NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Computing and Informatics

Department of Computer Science

QUALIFICATION : Bachelor of Computer Science Bachelor of Computer Science in Cyber Security Bachelor of Informatics	
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COURSE: Operating Systems	**COURSE CODE**: OPS611S
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DURATION: 3 hours	**MARKS:** 80

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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THIS QUESTION PAPER CONSISTS OF 6 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. Do not give too few or too many facts in your answers.

PERMISSIBLE MATERIALS

1. Non-programmable calculator

Section A [10 marks]

Choose the correct answer from the multiple choice questions below.
[10]

1.1 The Job Scheduler seeks to ____ when scheduling jobs.

a) Run all CPU intensive jobs first
b) Run all I/O intense jobs first
c) Balance the CPU and I/O intensive jobs
d) Run the quickest jobs first

1.2 ____ allows for faster turnaround of CPU-bound jobs

a) Movements between queues
b) Variance time quantum per queue
c) No movement between queues
d) Aging

1.3 Fill in the missing event that causes deadlock in a database. There are two processes (P1 and P2), each of which needs to update two records (R1 and R2) and the following sequence leads to a deadlock:
1. P1 accesses R1 and locks it.
2. P2 accesses R2 and locks it.
3. ____
4. P2 requests R1, which is locked by P1.

a) P2 releases R2
b) P1 requests R1 again
c) P1 requests R2, which is locked by P2
d) P2 releases R1

1.4 The Banker's Algorithm is an example of a(n) ____ policy

a) Avoidance
b) Recovery
c) Detection
d) Mutual exclusion

1.5 In the "dining philosophers" problem, a philosopher can pick up a fork when ____.

a) it is his/her turn, going in numerical order from one philosopher to the next
b) No other philosopher is eating
c) There is one available
d) There are two available

1.6 Interval between the time of submission and completion of the job is called:

a) Waiting time
b) Turnaround time
c) Throughput
d) Response time.

1.7 In ---------- several programs are kept in main memory at the same time.

a) Multiprocessor
b) On- line operation
c) Buffering
d) Multiprogramming.

1.8 Assume that four jobs, E-H, require the CPU cycles listed below. Using the SJN algorithm, the average turnaround time is ____.

Job: EFGH
CPU cycle: 5 2 6 4

a) 6.8
b) 11.1
c) 9.0
d) 5.5

1.9 An algorithm designed to detect starvation by tracking how long each job has been waiting for resources is using the concept of ----------.

a) Deadlock
b) Aging
c) Preemption
d) Round robin

1.10 The ..... strategy uses the same underlying philosophy as shortest job next, where the shortest jobs are processed first and longer jobs are made to wait.

a) SSTF
b) FCFS
c) LOOK
d) SCAN

Section B [30 marks]

Question 2

Define the following terms as used in operating systems:

2.1 Aging [2]

2.2 I/O control unit [2]

2.3 Concept starvation [2]

Question 3

Explain the fundamental differences between Pre-emptive and non-preemptive scheduling [4]

Question 4

List and define the two storage media groups [4]

Question 5

5.1 File management is one of the sub-system managers of the operating systems. List any three tasks that are performed by the mentioned sub-manager. [3]

5.2 List any three items that can be found in a file descriptor table. [3]

Question 6

Mention two types of data compression algorithms and give one example to each mentioned. [4]

Question 7

In a storage system with conventional magnetic-media disks, several different delays occur when servicing a request. Identify at least three of these delays, and comment on their relative contribution to the total delay for servicing a request. [6]

Section C [40 marks]

Question 8

Given the table below, answer the questions that follow.

Jobs	Required memory (KB)
Job 1	950
Job 2	330
Job 3	600
Job 4	940

Memory block	Size (KB)
1	650
2	400
3	1000
4	950

(Assume all jobs are in a waiting queue in the order given)

8.1 Illustrate with an aid of a diagram how the jobs will be assigned in main memory using fixed partitions method:

First-fit [4]

8.2 Calculate the total internal fragmentation for each algorithm stated in 8.1. [2]

Question 9

Suppose that a disk drive has 1000 cylinders, numbered 0 to 999. The drive is currently serving a request at cylinder 143, and previously it was at cylinder 125. The queue of pending requests, in FIFO order, is: 86, 600, 220, 940, 260, 770, 400, 850, 130.

9.1 Starting from the current head position, show how these requests will look like using the LOOK seek strategy. [4]

9.2 Using the same initial head position , show how these requests will look like using the SCAN seek strategy. [5]

Question 10

The system described in the table below, uses the Banker's algorithm for deadlock avoidance. You are given that the system has 14 devices.

Job No.	Devices Allocated	Maximum Required	Remaining Needs
Job 1	3	6	
Job 2	5	7	
Job 3	0	13	
Job 4	4	15	

Answer the following questions:

a) Fill in the table for the remaining needs of the system [4]

b) Determine whether the system is in a safe or unsafe state. In case if you find out that it is unsafe, explain which jobs will be able to complete executing and which jobs will not be able to complete executing.

If the system is in a safe state, list the sequence of requests and releases that will make it possible for all jobs to run to completion. [3]

Question 11

Consider the following information about resources in a particular system:

Resource A has 3 instances

Resource B has 2 instances

Resource C has 4 instances

The resources are allocated as follows:

Process 1 holds one instance of B and C and is waiting for an instance of A;

Process 2 holds one instance of A and waiting on an instance of B;

Process 3 holds one instance of A, one instances of B, and one instance of C.

a) Draw the resource allocation graph for the above described system. [8]

b) What is the state of each process? Just indicate if it is running or waiting. [3]

c) Is the system in a deadlock state or not? If so, mention the processes involved and specifically state what is causing the deadlock. If not, give execution sequences that eventually lead to all processes being executed. [2]

Question 12

You would like to visualize the function of the process scheduler and you are given the following information about jobs that need to be processed:

Process	Arrival Time	Burst Time	Priority
P_1	0	11	4
P_2	4	7	6
P_3	2	10	2
P_4	4	6	4
P_5	6	12	3

Draw a time line analysis (gantt chart) for each of the following scheduling algorithm:

Shortest Job Next [5]

End of Paper