortunately, there are very powerful error-detecting codes that can detect multiple errors in a word. When an error is detected at the receiver, a retransmission is requested (this is called ARQ or automatic retransmission request).

An alternative system is to encode the source so that a single error can be detected and corrected (e.g., the Hamming code). This technique does not require a retransmission and is called "forward error correction". Powerful error detecting and correcting codes exist and these can be used to correct multiple errors. Error correcting codes are used when there is no reverse channel or when the transmission path is long (e.g., deep space communications networks).

Examiners' comments

Most candidates understood how Wifi connection can be used to transfer. Good answers included a detailed coverage of various hardware and software needed. Part b) was poorly attempted. Candidates misunderstood what was required and provided a detailed explanation of the OSI ISO model.

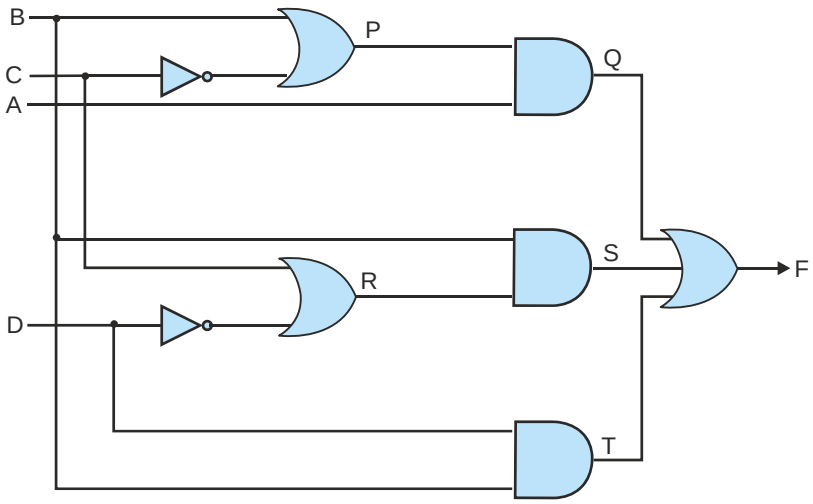
A4

{please include question}

Indicative answer pointers

A4

a) The following figure shows intermediate values



A	B	C	D	$P=B+\overline{C}$	$R=\overline{C}+\overline{D}$	Q=P.A	S=B.R	T=D.B	F=Q+S+T	
0	0	0	0	1	1	0	0	0	0	
0	0	0	1	1	0	0	0	0	0	
0	0	1	0	0	1	0	0	0	0	
0	0	1	1	0	1	0	0	0	0	
0	1	0	0	1	1	0	1	0	1	
0	1	0	1	1	0	0	0	1	1	
0	1	1	0	1	1	0	1	0	1	
0	1	1	1	1	1	0	1	1	1	
1	0	0	0	1	1	1	0	0	1	
1	0	0	1	1	0	1	0	0	1	
1	0	1	0	0	1	0	0	0	0	
1	0	1	1	0	1	0	0	0	0	

1	1	0	0	1	1	1	1	0	1	
1	1	0	1	1	0	1	0	1	1	
1	1	1	0	1	1	1	1	0	1	
1	1	1	1	1	1	1	1	1	1	

b) From the table

$F = \overline{A}.B.\overline{C}.\overline{D} + A.\overline{B}.C.D + A.B.\overline{C}.\overline{D} + A.B.C.D + \overline{A}.\overline{B}.C.\overline{D} + A.B.C.D + \overline{A}.B.C.\overline{D} + A.B.C.D + A.B.C.D + A.B.C.D$

Note that the rightmost terms have all possible combinations of C and D, therefore these four terms simplify to A.B

Similarly the leftmost four terms also have all combinations of C and D and simplify to $A.B$

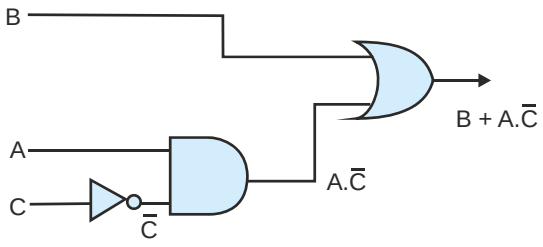
This leaves $\overline{A}.B + \overline{A}.\overline{B}.C.D + \overline{A}.B.\overline{C}.D + A.B$ Note $A.\overline{B} + A.B = B$

Therefore $F = B + \overline{A}.\overline{B}.\overline{C}.D + \overline{A}.\overline{B}.C.D = B + \overline{A}.\overline{C}.\overline{D} + A.C.D$

This simplifies to $F = B + \overline{A}.C$

A Karnaugh map could be used for the simplification.

c) The simplified circuit is



Examiners' comments

Few candidates were able to draw a correct truth table and fewer still included all the intermediate values of the truth table which were specially asked for. For those who developed the correct truth table, most were able to derive a simplified Boolean expression. Weaker answers did not include all the terms required. The circuit diagram was reasonably well drawn.

B5

{please include question}

Indicative answer pointers

a) An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.
b) IP conflicts tend to eventually work themselves out in DHCP environments because systems issue repeated requests for valid addresses. But since the process can take a while and doesn't always work as planned, one way to hasten a fix is by manually entering IPCONFIG /RELEASE and IPCONFIG /RENEW from a command prompt (restarting a system accomplishes the same thing but takes a lot longer).
c) Ipconfig is a command used to detect IP conflicts and can also be used to resolve these when devices on a network are not properly configured.

Examiners' comments

Good answers included a detailed coverage of IP address and its format. Weaker candidates simply mentioned what an IP address is. Candidates were not able to describe IP address conflicts. Few candidates were able to cover how IP address conflicts can be resolved.

B6

{please include question}

Indicative answer pointers

a) Simple book explanation; Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
b) Open Source OS e.g. Linux in contrast to proprietary OS e.g. MS Windows.

Examiners' comments

Answers were detailed and covered a range of functions. Some candidates also included illustrations via chosen operating systems. Most candidates were able to differentiate between open source and proprietary operating systems. Some candidates provided examples too.

B7

{please include question}

Indicative answer pointers

a) A hardware device or a computer's software that acts as a communication hub for users of a wireless device to connect to a wired LAN. APs are important for providing heightened wireless security and for extending the physical range of service a wireless user has access to.
b) Wi-Fi used in various devices such as laptops, mobile phones, printers, etc.

Examiners' comments

Candidates were able to explain what they understood about a WiFI access point. They used various examples to explain typical uses of WiFi. Overall, this question was well attempted.

B8

{please include question}

Indicative answer pointers

a) Graphical User Interface (GUI) provides a more user friendly interaction with a computer system. The GUI environment allows users to issue commands to the computer via icons and 'mouse clicks'. The GUI has made the use and operation of the computer more efficient

b) Mobile operating systems have changed the way users are able to access their computers, software and data. With an ever increasing use of various mobile devices (e.g. smartphones and tablets), mobile operating systems enable users to access and process data on their computers and associated servers from any location.

c) During the System Boot Process, the BIOS perform various tasks such as the initialisation of the power supply and internal self test. RAM is then accessed. The Power On Self Test (POST) is also performed.

Examiners' comments

This was the most popular question. Answers included good coverage of the key operating systems terms. Weaker candidates were not able to clearly explain system boot process. Candidates need to fully understand key techniques and processes in Computer and Network Technology.

B9

{please include question}

Indicative answer pointers

a) Device needed to ensure that the print services are properly dealt with in a computer system.

b) Simple explanation of how the laser printer produces output. This include the internal operation of the various part of the laser printer,

Examiners' comments

Candidates provided better answers describing the operation of a laser printer. Some answers included steps in producing output using a laser printer. Many candidates were unable to describe how a print server operates.

B10

{please include question}

Indicative answer pointers

These are typical malware which are seen as intrusive with the ever growing use of the internet. The virus usually requires user intervention to spread and infect other parts of the computer (since it needs execution). The worm on the other hand spreads itself automatically. The Trojan is a piece of software which 'invites the user' to run it. It usually conceals malicious programs called spyware. All three are threats to computer users and need to be stopped from 'entering' a computer.

Examiners' comments

Most candidates were able to explain the various threats. Examples were also given showing a detailed level of understanding. Some candidates attempted to provide protective measures too.

B11

{please include question}

Indicative answer pointers

Cloud computing relies on sharing computing resources rather than having local servers or personal devices to handle applications. The goal of cloud computing is to apply traditional supercomputing, or high-performance computing power, normally used by military and research facilities, to perform tens of trillions of computations per second, in consumer-oriented applications such as financial portfolios or even to deliver personalized information, or power immersive computer games. To do this, cloud computing network large groups of servers, usually those with low-cost consumer PC technology, with specialized connections to spread data-processing chores across them. This shared IT infrastructure contains large pools of systems that are linked together.

Examiners' comments

The topic of cloud computing is getting more popular and accordingly candidates were able to write reasonably good answers. Weaker candidates were unable to describe the benefits and problems associated with cloud computing.

B12

{please include question}

Indicative answer pointers

a) RAM known as the main memory of the computer but is volatile. It stores data that is being currently processed by the computer. RAM loses its content when the computer is switched off. RAM is essential in any computer since it allows it to operate effectively.

b) USB drive is commonly used and seen as a portable storage medium. It is classified as a plug and play device which can be used to back up and store large amount of data which need to be transported from one machine to the other.

c) Magnetic disk uses magnetic material to store data on a computer. The disk is made up of tracks and sectors. Data is stored on these in blocks. The disk has become popular medium of storage and has given rise to a range of applications.

d) The hard disk can hold large quantities of data. Today, maximum capacities per drive have reached 3Tbytes. Hard disks have a very low cost per byte. They are now reasonably compact (especially the new disks used in notebooks) However, they do require power to operate (the disk drive motor and the head actuator). They are non-volatile.

Examiners' comments

This question was well attempted by candidates. Answers included detailed descriptions of each term. Some candidates also provided suitable examples of how each of the devices is used.