INSTITUTE OF TECHNOLOGY BLANCHARDSTOWN

Year	Year 2
Semester	Semester 1 Winter 2010
Date of Examination	Thursday 14th January 2010
Time of Examination	3.30 – 5.30

Prog Code	Prog Title	Module Code
BN002	Higher Certificate in Science in Computing in Information Technology	COMP H2028
BN013	Bachelor of Science in Computing in Information Technology	COMP H2028
BN104	Bachelor of Science (Honours) in Computing	COMP H2028

Module Title	Operating Systems (Client)

Internal Examiner(s): *Dr. Kevin Farrell*

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

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 TWO questions from Section B.
4) This paper is worth 100 marks.
5) Question One is worth 40 marks, and all other questions are worth 30 marks each.

DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A: COMPULSORY QUESTION

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

(a) In relation to UNIX/Linux, what is *redirection*? What are *pipes*? Briefly explain how each are used.

(b) Briefly describe the *clock page-replacement algorithm* commonly used in memory management.

(c) In relation to Linux, briefly explain the concept of a *daemon* and the concept of a *run-level*. What, if any, is the relationship between them?

(d) In the context of UNIX, explain the letters *FHS*.

(e) Explain the concept of a *file link* in Linux. Distinguish between a *hard link* and a *symbolic link*.

(f) If the *page size* in a particular Operating System is **4K**, and the *virtual address space* is **4GB**, what is the maximum number of pages available? If each *page table* entry is **2 Bytes**, how much space is required for the whole page table?

(g) Briefly describe **four** tasks, which are generally performed by *start-up scripts* during the bootstrapping of a Linux Operation System.

(h) Distinguish between *user mode* and *kernel mode* in an Operating System.

(i) Distinguish between *soft real-time* Operating Systems and *hard real-time* Operating Systems. Give **one** example in each case of where such a type of real-time system is used.

(j) The following table contains data concerning **five** different processes when the *First-Come First-Served* scheduling algorithm is used (all processes are assumed to arrive at time 0 in the order Process #1, #2, #3, #4, #5)

Process #	Estimated Run Time	Waiting Time
1	2	0
2	60	2
3	1	62
4	3	63
4	3	63
5	50	66

Using the same data, compile a similar table for the *Shortest-Job First* scheduling algorithm. ***(End of Q.1 = 40 Marks Total)***

SECTION B: ANSWER ANY TWO QUESTIONS

Question 2: (30 marks total)

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

(4 marks)

(Question 2 = 30 marks total)

Question 3: (30 marks total)

(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 *virtual memory* based on *paging*, explain:

(i) the constraints regarding storing the *page table* of every process in *real memory*.
(ii) how the location of the *page table* of the currently running process is located.

(12 marks)

(d) Explain the terms *Translation Look-aside Buffer* and *Associative Mapping*

(4 marks)

(e) 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 **10 ns** (if the entry is there), what is the *Effective Access Time (EAT)*?

(6 marks)

(Question 3 = 30 marks total)

Question 4: (30 marks total)

(a) A Linux user wishes to install the *gnuplot* program from source-code. She downloads the source-code, *tarball*, **gnuplot.tar.gz**, and uncompresses it. Provide the commands that the user must now type to:

(i) *Extract* the *tarball*
(ii) *Configure* the source-code on their system
(iii) *Compile* the source-code on their system
(iv) *Install* the resulting program on their system

For each step provide the command prompt to indicate whether an **ordinary user** or **root** should type the command.

(8 marks)

(b) With reference to the Linux operating system, describe the **/etc/passwd** and the **/etc/shadow/** files under the following headings:

(i) Their purpose
(ii) The type of information they contain
(iii) The differences between them

(6 marks)

(c) 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)

(d) Consider the situation of a Linux System Administrator who has forgotten the *root* password. Propose a solution to this problem.

(4 marks)

(Question 4 = 30 marks total)