



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**BSc. (Honors) in Information Technology
Third Year - Semester II Examination – January / February 2023**

COM 3306 – OPERATING SYSTEMS

Time: THREE (03) hours

- This paper contains **FIVE (05)** questions in **THREE (03)** pages.
- Answer **ALL** questions.

1. a) State differences between timesharing and multiprogramming systems. (04 marks)
 - b) Describe functionalities of Program Counter and Stack Pointer. (06 marks)
 - c) Distinguish between Monolithic architecture and Layered architecture in operating systems. (06 marks)
 - d) How do iOS and Android differ with respect to following properties?
 - i. Security and Encryption
 - ii. Availability and Fragmentation (04 marks)
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2. a) Why do computers need a BIOS? (04 marks)
 - b) Explain the use of having semaphores for making blocking system calls. (05 marks)
 - c) Briefly explain context switching concept in operating systems. (05 marks)
 - d) Describe how a multi-threaded application can be supported by a user-level thread package. It may be helpful to consider (and draw) the components of such a package, and the function they perform. (06 marks)

3. a) Consider a simple operating system where live processes are either running, ready to run, or blocked on an event, before they exit.
- State four conditions under which the operating system will try to schedule processes.
 - OS schedulers are said to be preemptive or non-preemptive. State the principal problem with non-preemptive schedulers. Explain how preemptive schedulers solve this problem.
 - Explain why preemptive schedulers are more complex to implement.
- (10 marks)
- b) Discuss the reasons why it is unwise to achieve mutual exclusion through busy waiting mechanisms.
- (03 marks)
- c) Briefly explain the advantages of keeping separate memory for addressing Input Output devices over Memory mapped Input Output.?
- (04 marks)
- d) Under which circumstances do external and internal fragmentation occur? How can each be handled?
- (03 marks)
4. a) What are the conditions that should be satisfied for a deadlock to occur? Explain how global numbering of resources is used in deadlock prevention.
- (04 marks)
- b) State the major disadvantage of the Banker's Algorithm.
- (04 marks)
- c) Assume that A, B, C and D are processes, and they are holding and waiting for multiple copies of resources R1, R2, R3 and R4. The current allocation of the resources is mentioned in table (a) and the resources that are immediately requested by the processes are mentioned under table (b). The existing and available vectors of each resource respectively are denoted by E and A. Specify all possible ways to safely allocate future requests in processes to avoid deadlocks.

Table Aa

Process	R1	R2	R3	R4
A	2		3	
B		1		2
C	1		1	
D				2

E = (3,3,4,4)

Table Bb

Process	R1	R2	R3	R4
A		1		2
B	3		2	
C		1	3	
D	3			

A = (0,2,0,2)

(08 marks)

- d) How does Direct Memory Access increase system concurrency? How does it complicate hardware design?

(04 marks)

5. a) Compare and contrast free memory management with bitmaps and linked lists

(04 marks)

- b) How does Virtual Memory deal with memory overload?

(04 marks)

- c) Explain the use of I- Nodes in file implementation.

(04 marks)

- d) Consider the page reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 3 with 4-page frames.

Find number of page faults using Least Recently used algorithm (LRU).

(08 marks)

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