NCC INTERNATIONAL DIPLOMA
IN
COMPUTER STUDIES

COMPUTER TECHNOLOGY

6th June 2004

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 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 should be a whole mark.

For each question enter ONE letter ONLY in your answer booklet.

Marks

QUESTION 1   1

Many businesses make use of transaction processing systems. At which level of a business are transaction processing systems used?

a) Strategic level   **c)** Operational level
b) Management level   **d)** Executive level

Answer   C

QUESTION 2   1

Which of the following makes use of a computer control system?

a) Payroll processing   **c)** Airline booking
b) Car engine management   **d)** Expert system

Answer   B

QUESTION 3   1

A group of jobs is set up to be run on a computer system one after another without further human intervention. What type of operating system is required for this?

a) On-line   **c)** Multiprogramming
b) Real-time   **d)** Batch

Answer   D

QUESTION 4   1

A file that stores records in chronological (time) order is likely to be a

a) Master file   **c)** Transaction file
b) Work file   **d)** Backup file

Answer   C

QUESTION 5   1

Which of the following types of file can be stored, updated and effectively accessed on magnetic tape?

a) Indexed sequential file   **c)** Random access file
b) Serial file   **d)** Inverted file

Answer   B

QUESTION 6   1

Which of these storage media makes use of optical technology?

a) DVD   **c)** Hard disk
b) Floppy disk   **d)** Flash memory

Answer   A

QUESTION 7   1

What is the smallest part of a disk that can be read in a single operation?

a) A track   **c)** A cylinder
b) A sector   **d)** A cluster

Answer   B

QUESTION 8   1
Still images used on web pages are often compressed using which of these standards?

a)   MP3   **c)**   MPEG
b)   JPEG   **d)**   AVI

Answer   B

QUESTION 9   1
How does multimedia differ from ordinary television?

a)   Multimedia requires an analogue connection to a computer   **c)**   Multimedia is interactive
b)   Multimedia cannot play feature films   **d)**   Multimedia requires storage media

Answer   C

QUESTION 10   1
The connection of a corporate network to the Internet poses certain problems. Which of these problems is most likely to be prevented by using a firewall?

a)   Virus infection   **c)**   Staff misuse of the Internet
b)   Trojan horses   **d)**   Hacking

Answer   D

SECTION A - 2
ANSWER ALL QUESTIONS FROM THIS SECTION
EACH QUESTION REQUIRES MORE THAN ONE RESPONSE

QUESTION 11   3
During the running of a program, all of the following actions may occur in the CPU:

a) Decoding an instruction
b) Comparing two values
c) Adding two numbers together

For each of these actions, state whether it occurs in (i) the arithmetic logic unit or (ii) the control unit.

Answer   a) ii, b) i, c) i
        1 mark each

QUESTION 12   3
List the following amounts of storage in order of increasing size, starting with the smallest and ending with the largest.

a) 1 Gigabyte
b) 1000 Megabytes
c) 2000 Megabytes
d) 2 Gigabytes

Answer   B, A, C, D
        2 in order=1 mark, 3 in order=2 marks, 4 in order=3 marks

QUESTION 13   4
Convert the denary number 108 into

a) Eight bit binary
b) BCD
c) Octal
d) Hexadecimal

Answer   a) 01101100 (must have all eight bits), b) 0001 0000 1000, c) 154, d) 6C
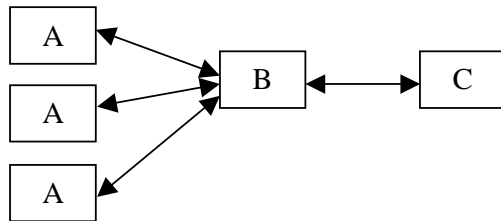   *1 mark each*

QUESTION 14 3

The following are all terms that relate to Internet communications. Match each term with the correct comment.
a) FTP
b) IP
c) DNS

i) Converts text based internet addresses to numerical addresses
ii) A protocol that governs the transfer of files
iii) The rules that control how packets of data are transmitted
iv) Rules that govern the sequence of transmission of data packets

Answer   a)ii
b)iii
c)i
1 mark each

QUESTION 15 3

The diagram shows the parts of a relational database system. Identify, by using the letters A, B and C,
- The DBMS
- The application
- The database

Answer   A=application
B=DBMS
C=database
1mark each – max 3 marks

QUESTION 16 3

The following are all technologies used in peripheral devices:
a) Liquid crystal
b) Electron gun
c) Light sensor

For each of these technologies, choose ONE peripheral device that makes use of it.

Answer   a)   screen / monitor / display panel
b)   screen / cathode ray tube
c)   scanner / digital camera / example of scientific or industrial sensor / bar code reader / OMR
reader / OCR reader / optical mouse
1 mark each – max 3 marks

QUESTION 17   **3**

The following are tasks that may be performed in an organisation:

a) The calculation of an optimum route for an airline pilot according to weather conditions.

b) The regulation of the flow of chemicals in an industrial manufacturing process.

c) The processing of a company's payroll.

For each task, identify which of the following types of IT system supports it by giving the correct number (i), (ii), (iii) or (iv).
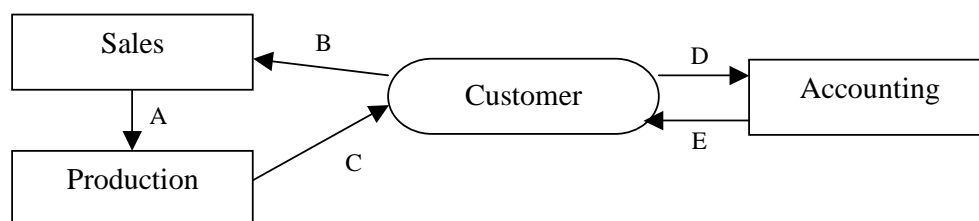
i)   Transaction processing system

ii) Control system

iii) Office automation system

iv) Decision support system.

Answer   a) iv, b) ii, c)i

1 mark each

QUESTION 18   **4**

A customer orders goods from a manufacturer. The flow diagram shows some of the relationships between the customer and the departments involved in the transaction.

The following are some of the items that are passed between the departments and the customer:

i)   Order

ii)   Invoice

iii)   Payment

iv)   Despatch instructions.

Indicate where each of these items occurs in the transaction process by matching them with the appropriate letter from the flow diagram.

Answer   i)   order – B

ii)   invoice - E

iii)   payment - D

iv)   despatch instructions – A

1 mark each

QUESTION 19   **3**

A bank offers the following services to its customers:

a) ATM cash points

b) On-line bill payment

c) Cheque processing

For each of these services, state the type of computer system that is best suited to processing it. Choose from:

(i)   Immediate

(ii) Convenient

(iii) Conversational

(iv) Non-urgent

(v)   Daily

Answer   a)iii, b)ii, c)v

1 mark each

QUESTION 20 **1**

The ASCII code for upper case (capital) A is 01000001. What letter is represented by 01001011?

Answer   K

Total 40 Marks

QUESTION 21   **Marks**

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

a)   i)   Distinguish between an operating system and an application.   **2**

   <u>OS</u>

   • *Software for controlling the computer*

   <u>Application</u>

   • *Software for solving user problems*

   1 mark each

   ii)   Distinguish between a job and a process.   **2**

   • *A job is a program plus its data, ready to run.*

   • *A process is an instance of a program (plus its data) <u>which is running</u>.*

   1 mark each

b)   i)   Explain what is meant by *multiprogramming*.   **1**

   The <u>apparently</u> simultaneous running of more than one program.

   ii)   State TWO objectives of a multiprogramming operating system.   **2**

   • *Minimise unused CPU time;*

   • *Reduce the incidence of peripheral-bound operations;*

   • *Minimise total elapsed time;*

   • *Prevent single programs from dominating the CPU.*

   Any two points, 1 mark each

c)   An airline booking system makes use of a real-time operating system.

   i)   Explain what is meant by a real-time operating system.   **2**

   • *An operating system that supports an immediate response to an output*

   • *Quickly enough to influence the (next) input*

   2 marks

   ii)   Explain why a real-time operating system is necessary in the airline booking system.   **2**

   • *Inputs are unpredictable*

   • *Many events may happen at the same time*

   • *Bookings have to be made on the result of current information*

   • *Files have to be updated immediately to prevent multiple bookings*

   Any 2 points, 1 mark each

d)   i)   Explain what is meant by *round robin* scheduling.   **2**

   • *Processes are put in a queue*

   • *Processes are run for a fixed length of time*

   • *Processes get equal amounts of time*

   • *Processes are put to the back of the queue after their allocated time*

   Any 2 points, 1 mark each

   ii)   Explain why round robin scheduling is a suitable strategy in an interactive multiprogramming   **2**
   system.

   • *With interactive systems, length of time required for a process is unpredictable*

   • *Therefore equal time slices are most likely to satisfy all users*

   • *No sense in allocating differential times based on job requirements*

   Any 2 points, 1 mark each

iii) Two programs A and B are running in a multiprogramming environment. Program A outputs much data to a printer. Program B produces very little output. Describe a suitable scheduling policy in this case, explaining your reasons. **2**
- *Program B should be given more processor time*
- *Program A gives up processor during output / Program B uses processor during output*
- *Output does not require processor involvement*

Any 2 points, 1 mark each

e) A large program is written which requires more RAM than is available. Explain how an operating system is able to allow such large programs to run in a limited amount of memory space. **3**
- *Program split into parts*
- *Parts are swapped in (and out) of memory as needed*
- *From disk*
- *Virtual memory*
- *Memory divided into partitions*
- *Paging*

Any 3 points, 1 mark each

Total 20 Marks

QUESTION 22   **Marks**

a)   Describe, with examples, the purpose of each of the following registers: **6**
Flags register, General purpose registers, Program counter register.
Flags register
- *Stores the outcome of an operation*
- *Such as overflow / division by zero / other correct occurrence*

General purpose register
- *Stores data currently being worked on*
- *Carries out arithmetic operations*
- *Such as addition etc*
- *Carries out comparisons*
- *Such as JNE 100 or other instruction that examines accumulator content*
- *Holds data in transit from input or to output*

Program counter
- *Holds next instruction*
- *To be fetched from memory*
- *Incremented after fetch*

Up to 2 marks per point to a maximum of 6 marks.

b)   i)   Describe the purpose of any **three named** lines found in a typical control bus.   **6**
- *Memory write: to send data to memory*
- *Memory read: to read data from memory*
- *I/O write: to send data to be output to a specific I/O port*
- *I/O read: to read data from a specific I/O port*
- *Transfer acknowledge: to confirm that the data signals have been transferred either on or off the data bus*
- *Bus request: when a component is requesting control of the system bus*
- *Bus grant: when control of the system bus has been granted to a component*
- *Interrupt request: to indicate that an interrupt is pending*
- *Interrupt acknowledge: to confirm that an interrupt has been acknowledged*
- *Clock: to synchronise operations*
- *Reset: initialises all the components*

1 mark each for three named bus lines, plus 1 mark each for a purpose described up to a maximum of 6 marks.

   ii)   Describe the purpose of the **address bus**.   **2**
- *Indicates the address in memory*
- *From which data is to be read*
- *Or to which data is to be written*

Any two points, 1 mark each

   iii) A computer has an address bus consisting of 16 lines. How many different addresses can be   **2**
accommodated by this bus? Express your answer in denary and show how you worked this out.
Total number = 2^{16}; 65536
2 marks

c)   Describe the differences between a distributed system and a client-server network.   **4**

<u>Distributed system</u>
- *Each office / area has its own linked computers*
- *All offices / areas linked together*
- *Services / processing occurs on many machines*
- *No centralisation of processing*

Any 2 points

<u>Client-server</u>
- *Server machine provides services*
- *Clients request services*
- *Centralised storage / processing of some tasks / communication links / peripheral access*

Any 2 points

Total 20 Marks

QUESTION 23

Throughout the question, please credit any valid alternative point.

a) i) Explain the difference between connectionless mode and connection mode when data is transmitted between two devices on a network.

     Connection mode
- *Dedicated channel set up between the devices*
- *Remains open as long as the transfer occurs*

     2 marks

     Connectionless mode
- *Data split into packets / units*
- *No specific pathway set up*
- *Data may travel by a variety of alternative routes*

     Any 2 points

4

ii) Give one example of a situation where connection mode data transfer is suitable.
- *Remote terminal access*
- *File transfer*
- *Long term remote access of processor by terminals*

     Any 1 point

1

b) i) Explain what is meant by a *data packet*.
- *An individual item of data*
- *Transmitted from one device to another on a network*

     2 marks

2

ii) State any THREE components of a data packet.
- *Source address*
- *Destination address*
- *Data*
- *Checksum*
- *Packet number*

     Any 3 points

3

c) i) An ethernet network can experience a poor performance as more workstations are attached to it. Explain why this can happen.
- *More workstations – more traffic*
- *More collisions*
- *More resends*

     3 marks

3

ii) Explain the purpose of a modem in a WAN.
- *To connect computer to phone line*
- *Convert analogue to digital signals*
- *Convert digital to analogue signals*

     any 2 points

2

iii) For some businesses, ISDN is a more economical method of connecting to a WAN than a leased line. Explain why ISDN can sometimes be a cheaper option.
- *ISDN is dialup*
- *Only charged when in use*
- *Appropriate when only intermittent access required*

     any 2 points

2

c)   Explain the differences between a hub and a switch in connecting devices to a network.   **3**

Hubs
- *Allow connection of multiple devices*
- *To single device*

Switches
- *Provide separate segment on each port*
- *Fewer collisions than hubs*
- *Faster performance*

any 3 points

Total 20 Marks

QUESTION 24   **Marks**

a)   i)   Explain what is meant by *floating point* storage.   **2**
- *Number*
- *Stored in two parts*
- *Mantissa / fractional part*
- *Exponent / power*

Any 2 points – 1 mark each

ii)   Explain why floating point storage can sometimes cause problems in the results produced by a   **2**
program.
- *Floating point numbers are not always stored exactly*
- *Rounding occurs*
- *Results may be approximations*
- *Successive approximations can lead to big errors*

Any 2 points – 1 mark each

iii)   Characters are stored in ASCII code using 7 bits. State how many different characters can potentially   **1**
be encoded in this system.
128 (2^7) (accept 127 as in student text book)

iv)   Explain why ASCII storage is being replaced by Unicode.   **2**
- *Too few characters in ASCII*
- *To code a wide variety of international characters*
- *Unicode is 16 bit code*
- *Can therefore code for more (2^{16} or 65536) characters*

Any 2 points – 1 mark each

b)   It is desirable that records in data files   **4**
- Take as little storage space as possible
- Are easy to access

Explain why these two requirements are often in conflict.
- *Reducing storage space implies variable length records*
- *No storage wasted in redundant characters*
- *Variable length records are difficult to search*
- *Because can't predict the location of a given record in a file*

Up to 4 marks for relevant points/explanation

c)   A list of numbers is searched using the binary search (chop) method. The numbers are: **3**

4,6,9,15,17,19,20,22,23,25,26,27,30,31

State, in order, the numbers that will be examined when searching for the value 6.
20,9,6
1 mark for each number in correct order

d) i) A hashing algorithm is used to store bank account records in a random access disk file. The account **3**
number is used to locate the disk address where the details are to be stored. Each disk address can
only store one record. The details of the following accounts are stored as follows:

Account number	Disk address
156456	456
465876	876
143765	765
765899	899
756456	457

The following new accounts are to be stored in order:
754456
564899
345123

State the addresses where these account details will be stored.
- *458*
- *900*
- *123*
1 Mark for each correct address

ii) Explain how a record will be deleted from a random access file. **3**
- *Record is marked as deleted*
- *In a boolean field in the record*
- *Can now be over-written*
Up to 3 marks for full explanation

Total 20 Marks

Question	Objective	Marks	Student book page ref
1	A3	1	10
2	A8	1	15
3	E2	1	116
4	F4	1	159
5	F4	1	160-166
6	C3	1	66
7	C3	1	60
8	I3	1	247
9	I1	1	243
10	H3	1	201, 234
11	B2	3	39
12	B3	3	44
13	F1	4	153
14	H2	3	222
15	F7	3	172
16	C1	3	73-76
17	A4	3	13
18	D1	4	101
19	D3	3	106
20	F1	1	154
Question 21			
(a)	B2, B3	6	42
(b) (i)	B2	6	48
(b) (ii) and (iii)	B2	4	49
(c)	B4	4	51
Question 22			
(a) (i)	E1	2	113
(a) (ii)	E1	2	116
(b) (i)	E4	1	117
(b) (ii)	E4	2	118
(c) (i)	E4	2	121
(c) (ii)	E5	2	121
(d) (i)	E4	2	128
(d) (ii)	E5	2	128
(d) (iii)	E4	2	128
(e)	E4	3	129
Question 23			
(a) (i)	F1	2	153
(a) (ii)	F1	2	153
(a) (iii)	F1	1	155
(a) (iv)	F1	2	155
(b)	F2, F4	4	157
(c)	F9	3	162
(d) (i)	F11	3	165
(d) (ii)	F11	3	165
Question 24			
(a) (i)	G1	4	196
(a) (ii)	G1	1	196
(b) (i) and (ii)	G2	5	199
(c) (i)	G3	3	204
(c) (ii)	G6	2	206
(c) (iii)	G5	2	206
(c) (iv)	G7	3	210-211