



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**Faculty of Computing and Informatics**

<b>QUALIFICATION :</b> BACHELOR OF COMPUTER SCIENCE : SYSTEMS ADMINISTRATION, COMMUNICATION NETWORKS ; BACHELOR OF SOFTWARE DEVELOPMENT, BACHLOER OF GEO-INFORMTION TECHNOLOGY	
<b>QUALIFICATION CODE:</b> 80BSAN; 07BACS, 07BGEI	<b>LEVEL:</b> 6
<b>COURSE:</b> OPERATING SYSTEMS	<b>COURSE CODE:</b> OPS621S
<b>DATE:</b> NOVEMBER 2024	<b>SESSION:</b> 1
<b>DURATION:</b> 3 HOURS	<b>MARKS:</b> 80

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
<ol style="list-style-type: none"><li>1. Answer ALL the questions.</li><li>2. Read all the questions carefully before answering.</li><li>3. Number the answers clearly</li></ol>

THIS QUESTION PAPER CONSISTS OF 6 PAGES  
(Including this front page)

## SECTION A

[20 Marks]

Multiple Choice, Fill in question and True and False. Write the question number and the correct answer next to it.

1. Which of the following is NOT a function of an operating system?
  - a) Memory management
  - b) File management
  - c) Network management
  - d) Program compiling
2. Select the resource that is non-preemptive.
  - a) Printer
  - b) CPU CYCLE
  - c) File lock
  - d) RAM
3. Which type of operating system is designed to perform specific tasks or functions on dedicated hardware platforms?
  - a) Batch OS
  - b) Real time OS
  - c) Embedded OS
  - d) Multi-user OS
4. Which of the following characteristic defines sequential access storage media?
  - a) Fast retrieval of any data item
  - b) Data is organized in a linear format
  - c) Data can be accessed randomly
  - d) Low cost per gigabyte
5. Which storage media type is best suited for applications that require quick and frequent access to individual records?
  - a) Sequential access media
  - b) Direct access media
  - c) Both sequential and direct access media
  - d) None of the above
6. Which is not examples of operating systems?
  - a) Office 2016
  - b) Linux
  - c) Windows

- d) Mac OS
7. Which algorithm works on the assumption that the most recently used page is likely not to be requested back in the RAM?
- a) FIFO
  - b) FCFS
  - c) MRU
  - d) LRU
8. Which process state/queue are jobs moved to while waiting to have the process time?
- a) Waiting
  - b) Ready
  - c) Running
  - d) Complete
9. Which RAID levels provides redundancy by mirroring data across multiple drives?
- a) RAID 0
  - b) RAID 1
  - c) RAID 5
  - d) RAID 10
10. Which algorithm functions by moving the disk arm in one direction and servicing all requests along the way as it progresses?
- a) C-LOOK
  - b) C-Seek
  - c) C-Service
  - d) C-SCAN

***Fill in the missing words***

11. The primary purpose of any page replacement algorithm is to reduce the number of\_\_\_\_\_.
12. \_\_\_\_\_are processes that are started by the operating system and ensures that the running of the OS.
13. \_\_\_\_\_is a process of moving a process temporarily from main memory into a secondary memory and vice-versa.
14. \_\_\_\_\_ is a scheduling policy goal that ensures that the processor runs as many jobs as possible in each amount of time.
15. The equal time slice shared by all process in round robin is called \_\_\_\_\_.

***State whether the following statements are true or false***

16. When executing a job, the file manager determines whether a user request requires that a file be retrieved from storage or whether it is already in memory.
17. Device management principles are changing rapidly to accommodate cloud computing.

18. As a process moves through the system, its status changes. Possible process statuses include FINISHED, HOLD, READY, RUNNING, and WAITING.
19. A large job can have problems with a first-fit memory allocation scheme.
20. A compressed image file can be reconstructed if a lossy compression algorithm is used because the compression process is reversible.

## SECTION B: SHORT QUESTIONS

[30

Marks]

1. Various OS components work together seamlessly to manage computer tasks. Explain the functions of the following OS components from the time a user initiates a printing job to the completion of the job. (4)
  - a) Device Drivers
  - b) Process Management
  - c) Memory Management
  - d) File Management
2. Explain the difference between a process and a thread. (2)
3. Explain two security and protection measures that are offered in a multi-User environment by the operating system. (4)
4. List and explain the four conditions that activate the occurrence of a deadlock in the system? (8)
5. Distinguish between page replacement algorithms and scheduling algorithms in operating systems. (2)
6. Explain paging in terms of memory management? (2)
7. Distinguish the types of file organisation in a system. (6)
8. Explain the role of device drivers in device management. (2)

## Section C: Practical

[30 Marks]

**Question 1:** Consider a system having resources and processes as described below:

Resource 1 (R1) have 1 instance

Resource 2 (R2) have 1 instance

Resource 3 (R3) have 1 instance

Process 1 is holding R1; and is requesting R2.

Process 2 is holding R2; and is requesting R1 and R3.

Process 3 is holding R3; and is requesting R1.



Process 4 is holding none; and is requesting R2 and R3.

- a) Draw the resource allocation graph for the above-described system. (5)

**Question 2:** Consider the following page request: 4 1 0 1 3 2 0 4 2 0 1 3 0 4 3

Suppose that all the page frames are initially empty, given that the main memory has 3-page frames and that a program/job consisting of 15 pages is to be loaded in main memory.

- a) Using the **Most Recently Used (MRU)** page removal algorithm, demonstrate how you will fit the given pages in the memory. (6)  
 b) Indicate the number of pages faults and hits and misses in this algorithm (2)  
 c) Discuss 1 advantage and disadvantages of this algorithm (2)

**Question 3:** You are given the following information about jobs that need to be processed:

Process	Arrival Time	Burst Time	Priority	Start	Completion	Waiting	Turn Around Time
P <sub>1</sub>	0	11	4				
P <sub>2</sub>	4	7	6				
P <sub>3</sub>	2	10	2				
P <sub>4</sub>	4	6	4				
P <sub>5</sub>	6	12	3				

- (a) Draw a timeline analysis (Gantt chart) using **Priority scheduling algorithms (non-Preemptive)**: (3)  
 (b) Calculate the average turnaround and waiting time for all processes. (2)

**Question 4:** Consider the system with the following resources and processes:

- Processes: P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub>, P<sub>4</sub> P<sub>5</sub>
- Resources and instances: A=10, B=5, C=7

- (a) Given the table below, write down the available resources before any execution. (1)

Processes	Allocation	Maximum	Available	Need
	A B C	A B C		
P <sub>0</sub>	0 1 0	7 5 3		
P <sub>1</sub>	2 0 0	3 2 2		

<b>P2</b>	<b>3 0 2</b>	<b>9 0 2</b>		
<b>P3</b>	<b>2 1 1</b>	<b>2 2 2</b>		
<b>P4</b>	<b>0 0 2</b>	<b>4 3 3</b>		

- (b) Calculate the total need for all processes. Show all your work by re-drawing the table on your answer sheet and provide the missing information. (3)
- (c) Calculate the sequence of process execution and verify if the system is in a safe state after execution of the processes. Show your execution process. (3)
- (d) Identify the order in which processes need to be executed to ensure that the system is in safe state. (3)

***Exam Ends***