NCC EDUCATION

**INTERNATIONAL DIPLOMA
IN
COMPUTER STUDIES**

**FUNDAMENTALS OF HARDWARE
AND
OPERATING SYSTEMS**

DECEMBER 2008 – LOCAL EXAMINATION

MARKING SCHEME

Markers are advised that many answers in Marking Schemes are **examples only** of what we might expect from candidates. Unless a question **specifically states** that an answer is demanded in a particular form, then an answer that is correct, factually or in practical terms, must be given the available marks.

If there is doubt as to the correctness of an answer the relevant NCC Education textbook should be the first authority.

This Marking Scheme has been prepared as a guide only to markers. This is **ABSOLUTELY NOT** a set of model answers; **NOR** is the Marking Scheme exclusive, for there will frequently be alternative responses which will provide a valid answer.

Notice to Markers

Where markers award half marks in any part of a question they should ensure that the <u>total</u> mark recorded for a question is rounded up to a whole mark.

Throughout the question, please credit any valid alternative point.

SECTION A
ANSWER ALL QUESTIONS IN THIS SECTION

Marks

QUESTION 1   4

Briefly describe any FOUR (4) major sub-components available inside a system unit.

Answer   *The major components of interest in a PC system are as follows:*

- *Power supply: the component in the system that converts the AC voltage from the commercial power outlet to the DC voltage required by the computer circuitry.*

- *System Board: The main component of a personal computer. It contains the major structures that make up a computer system.*

- *Disk Drives: The system's mass storage devices that hold data for an extended time, even when power is removed from the system. Disk drives include floppy drives, hard drives and CD-ROM drives.*

- *Adapter cards: Interface cards used to enhance the basic system with additional functions. Examples of common adapter cards include video display adapters, modems, and local area network (LAN) cards.*

- *Signal cables: connecting cables typically configured in a flat ribbon format that pass control signals and data between system components such as the disk drives and the system board.*

(1 mark each, max 4 marks)

QUESTION 2   4

Differentiate between the terms *RAM* and *ROM*.

Answer   *RAM – Random Access Memory, which is quick enough to operate directly with the microprocessor and can be read from and written to as often as desired. RAM is a volatile type of memory; its contents disappear when power is removed from the memory.*   **2**

ROM – Read Only Memory, which contains the computer's permanent startup programs. ROM is non-volatile; its contents remain with or without power being applied.   **2**

(2 marks each, max 4 marks)

QUESTIONS CONTINUE ON NEXT PAGE

QUESTION 3   4

Briefly describe the term *character framing*.

Answer   Character framing refers to the total number of bits used to transmit a character. This   **2**
includes the length of the coded character and the number and type of overhead bits
required for transmitting it. A common character-framing scheme calls for a start bit,
and a stop bit. An additional bit is often added to the frame for error-checking
purposes.

Although this character-framing technique is typical, it is not universal throughout the   **2**
industry. The problem here is one of device comprehension. The composition of the
character frame must be the same at both the sending and receiving ends of the
transmission.

QUESTION 4   4

Distinguish between *maskable* and *non-maskable interrupts* in a microcomputer.

Answer   • Maskable Interrupts (IRQS) – Interrupts request that the system microprocessor
can ignore under certain conditions.   **2**

• Non-Maskable Interrupts (NMI) – Serious interrupts to which the system
microprocessor must always respond. NMI conditions normally result in the system   **2**
being shut down.

QUESTION 5   4

Briefly describe the purpose of the *kernel* in operating systems.

Answer   The kernel is the foundation of the system.
It includes the basic memory and I/O management, task scheduling, error (exception)
handling, and program-execution-function.

QUESTION 6   4

Define the term *protocol* and give TWO (2) examples of a protocol.

Answer   A network protocol is a set of rules that governs how communications are conducted   **2**
across a network. These protocols operate at the Network and Transport layer of the
OSI model.

Any two examples, e.g.:
1) SMTP Simple Mail Transfer Protocol   **1**
2) FTP   File Transfer Protocol   **1**

QUESTIONS CONTINUE ON NEXT PAGE

QUESTION 7   4

Name and explain the operation of any TWO (2) *backup techniques* in a computer.

Answer   The backup operation falls into four categories. They are Full or total, Incremental, Daily, Differential (or modified-only), e.g.

*In a <u>full, or total, backup</u>, the entire contents of the designated disk are backed up.   2
This includes directory and subdirectory listings and their contents. This backup method requires the most time each day to perform but also requires the least time to restore the system after a failure. Only the most recent backup copy is required to restore the system.*

*In an <u>incremental backup</u> operation, the system backs up files that have been created   2
or changed since the last backup. Restoring the system from an incremental backup requires the use of the last full backup and each incremental backup made since then: this method requires the least amount of time to back up the system but the most amount of time to restore it.*

QUESTION 8   4

Explain the purpose of the *scandisk* and *defrag* command-line utilities.

*Answer   Scandisk – This hard disk-checking utility inspects the data on a specified disk for   2
error and corruption. It is used to find and possibly repair cluster chains that make up files that have become disconnected from each other.*

*Defrag - this disk drive utility organizes disjointed information on hard-disk drives into   2
more efficient patterns to speed up the access and read times associated with finding and reading data from the drive.*

QUESTION 9   4

Briefly explain the use of a *setup disk* and an *emergency repair disk* in a computer.

*Answer   Set up disks are the equivalent of the windows 9x startup disk, Windows NT 4.0   2
generate a three disk set, and windows 2000 creates a four-disk set. Unlike the windows 9x Startup disk, the setup disks do not bring the system to a command prompt. Instead they initiate the windows setup process.*

*Both windows NT 4.0 and windows 2000 provide for an emergency repair disk (ERD)   2
to be produced. The ERD is different from the setup disks in that it is intended for use with an operational system when it crashes. It is not a bootable disk and must be used with the Setup disks or windows distribution CD.*

QUESTION 10   **4**

Briefly explain how a *boot-sector virus* and a *file infector virus* infect a computer system.

Answer   *A boot – sector virus – this type of virus copies itself onto the boot sector of floppy and*   **2**
            hard disks. The virus replaces the disk original boot-sector code with its own code. The
            allows it to be loaded into memory before anything else is loaded, once in memory the
            virus can spread to other disks.

            A file infector – this type of virus adds its virus to executable files. After the file with   **2**
            the virus is executed it spreads to other executable files. A similar type of virus, called
            a macro virus, hides in the macro programs of word processing document files. These
            files can be designed to load when the document files.

                                                                        Total 40 Marks

QUESTIONS CONTINUE ON NEXT PAGE

SECTION B
ANSWER ANY TWO QUESTIONS

QUESTION 1   **Marks**
Throughout the question, please credit any valid alternative point.

A)   Describe the purpose of the *Small Computer Systems Interface (SCSI)* in a computer.   **3**

Answer   • *The SCSI is a specially designed interface that allows for a very high speed transfer*   **1**
                of data between disk drive and computer.

            • *This makes maintenance and repairs simpler to peripherals because the power to*   **1**
                the workstation does not have to be shut off.

            • *The original SCSI specification makes provisions for 8-bits parallel data transfers.*   **1**
                It can be used to connect a controller to a hard disk, CD-ROM, Scanner etc.

B)   Briefly describe the importance of the *USB* interface standard in a computer.   **4**

Answer   • *Universal Serial Bus (USB) provides a fast, flexible method of attaching up to 127*   **2**
                peripheral devices to the computer. The USB provides a connection format designed
                to replace the system's traditional serial and parallel port connections. USB
                Peripherals can be daisy-chained or networked together using connection hubs that
                enable the bus to branch out through additional port connections.

            • *The system provides a USB host connection that serves as the main USB*
                connection. USB devices can be added to or removed from the system while it is   **2**
                powered up and fully operational. This process is referred to as hot-swapping or hot-
                plugging the device. The Plug-and-Play capabilities of the system detect the
                presence (or absence) of the device and configure it for operation.

C)   Define the term *polling*.   **3**

Answer   • *In the polling method, the software periodically checks with the system's I/O devices*   **1**
                to determine whether any device is ready to conduct a data transfer.

            • *The programmed I/O method calls for the microprocessor to alert the desired*   **1**
                peripheral of an I/O operation by issuing its address to the address bus.

            • *The peripheral can delay the transfer by asserting its busy line.*   **1**

D)   How does *Direct Memory Access (DMA"* work and describe why is it useful.   **5**

Answer   • *Direct Memory Access operations are similar to interrupt-driven I/O operations,*   **2**
                except that the controller does not ask the system microprocessor to stop what it is
                doing to manage the I/O operation.

            • *Instead, the DMA controller asks the microprocessor to get out of the way so that it*   **3**
                can control the system and handle the I/O transfer. The DMA controller is a
                specialized microprocessor that can conduct the transfer much faster than the
                standard microprocessor can.

QUESTIONS CONTINUE ON NEXT PAGE

E)   Describe what a *RAID* is and briefly explain how *level 0 RAID* stores the information on a disk.   **5**

Answer
- *RAID is an acronym for Redundant Arrays of Independent Disks. Later usage of the term RAID exchanges the world independent for inexpensive. Five levels of RAID technology specifications are given by the RAID Advisory Board.*   **2**

- *The RAID Advisory Board designated the classic striped array just described as RAID level-o (RAID 0-Striped Disk Array without Fault Tolerance). These volumes are made up of disk space from multiple physical disks (up to 32 different disks in Windows). When data is written to a striped volume, it is broken into equal-sized pieces and distributed to the various drives (this process is actually faster than writing one large pieces to a single drive). However, as its name implies, striped Disk without Fault Tolerance, RAID 0 offers no protection from lost data if one of the drives fails.*   **3**

F)   Explain the operations of the Windows *Infrared Monitor* utility in a computer.   **5**

Answer
- *This utility is used to track the computer's activity.*   **1**
- *It alerts the user when infrared devices are within range of the computer*   **1**
- *It does this by placing the infrared icon on the task bar.*   **1**
- *It identifies how well it communicates with the infrared devices.*   **1**
- *It also reports the status of the infrared activity.*   **1**

G)   Describe the purpose of a *UPS* in a computer.   **5**

Answer
- *An uninterruptible power supply (UPS) is a special power-supply protection system that is designed to supply power to devices when a power failure occurs.*   **1**
- *It does this by monitoring the incoming commercial power supply and producing power for any device connected to it when it senses that the incoming power is missing or incorrect .*   **1**
- *The UPS system is connected to the commercial power supply and sits between the supply and the devices it is protecting.*   **1**
- *Computers connected to the UPS draw their power from outlets on the UPS.*   **1**
- *The UPS can communicate with the system it is protecting-typically through a serial interface cable.*   **1**

Total 30 Marks

QUESTIONS CONTINUE ON NEXT PAGE

Marks

QUESTION 2

<mark>Throughout the question, please credit any valid alternative point.</mark>

A) Explain the various factors that should be considered when measuring the performance of a **12** *HDD* in a computer.

Answer
- *Access Time – The average time, expressed in milliseconds, required to position the drive's R/W heads over a specified track/cylinder and reach a specified sector on the track.* **3**

- *Track seek time – The amount of time required for the drive's R/W heads to move between cylinders and settle over a particular track following the seek command being issued by the system.* **3**

- *Data transfer rate – The speed, expressed in megabytes per second (Mbps), at which data is transferred between the system and the drive.* **3**

- *Rotation speed – Different hard drives feature different rotational speed specifications. Generally, the faster the rotational speed of the disk (for example, 7200rpm versus 5400rpm), the faster the data transfer speed of the entire drive.* **3**

(1 mark for each factor, 2 marks for each explanation)

B) What is an *EDO DRAM?* **2**

Answer
- *Extended data out (EDO) memory increases the speed at which RAM operations are conducted by cutting out the 10 nanosecond wait time normally required between issuing memory addresses. It does so by not disabling the data bus pins between bus cycles.* **1**

- *EDO is an advanced type of fast page-mode (FPM) DRAM also referred to as hyper page mode DRAM. The advantage of EDO DRAM is apparent when multiple sequential memory accesses are performed.* **1**

QUESTIONS CONTINUE ON NEXT PAGE

C)   Describe the structure and operations *of star, bus, ring* and *mesh* LAN topologies.   **16**

Answer   *In the bus topology, the nodes, or stations, of the network connect to a central communication link. This was easy to see in older bus topology LANs that employed coaxial cable. In these networks, each node connected into a single linear cable that provided the bus line. This concept may not be as apparent in newer bus networks that use hubs and twisted wire cables.*   **4**

In a ring network configuration, the communication bus is formed into a closed loop. Each node inspects the information on the LAN as it passes by. A repeater, built into each ring LAN card, regenerates every message not directed to it and sends it to the next appointed node. The originating node eventually receives the message back and removes it from the ring. Ring topologies tend to offer very high data-transfer rates but require additional management overhead. If a node in a ring network fails, the entire network fails.   **4**

In a star topology, the logical layout of the network resembles the branches of a tree. All the nodes are connected in branches that eventually lead back to a central unit. Nodes communicate with each other through the central unit. The central station coordinates the network's activity by polling the nodes, one by one, to determine whether they have any information to transfer. If so, the central station gives that node a predetermined slice of time to transmit, if the message is longer than the time allotted, the transmissions are chopped into small packets of information that are transmitted over several polling cycles.

    4

The mesh topology design offers the most basic network connection scheme. In this design, each node has a direct physical connection to all the other nodes in the network. Although the overhead for connecting a mesh network topology together in a LAN environment is prohibitive, this topology is employed in two very large network environments: the public telephone system and the Internet.

(4 marks each, max 16 marks)

    4
    Total 30 Marks

QUESTIONS CONTINUE ON NEXT PAGE

QUESTION 3 **Marks**
Throughout the question, please credit any valid alternative point.

A)   List the FOUR (4) major problems that may be encountered whilst performing a clean   **4**
operating system installation.
Answer   *Insufficient hard drive or partition sizes.*
Memory speed Mismatches,
Insufficient memory problems
Incompatible device drivers
(1 mark each, max 4 marks)

B)   What is an *IP Subnet?*   **2**
Answer

*Subnets are created by masking of (hiding) the network address portion of the IP
address on the units within the subnets. This, in effect, limits the mobility of the data to
those nodes within the subnets because they can reconcile only addresses from within
their masked range.*

C)   Briefly explain the THREE (3) common reasons for creating a subnet.   **9**
Answer

To isolate one segment of the network from all the others   **1**
Suppose, for example, that a large organization has 1000 computers all of which are   **2**
*connected to the network. Without segmentation, data from all 1000 units would run
through every other network node. The effect of this would be that everyone else in the
network would have access to all the data on the network, and the operation of the
network would be slowed considerably by the uncontrolled traffic.*

To efficiently use IP addresses   **1**
Because the IP addressing scheme is defined as a 32 bit code, there are only a limited   **2**
*number of possible addresses. Although 126 networks with 17 million customers may
seem like a lot, in the scheme of a worldwide network system, that's not many addresses
to go around.*

To utilize a single IP address across physically divided locations   **1**
For example, subnetting a Class-C address between remotely located areas of a campus   **2**
*would permit half of the 255 possible addresses to be allocated to one campus location,
and the other half to be allocated to hosts at the second location. In this manner, both
locations can operate using a single Class-C address.*

D)   Explain the term "*Blue Screen Of Death (BSOD)*".   **3**

Answer

> *In the normal course of operation, Windows NT, Windows 2000, or Windows XP can encounter situations that cause it to stop and display a blue screen.*   **1**

> *Collectively, these errors are referred to as Stop errors; They basically occur whenever Windows NT/2000/XP operating systems detect a condition from which they cannot recover.*   **1**

> *The system stops responding, and a screen of information with a blue or black background appears. The stop errors are also known as Blue Screen errors or simply as the Blue screen of Death (BSOD).*   **1**

E)   Explain the purpose of the "*Power On Self Test*" *(POST)* in a computer system.   **12**

Answer

- *The power on self test is actually a series of tests that are performed each time the system is turned on. The different tests check the operation of the microprocessor, keyboard, video display, Floppy-and hard-disk drive units, as well as both the RAM and ROM memory units.*

- *When the system is first turned on or reset, the system applies a Reset Signal to the microprocessor and other intelligent system board components, causing them to clear most of their internal registers: However, the microprocessor sets its instruction pointer register to the address at the beginning of the ROM BIOS program.*

- *When the system is started up, the microprocessor must begin taking instructions from this ROM location to initialize the system for operation.*

- *The first instruction that the microprocessor executes causes it to jump to the POST routines where it verifies that the BIOS program is accurate and checks the systems installed RAM (including the system's CMOS RAM).*

- *During the memory tests, the POST displays a running memory count to show that it is testing and verifying the individual memory locations. Next the POST verifies the operation of the microprocessors registers and performs tests on the ROM BIOS chip.*

- *At this point, the program checks to determine whether the system is being started from an off condition or from some other state. When the system is started from an off condition a cold boot is being performed.*

(2 marks for each point, max 12 marks)

Total 30 Marks

END OF PAPER

Learning Outcomes Matrix

Section A	L/O 1	L/O 2	Page reference
Q1	4		26 FH
Q2	4		29 FH
Q3	4		122 FH
Q4		4	183 FH
Q5		4	27 OS
Q6	4		696 FH
Q7		4	186-187 OS
Q8		4	133 OS
Q9		4	294 OS
Q10	4		419 OS
Section B			
Q1 a)	3		244-245 FH
Q1 b)	4		124 FH
Q1 c)	3		182 FH
Q1 d)	5		185-186 FH
Q1 e)	5		257 FH
Q1 f)	5		277 FH
Q1 g)	5		279-280 FH
Q2 a)	12		301 FH
Q2 b)	2		508 FH
Q2 c)	16		673-674 FH
Q3 a)		4	256 OS
Q3 b)	2		492 OS
Q3 c)	9		492 OS
Q3 d)		3	403 OS
Q3 e)		12	272-273 OS
Total A	20	20	
Total B	71	19	
A + B	91	39	