

**HIGHER CERTIFICATE IN SCIENCE IN COMPUTING
IN INFORMATION TECHNOLOGY – BN002 Year 2**

**BACHELOR OF SCIENCE IN COMPUTING
IN INFORMATION TECHNOLOGY – BN013 Year 2**

**BACHELOR OF SCIENCE (HONOURS)
IN COMPUTING – BN104 Year 2**

**Operating Systems (Client)
COMP H2028**

**Stage 2
Semester 1**

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**External Examiner(s): Mr. John Dunnion
Dr. Richard Studdert**

**Wednesday 16th January 2008
3.30pm – 5.30pm**

Instructions to candidates:

1. Question One in Section A is **COMPULSORY**.
2. Candidates should attempt **ALL** parts of Question One in Section A
3. Candidates should attempt **ONE** question from Section B, and **ONE** question from Section C
4. This paper is worth 100 marks.
5. Question One is worth 40 marks, and all other questions are worth 30 marks each.

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SECTION A: COMPULSORY QUESTION

Question 1: Answer ALL parts of this question (4 marks each part)

- a) Describe the sequence of steps required, (which does not involve re-installing the operating system), to re-install the *LILO boot loader* into the *MBR* on a *Mandriva Linux* operating system that no longer boots.

- b) With reference to memory management, consider a paging system with the *page table* stored in memory.
 - i. If a memory reference takes **200 ns**, how long does a paged memory reference take?
 - ii. Consider the addition of a *translation look-aside buffer (TLB)*. If **75%** of all page-table references are found in the *TLB*, and if finding a page-table entry in the *TLB* takes **zero time** (if the entry is there), what is the *effective access time (EAT)*?

- c) Briefly explain **two** mechanisms, by which different programs in a Linux operating system specify the log files to which they write. Give an example of **one** program in each case.

- d) List **two** possible rules of thumb when determining the *time quantum* in a *round robin* scheduling scheme.

- e) List **four** objectives of a good *process scheduling policy* for an operating system?

- f) Describe the difference between a *process* and a *thread*. What advantages do threads have over processes?

Question 1 is continued on the next page

- g) Why is it considered bad practice to log directly into a Linux GUI-based system as *root*? What command must an ordinary user type in a *terminal window*, in order to become *root*?
- h) Consider the situation where a user downloads the source-code tarball of an application they wish to install on their Linux system. The user has extracted, using the **tar** command, the files from the tarball into their home directory, and now wishes to install the application. List the steps that the user must type to *configure*, *compile* and *install* the software on their system. For each step, provide the command prompt symbol to indicate whether an ordinary user or root should type the command.
- i) With reference to the Linux Operating System, describe the **/etc/passwd** file under the following headings:
- What is its purpose?
 - What does it contain?
- j) Explain the relationship between *sectors* and *clusters*; and explain why files stored on disk are often fragmented.

(40 Marks Total)

SECTION B: ANSWER QUESTION 2 or QUESTION 3

Question 2

- a) Briefly explain the concept of a *Process Control Block (PCB)*, and how it is used in a *context change*.

(3 marks)

- b) (i) Explain the concept of a *kernel* in operating systems design.

(6 marks)

- (ii) Describe one advantage and one disadvantage of implementing an operating systems function as part of the kernel rather than as a user-mode function.

(4 marks)

- c) Describe, with the aid of a diagram, the *UNIX System V Release 4* Process State Model, indicating the transitions between states, and the reasons for those transitions.

(13 marks)

- d) Briefly explain why the *UNIX System V Release 4* operating system is not suitable for *real-time* processing

(4 marks)

(30 Marks Total)

Question 3

- a) In relation to memory management, explain the following terms:
logical address, physical address, process loading, swapping
(4 marks)
- b) Describe a simple method which allows memory to be addressed as a set of *pages* each containing a fixed number of *displacements*.
(4 marks)
- c) In relation to the methods of *simple-paging* and *simple segmentation*, distinguish between *pages*, *page-frames* and *segments*.
(6 marks)
- d) In relation to the method of *simple paging*, describe **three** tables used by the *memory manager* to keep track of processes and their associated pages.
(6 marks)
- e) (i) In relation to *virtual memory* based on paging, explain the constraints regarding storing the *page table* of every process in *real memory*.
(6 marks)
- (ii) In relation to *virtual memory* based on *paging*, briefly explain how the location of the *page table* of the currently running process is located.
(4 marks)

(30 Marks Total)

SECTION C: ANSWER QUESTION 4 or QUESTION 5

Question 4

a) Give a description of the *Filesystem Hierarchy Standard (FHS)* under the following headings:

- i. What is the FHS?
- ii. What are its advantages?
- iii. What is its purpose?
- iv. How is it achieved?
- v. Who is its target audience?

(10 marks)

b) Describe in detail the **two** independent categorisations of files in the *Filesystem Hierarchy Standard* under the following headings:

- i. What are the **two** categorisations?
- ii. Features
- iii. Rationale
- iv. Historical problem(s) overcome by the categorisations

Provide examples for each categorisation to illustrate your answer.

(8 marks)

c) According to the *Filesystem Hierarchy Standard*

- i. what is the purpose of the *root filesystem*?
- ii. What are the subdirectories, or symbolic links to subdirectories, which are required to exist in the *root directory*?

(8 marks)

d) Besides the root filesystem, what is the second major hierarchical section in an *FHS*-compliant filesystem?

(4 marks)

(30 Marks Total)

Question 5

a) Distinguish between *automatic* and *manual* booting in Linux. (2 marks)

b) List and describe the **six** distinct phases involved in bootstrapping a Linux Operating System.

(12 marks)

c) Briefly describe **six** tasks, which are generally performed by *start-up scripts* during the bootstrapping of a Linux Operating System

(6 marks)

d) (i) With reference to Linux, explain the concept of a *run-level*.

(2 marks)

(ii) How many *run-levels* are supported in Linux, and how many are actually defined?

(2 marks)

(iii) Describe each of the defined *run-levels*.

(6 marks)

(30 Marks Total)