Institute of Technology Blanchardstown
Institiúid Teicneolaíochta Baile Bhlainséir

INSTITUTE OF TECHNOLOGY BLANCHARDSTOWN

HIGHER CERTIFICATE IN SCIENCE IN COMPUTING IN INFORMATION TECHNOLOGY

BN002

Operating Systems (Server)

COMP H2014

Stage 2

Repeat

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

Wednesday 29th August
2007

1.00pm – 3.00pm

Instructions to candidates:

1) Question One in Section A is COMPULSORY. Candidates should attempt ALL parts of Question One in Section A and ANY other <u>two</u> questions in Section B.
2) This paper is worth 100 marks. 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 *(4 marks for each part)*

a) List two advantages and two disadvantages to using kernel threads.

b) With reference to the concept of a *Process Control Block*, briefly describe a programming method used for adding and removing processes from a *Scheduling* queue.

c) Describe the *First Readers-Writers Problem* of process synchronisation. Explain why a synchronisation solution is necessary, and outline any problems it may have.

d) Briefly describe the operating system structure of Linux, and the advantages of this design.

e) Explain the main difference between a *semaphore* and a *monitor*.

f) Give the code for the *"spin-lock"* definition of the **wait(*S*)** atomic operation on the semaphore, ***S***. Explain why this defintion of **wait*(S)*** is called a spin-lock.

Question 1 continued on next page...

g) Explain the following terms in relation to thread processing:

- Thread Pools
- Thread Specific Data

h) With regard to the *Network File System* (NFS), explain the terms *Magic Cookie* and *Stateless Mounting*.

i) Explain the letters *NIS*. Briefly describe its purpose.

j) Briefly describe how threads are implemented in Linux.

(40 Marks Total)

SECTION B: ANSWER ANY *TWO* QUESTIONS

Question 2

a) (i) Describe the *Bounded-Buffer Producer-Consumer Problem*, detailing why a synchronisation solution is necessary.

(4 marks)

(ii) Propose a *shared-memory* solution which does **not** use semaphores. Your answer should include *C* code fragments for the *shared data*, *producer process* and *consumer process*, with an explanation as to how it operates.

(8 marks)

(iii) Explain any inefficiencies your solution may have.

(2 marks)

b) Compare and contrast the methods of *Direct Communication* and *Indirect Communciation* used in *Inter-Process Communication*.

(6 marks)

c) (i) Give the definition of a *socket*. What does a socket consist of?

(2 marks)

(ii) Explain the concept of a Remote Procedure Call (RPC), and how it is implemented. Use a diagram to aid your answer.

(8 marks)

(30 Marks Total)

Question 3

a) With respect to the Linux operating system, describe the **six** all-round most important security issues to consider.

(6 marks)

b) Explain the concept of *Pluggable Authentication Modules (PAM)* in Linux, and the files which are involved in configuring them.

(10 marks)

c) Explain the concept of *setuid* Programs in Linux. What is the most secure way of preventing users from running *setuid* programs on a particular filesystem?

(10 marks)

d) Briefly describe **two** sources of security lapse which occur with computer systems, and their associated counter-measures.

(4 marks)

(30 Marks Total)

Question 4

a) Name and describe three common types of thread model in operating systems.

(9 marks)

b) Describe four benefits for using threads.

(8 marks)

c) Describe in detail the implementation of threads in the Solaris 2 operating system.

(13 marks)

(30 Marks Total)