

HIGHER CERTIFICATE IN SCIENCE IN COMPUTING IN INFORMATION TECHNOLOGY BN002

**Operating Systems (Client)
COMP H2028**

**Stage 2
Semester 1**

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**Thursday 18th January 2007
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) An operating system uses a 32-bit address system. Each 32-bit address is subdivided by allocating 19 bits to the *page number* and the remaining 13 bits to the *displacement*. What is the maximum number of pages available in such a system?
- 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) Describe the operation of the *Highest Response Ratio Next (HRRN)* scheduling algorithm.
- e) Explain the concept of a *link* in Linux. Distinguish between a *hard link* and a *symbolic link*.

Question 1 is continued on the next page

- f) Distinguish between a *process* and a *program* in an operating system.
- 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 following situation:
- A user creates a script file, called *myscript* in their home directory of a Linux system.
 - They try to run this script by changing to their home directory, and typing the script name at the \$ prompt in a terminal window, as follows:

\$ myscript

- But, the shell returns the error "*command not found*".
- They have correctly debugged the script, and have also set the correct executable permissions on the file.

What do they need to type in order to run it. Give a reason for your answer.

- i) With regard to Linux, what is the *cron* system?
- j) In relation to memory management, what is thrashing?

(40 Marks Total)

SECTION B: ANSWER ONE QUESTION

Question 2

- a) In relation to UNIX/Linux, explain the concept of the *Process Tree*. Your answer should make reference to the terms *PID*, *PPID* and *init*.

(4 marks)

- b) (i) In UNIX, describe the **six** tasks, which the Operating System performs, to deal with a `fork()` request issued by a process.

(6 marks)

- (ii) What are the **three** possible choices the kernel has, once those **six** tasks, referred to in **part (i)** above, are completed?

(3 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) Distinguish between *system processes* and *user processes* in UNIX. Describe what *modes* of operation in the Operating System are used by each.

(4 marks)

(30 Marks Total)

Question 3

- a) In relation to memory management, explain the following terms:
fragmentation, segmentation, page fault, resident set, working set.

(5 marks)

- b) Describe the method of *simple paging* under the following headings:

- (i) *Pages and page frames*
- (ii) *Implementation of simple paging*
- (iii) *Translation of a logical address to a physical address*

(9 marks)

- c) In relation to *virtual memory* based on paging, explain how the translation of a *virtual address* to a *physical address* is implemented, and how it differs from *simple paging*.

(4 marks)

- d) (i) Explain the term *page replacement*, and why it is needed.

(4 marks)

- (ii) Describe any **two** of the following page replacement algorithms: *Least Recently Used (LRU)*, *Not Recently Used (NRU)*, *First-In First-Out (FIFO)* and *Clock*.

(8 marks)

(30 Marks Total)

SECTION C: ANSWER ONE QUESTION

Question 4

- a) With reference to the Linux Operating System, describe the `/etc/passwd` and the `/etc/shadow` files under the following headings:
- What is their purpose?
- What do they contain?
- The differences between them.
- (6 marks)**
- b) How many fields are used on each line in both the `/etc/passwd` and the `/etc/shadow` files? Describe the purpose of the different fields in each case.
- (12 marks)**
- c) With reference to the Linux Operating System, describe the `/etc/group` file under the following headings:
- (i) What is its purpose?
- (ii) What does it contain?
- (3 marks)**
- d) Describe the steps involved in the procedure of adding a new user to a Linux system. Your answer should include a description of:
- (i) The steps required by the system
- (ii) The steps that establish a useful environment for the new user, and
- (iii) The steps need for the convenience of the administrator

(9 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)