



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE (SYSTEMS ADMINISTRATION)	
QUALIFICATION CODE: 07BCMS	LEVEL: 6
COURSE: Operating Systems	COURSE CODE: OPS611S
DATE: July 2024	SESSION: 2
DURATION: 3 hours	MARKS: 100

SECOND OPPORTUNITY / SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER(S)	FRANS HAINGURA
MODERATOR:	LOIN IYAMBO

THIS QUESTION PAPER CONSISTS OF 5 PAGES

(Excluding this front page)

INSTRUCTIONS

1. Answer ALL the questions.
2. Write clearly and neatly.
3. Number the answers clearly.
4. When answering questions you should be guided by the allocation of marks in []. Do not give too few or too many facts in your answers.

PERMISSIBLE

1. Non programmable Scientific Calculator.

SECTION A (MULTIPLE CHOICE) 20 MARKS

1. When a job is accepted by the system, it's put on ____ and placed in a queue. [1]
- a. RUNNING
 - b. WAITING
 - c. HOLD / NEW
 - d. READY

2. Which of the following statements is true regarding CPU context switching? [1]
- a. Register values for the currently running process are all reset.
 - b. Register values for the currently running process are stored into its PCB
 - c. Register values of the new running state are not loaded into the CPU
 - d. None of the above

3. Assume that jobs A-D arrive in the READY queue in quick succession and have the CPU cycle requirements listed below. Using the SRT algorithm, the average turnaround time is _____. [1]

Arrival time: 0 1 2 3

Job: A B C D

CPU cycle: 6 3 1 4

- a. 2.5
 - b. 6.15
 - c. 7.75
 - d. 6.25
4. Some systems use a strategy known as ____ to increase the priority of jobs that have been in the system for an unusually long time to expedite their exit. [1]
- a. Logging
 - b. Preempting
 - c. Aging
 - d. Accelerated priority
5. When the operating system detects a nonrecoverable error, the following step is performed first by the interrupt handler: _____. [1]
- a. The state of the interrupted process is saved
 - b. The type of interrupt is described and stored
 - c. The interrupt is processed
 - d. The processor resumes operation
6. A livelock can be caused by two processes accessing different areas of the same disk. [1]
- a. False
 - b. True

7. If locks are not used to preserve data integrity, the updated records in a database may include only some of the data and their contents depend on the order in which each process finishes its execution. [1]
a. True
b. False
8. Database locking should be done only at the level of the entire database. [1]
a. True
b. False
9. When using a directed graph to model a system, if there's a cycle in the graph, then there is a deadlock involving the processes and the multi-instance resources shown in the cycle. [1]
a. False
b. True
10. According to the Banker's Algorithm, an unsafe state always leads to deadlock. [1]
a. True
b. False
11. On an optical disc, all sectors are _____. [1]
a. of varying sizes depending upon where you are on the disc
b. larger as you move to the edge
c. smaller as you move to the edge
d. of the same size throughout the disc
12. Device management principles are changing rapidly to accommodate cloud computing. [1]
a. False
b. True
13. Seek time is the most important characteristic of a fixed-head disk drive. [1]
a. True
b. False
14. In the SCAN device-scheduling algorithm, any requests that arrive while the arm is in motion are grouped for the arm's next sweep. [1]
a. False
b. True
15. The job of the I/O control unit is to keep up with the I/O requests from the CPU and pass them down the line to the appropriate control unit. [1]
a. True
b. False

16. _____ are special files with listings of file names and their attributes. [1]
- Databases
 - Directories
 - Programs
 - Data files
17. The computer system _____ a file by activating the appropriate secondary storage device and loading the file into memory while updating its records of who is using that file. [1]
- Creates
 - Formats
 - Allocates
 - Configures
18. A file's _____ file name includes all path information for that file. [1]
- Extended
 - Absolute
 - Relative
 - Long-form
19. A(n) _____ file name is the name that differentiates a file from other files in the same directory. [1]
- Absolute
 - Relative
 - Short-form
 - Directory
20. As long as users refer to files in the _____ directory, they can access the files without entering the absolute filename. [1]
- Root
 - Main
 - Home
 - Working

SECTION B (THEORY) 20 MARKS

- Name and explain three features of an Operating System. [6]
- How does a Batch System differ from an Interactive System [2]
- Differentiate between preemptive and non-preemptive scheduling policies with examples. [4]
- Differentiate between a time quantum expiration interrupt and an illegal arithmetic operation interrupt. [2]
- What are the prerequisite conditions of a deadlock? [4]
- Briefly explain the difference between buffering and blocking. [2]

SECTION C (ALGORITHMS AND COMPUTATIONS) 60 MARKS

1. Given the following configuration with jobs arriving in order (Job A, B, C, D) and with blocks shown in order from low order memory to high order memory: [12]

Job List:	
Job Number	Memory Requested
Job A	256K
Job B	900K
Job C	50K
Job D	350K

Memory Block List:	
Memory Block	Memory Block Size
Block 1	910K
Block 2	900K
Block 3	200K
Block 4	300K

- a. Use the best-fit algorithm to indicate which memory blocks are allocated to each of the arriving jobs. [4]
 - b. Use the first-fit algorithm to indicate which memory blocks are allocated to each of the arriving jobs. [4]
 - c. Calculate the internal fragmentation in all four blocks using the best-fit algorithm. [4]
2. Given the information below. Use SRT scheduling algorithm to answer the following questions. Note that the concept of aging is used in this system. [7]

Process	Arrival Time	CPU Cycle
P1	0	6
P2	0	2
P3	2	4
P4	6	6

- a. Draw a timeline analysis. [4]
 - b. Calculate turnaround time for each process. [2]
 - c. Calculate the average turnaround time. [1]
3. Given the reference bits for the pages shown below, answer the following questions: [4]

Page Number	Time 0	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6
0	10000000	11000000	01100000	10110000	01011000	10101100	01010110
1	10000000	01000000	00100000	10010000	01001000	00100100	00010010
2	10000000	01000000	00100000	00010000	10001000	11000100	01100010
3	10000000	11000000	11100000	01110000	10111000	11011100	01101110
4	10000000	11000000	01100000	10110000	01011000	00101100	10010110
5	10000000	11000000	11100000	01110000	10111000	11011100	11101110
6	10000000	01000000	10100000	01010000	00101000	00010100	10001010

- a. Identify which of the pages was referenced most often as of the last time snapshot. [2]
- b. Which page was referenced least often? [2]

4. Given that the total number of requests is 2056, and 1786 of those requests are found in cache, with a 190 nanoseconds (nSec) Average Cache Access Time, and 855 nanoseconds (nSec) Average Main Memory Access Time. Answer the following questions. [6]

- a. Compute the HitRatio. [2]
- b. Compute the Average Memory Access Time. [2]
- c. Is this system optimal? Motivate your answer. [2]

5. Given a system with 12 identical devices below, use the banker's algorithm and answer the following questions. [8]

Process	Devices Allocated	Maximum Required
A	4	7
B	2	6
C	1	4
D	3	6

- a. Calculate the number of available devices. [2]
- b. Determine the remaining needs for each process in the system. [4]
- c. Determine whether the system is safe or unsafe. Motivate your answer [2]

6. Given the resource allocation and request matrix table below, answer the following questions. [11]

Process	Resource Allocation			Resource Request		
	R1	R2	R3	R1	R2	R3
P1	0	1	0	1	0	0
P2	1	0	1	0	1	0
P3	0	1	0	1	0	1

- a. Draw a RAG. [6]
- b. What is the status of each process? Indicate whether the process is RUNNING or WAITING. [3]
- c. Is the system in a deadlock? Motivate your answer. [2]

7. Given a 60 track disk (0-59), it takes 0.2 ms to travel from one track to the next. The head is initially positioned at track 33 and moving outwards. Using the C-SCAN strategy, illustrate how the following requests would be serviced. Note that all the requests are present in the wait queue and arrived in the order from left to right, ignore rotational time and transfer time. Request: 45, 20, 15, 33, 3, 18, 52. [12]

GOOD LUCK!