



*(The University of Choice)*

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**UNIVERSITY EXAMINATIONS**

**MAIN CAMPUS**

**2022/2023 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER SPECICAL/SUPPLEMENTARY EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF COMPUTER SCIENCE**

**COURSE CODE: BCS 224**

COURSE TITLE: Operating Systems

**DATE: 11/04/2023**

**TIME: 8:00-10:00AM**

**INSTRUCTIONS TO CANDIDATES**

Answer questions ONE and any other TWO questions.

TIME: 2 Hours

**MMUST observes ZERO tolerance to examination cheating**

This Paper Consists of 3 Printed Pages. Please Turn Over. 

### QUESTION ONE (30 Marks) – COMPULSORY

- a) Explain interrupts and traps, and provide a detailed account of the procedure that an operating system handles an interrupt [4 marks]
- b) How does the distinction between *kernel* mode and *user* mode function as a basic form of protection (security) system? [4 marks]
- c) Describe four circumstances under which CPU scheduling decisions may take place [4 marks]
- d) Distinguish between system calls and system programs? [4 Marks]
- e) List and explain ANY TWO operating system structures [4Marks]
- f) Illustrate how race-condition can be prevented in concurrent processing [4 Marks]
- g) Distinguish the following terms
  - i) Critical sections and Race conditions [3 Marks]
  - ii) Process and thread [3 Marks]

### QUESTION 2 (20 MARKS)

- a) Compare programmed I/O with Direct Memory Access (DMA) I/O and show why DMA is a better technique for data transfer. [2 marks]
- b) Four jobs to be executed on a single processor system arrive at time 0 in the order of A, B, C, D. Their burst time requirements are 4, 1, 8, 1 time unit respectively. What is the average turn-around time using Shortest Job First [6 marks]
- c) A disk contains 200 cylinders numbered from 0 to 199). In order to move the read/write heads from one cylinder to the next, one time unit is required. Assume that the disk head starts at number 100. Six requests arrive in the following order:

23, 89, 132, 42, 187

Assuming that the rotational and transfer times are negligible and using the **First Come First Serve (FCFS)** and **Shortest-Seek-Time-First (SSTF)** scheduling policy:

- i) Draw a graph showing the order of satisfying these disk requests. [6 marks]
- ii) Determine the total time units required to for this operation. [6 marks]

### QUESTION 3 (20 MARKS)

- a) Describe the inter-Process Communication (IPC) [4 Marks]
- b) Explain how to use any algorithm to ensure mutual exclusion for a critical section [4 Marks]
- c) Suppose that a system is in safe state, show that it is possible for the processes to complete their execution without entering in deadlock state [4 Marks]

- d) Given process resource usage and availability as described in the following table, draw the resource allocation graph [8 Marks]

Process	Current Allocation		Outstanding Requests		Resource Available	
	R1	R2	R1	R2	R1	R2
P1	1	2	4	2	1	1
P2	0	1	1	2		
P3	1	0	1	3		
P4	2	0	3	2		

#### **QUESTION 4 (20 MARKS)**

Distinguish between the following file management system concepts:

- i) Full pathname and relative pathname [3 marks]
  - ii) Spanned and unspanned blocking [3 marks]
  - iii) Direct access and index access [3 marks]
- b) Describe problems that could occur if a system allowed a file system to be mounted simultaneously at more than one location. [5 marks]
- c) Consider a system that supports the strategies of contiguous, linked, and indexed allocation. Explain the **major** criteria that should be used in deciding which strategy is best utilized for a particular file. [6 marks]

#### **QUESTION 5 (20 MARKS)**

- a) Describe four circumstances under which CPU scheduling decisions may take place [4Marks]
- b) Clearly distinguish between the physical address space and the logical address space of a process [4 marks]
- c) On a system with 1 MB of memory using the buddy system, draw a diagram showing the allocation of memory after each of the following events: [12 Marks]
  - (1) Process A, request 55K, (2) Process B, request 160K, (3) Process C, request 70K, (4) Process D, request 60K, (5) Process E, request 60K
  - (6) Process D, exit (7) Process C, exit (8) Process E, exit (9) Process A, exit
  - (10) Process F, request 125K (10) Process F, request 125K (10) Process G, request 150

