INSTITUTE OF TECHNOLOGY BLANCHARDSTOWN

Year	Year 2
Semester	Semester 1
Date of Examination	Autumn 2012
Time of Examination	Tuesday 21st August 2012 1.00pm – 3.00pm

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

Module Title	Operating Systems (Client)

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

External Examiner(s): **Dr. Richard Studdert**

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 for each part)*

a) In Linux, explain the purpose of the `mkfs` command.

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

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) In Linux, distinguish between the *ext2* filesystem and the *ext3* filesystem.

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

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

Question 1 is continued on the next page

g) The output below is obtained from a real Linux system using the command indicated. Identify *Primary Partition(s)* (if any) and *Logical Partition(s)* (if any).

```
[root@feynman ~]# fdisk -l /dev/sdd

Disk /dev/sdd: 500.1 GB, 500107862016 bytes
255 heads, 63 sectors/track, 60801 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00062d08

   Device Boot      Start         End      Blocks   Id  System
/dev/sdd1   *           1       38349   308037318+   7  HPFS/NTFS
/dev/sdd2           38350       60801   180345690    5  Extended
/dev/sdd5           38350       60801   180345658+  83  Linux
```

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

i) In relation to *parallel operating systems*, what do the letters *COTS* stand for?

j) In Linux, explain the letters, *GRUB.*

(40 Marks Total)

SECTION B: ANSWER QUESTION 2 or QUESTION 3

Question 2

a) Explain the concept of *multiprogramming*. By comparing the execution time of *N* processes in a *uni-programming* versus a *multiprogramming* system, show, using a mathematical argument **or** diagrams, how *multiprogramming* increases system efficiency.

(12 marks)

b) Explain the following terms with regard to Process Management: *ageing, time quantum, thread, context switch.*

(4 marks)

c) (i) Describe the *First-Come First-Served* scheduling algorithm by addressing the following questions:

- Is it Pre-emptive or Non-pre-emptive?
- What are the uses of this algorithm?
- What are the disadvantages of this algorithm?

(3 marks)

(ii) 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
5	50	66

Using the same data, compile a corresponding table for the *Shortest Job First* scheduling algorithm.

(5 marks)

(iii) Using the *average waiting time* as a metric for comparing the efficiency of the two scheduling algorithms in part **(c)(ii)** above, which algorithm is more efficient? Give reasons for your answer.

(6 marks)

(30 Marks Total)

Question 3

a) (i) In relation to memory management, describe, in detail, the methods of *simple paging* and *simple segmentation*.

(10 marks)

(ii) Explain the allocation problems associated with simple segmentation, and how these might be addressed.

(4 marks)

b) In relation to virtual memory using simple paging, explain the concept of the *working set model*. Your answer should refer to the terms: *locality of reference, working set window, working set, resident set.*

(8 marks)

c) Explain the terms: *Translation Look-aside Buffer* and *Associative Mapping*.

(4 marks)

d) 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)*?

(4 marks)

(30 Marks Total)

SECTION C: ANSWER QUESTION 4 or QUESTION 5

Question 4

a) Briefly describe **three** common logging schemes employed by UNIX/Linux System Administrators. For each scheme, outline **one** advantage and **one** disadvantage.

(6 marks)

b) Briefly explain the **three** mechanisms, by which different programs in a Linux operating system specify the log files to which they write. Give an example of **one** program for one of these mechanisms.

(4 marks)

c) Discuss Linux kernel logging, under the following headings:

i. Boot-time Logging
ii. Ongoing Logging
iii. Message Duplication across Logfiles
iv. Console Management

(8 marks)

d) Describe the *syslog* system under the following headings:

i. What is it?
ii. Components
iii. Operation
iv. Configuration

(12 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) With reference to Linux:

(i) Explain the concept of a *run-level*.

(2 marks)

(ii) State 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)