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**UNIVERSITY REGULAR EXAMINATIONS**

**2013 /2014 ACADEMIC YEAR**

**2<sup>ND</sup> SEMESTER EXAMINATIONS**

**(MAIN EXAMINATION)**

**FOR THE CERTIFICATE IN INFORMATION TECHNOLOGY**

**COURSE CODE: ICT 720**

**COURSE TITLE: OPERATING SYSTEMS**

**Instructions**

Answer question **ONE** and any other **TWO** questions.

### Question 1

- a) Explain the difference between the following terms.
  - i. System call and software interrupt
  - ii. User thread and kernel thread
  - iii. Logical address and physical address (6 marks)
- b) Explain why it is difficult to protect a system in which users are allowed to do their own I/O? (6 marks)
- c) State any TWO advantages and any TWO disadvantages of placing functionality in a device controller, rather than in the kernel. (6 marks)
- d) List any FOUR services provided by an operating system. Explain how each provides convenience to the users. (6 marks)
- e) Identify and describe any FOUR techniques used for Interprocess communication (IPC) in Windows XP. (6 marks)

### Question 2

- a) Give the reasons why Solaris, Windows XP, and Linux implement multiple locking mechanisms. Describe the circumstances under which they use spinlocks, mutexes, semaphores, adaptive mutexes, and condition variables. In each case, explain why the mechanism is needed. (6 marks)
- b) Explain the concept of transaction atomicity. (4 marks)
- c) Describe the producer-consumer problem. Write a program to coordinate the producer and the consumer. (6 marks)
- d) Explain how critical sections and the principle of mutual exclusion are related to each other. (4 marks)

### Question 3

- a) Explain the differences in the degree to which the following scheduling algorithms discriminate in favour of short processes:
  - i. FCFS
  - ii. RR
  - iii. Multilevel feedback queues (6 marks)
- b) Define the difference between preemptive and nonpreemptive scheduling. State why strict nonpreemptive scheduling is unlikely to be used in a computer center. (4 marks)
- c) Describe the four conditions that must hold for a deadlock to become possible. (6 marks)
- d) Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Show that the system is deadlockfree. (4 marks)

#### Question 4

- a) Segmentation is similar to paging but uses variable-sized “pages.” Describe two segment-replacement algorithms based on FIFO and LRU page replacement schemes. (6 marks)
- b) Describe the actions taken by the operating system when a page fault occurs. (4 marks)
- c) Consider a system in which a program can be separated into two parts: code and data. The CPU knows whether it wants an instruction (instruction fetch) or data (data fetch or store). Therefore, two base–limit register pairs are provided: one for instructions and one for data. The instruction base–limit register pair is automatically read-only, so programs can be shared among different users. Discuss any TWO advantages of this scheme. (6 marks)
- d) Describe a mechanism by which one segment could belong to the address space of two different processes. (4 marks)

#### Question 5

- a) i) Explain how the indexed file allocation scheme operates. (6 marks)  
ii) Outline the access rights issues with regard to file sharing. (4 marks)
- b) Consider a system that supports the strategies of contiguous, linked, and indexed allocation. What criteria should be used in deciding which strategy is best utilized for a particular file? (6 marks)
- c) In some systems, a subdirectory can be read and written by an authorized user, just as ordinary files can be.
  - i. Describe the protection problems that could arise.
  - ii. Suggest a scheme for dealing with each of the protection problems you named in part i. (4 marks)