



UNIVERSITY EXAMINATIONS: 2013/2014
EXAMINATION FOR THE MASTER OF SCIENCE IN
DATA COMMUNICATIONS
MDC 6104 OPERATING SYSTEMS THEORY

DATE: AUGUST, 2014

TIME: 2 HOURS

INSTRUCTIONS: Answer Question One and Any Other Two Questions

QUESTION ONE: [20 Marks]

- (a) Contrast the scheduling policies you might use when trying to optimize a time-sharing system with those you would use to optimize a multi-programmed batch system.
- (b) The SJF scheduling policy sometimes employs an additional 'ageing' adjustment, which alters the priority of processes using the formula given below: -

$$\text{Priority} = \frac{\text{Estimated run time}}{1 + \frac{\text{wait time}}{k}}$$

Where: wait time is the time the process has been in the READY queue

K is a constant value of the order of 2. Investigate and comment on the effect of this formulae and the effect of value of k.

- (c) Describe how single buffering can improve the performance of the computer. Explain how double buffering can produce further improvement and in what circumstances multiple buffers would be advantages.
- (d) Describe how a file directory system can be organized into a tree structure and explain the advantage of such an arrangement.
- (e) At the moment, it appears that our computing systems are easy targets for penetration. Emulate the kinds of weakness that are prevalent in today's systems. Suggest how to correct them.

QUESTION TWO [15 MARKS]

- (a) In some system, a spawned process is destroyed automatically when its parent is destroyed; in other systems spawned processes proceed independently of their parents, and the destruction of a parent has no effect on its children. Discuss the advantages and disadvantages of each approach. Give an example of a situation in which destroying a parent should specifically not result in the destruction of its children.
- (b) When interrupts are disabled, on most types of devices they remain pending until they can be processed when interrupts are again enabled. No further interrupts are allowed. The functioning of the devices themselves is temporarily halted. But in real-time systems, the environment that generates the interrupts is often disassociated from the computer system. When interrupts are disabled on the computer system, the environment keeps on generating interrupts anyway. These interrupts are often lost. Discuss the consequences of lost interrupts. In a real-time system, is it better to lose occasional interrupts or to halt the system temporarily until interrupts are again enabled?
- (c) Some types of processes perform well under certain page replacement strategies and poorly under others. Discuss the possibility of implementing a storage manager that would dynamically determine the type of a process, and then select and use the appropriate page replacement strategy for that process.

QUESTION THREE [15 MARKS]

- (a) The interaction between the various components of an operating system is critical to achieving good performance. Discuss the interaction between the storage manager and the job initiator in a virtual storage multiprogramming system. In particular, suppose the storage manager uses a working set storage management approach.
- (b) Suppose a spooling system is susceptible to deadlock. As an operating system designer what features might you provide in this operating system to help an operator unwind spooling deadlocks without loss of work done so far by any of the deadlocked user process?
- (c) Many early spooling systems operated with a fixed amount of spooling space. Today's systems are more dynamic in that spooling space may be obtained by the OS while the system is executing. How does this help decrease the chance of deadlock? Such a system could still deadlock. How?

QUESTION FOUR [15 MARKS]

- (a) Suppose a given system allows for indefinite postponing of certain entities. How would you as a system designer provide a means for preventing indefinite postponement?
- (b) One of the attractions of virtual storage is that users no longer have to restrict the size of their programs to make them fit into limited real storage. Programming style becomes a freer form of expression. Discuss the effects of such a free programming style on performance in a multiprogramming virtual storage environment. List both positive and negative effects.
- (c) Give several reasons why simple password protection is the most common authentication scheme in use today. Discuss the weaknesses inherent in password protection schemes