NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Computing and Informatics

Department of Computer Science

QUALIFICATION: Bachelor of Computer Science in Cyber Security	
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COURSE: Operating Systems	**COURSE CODE:** OPS621S
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DURATION: 3 hours	**MARKS:** 80

SECOND OPPORTUNITY / SUPPLEMENTARY 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]

Question 1

Below are multiple choice questions as well as true / false questions. Select the correct answers. [10]

1.1 In a paged memory allocation scheme, a page size that is too small will generate ____.

a) excessive external fragmentation
b) excessive internal fragmentation
c) excessive page faults
d) very long Page Map Tables

1.1 Which of the following is the first step in reducing a directed graph to eliminate deadlock?

a) Remove the process that is holding on to the most resources.
b) Find a process that's waiting only for resource classes that aren't fully allocated
c) Find a process that is currently using a resource and not waiting for one.
d) Find the oldest process and remove it from the graph.

1.2 A _____ system is used when there are rigid time requirements on the operation of processor.

a) Batch
b) Time sharing
c) Real time
d) None of the above.

1.3 On magnetic disks, files can be organized in one of three ways: ----------.

a) sequential, direct, or indexed sequential
b) sequential, indirect, or direct
c) sequential, random, or indirect
d) indexed direct, indexed indirect, or random

1.4 A(n) _____ contains a list of files, each of which is associated with the names of users who are allowed to access it and the type of access each user is permitted.

a) Access control matrix
b) Access control list
c) Capability list
d) Capability matrix

1.6 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.

1.7 Device management principles are changing rapidly to accommodate cloud computing.

1.8 As a process moves through the system, its status changes. Possible process statuses include FINISHED, HOLD, READY, RUNNING, and WAITING.

1.9 A large job can have problems with a first-fit memory allocation scheme.

10.1 A compressed image file can be reconstructed if a lossy compression algorithm is used because the compression process is reversible.

Section B [30 marks]

Question 2

Define the following terms as used in operation systems.

2.1 Interblock gap (IGB) [2]

2.2 Aging [2]

Question 3

Differentiate between internal fragmentation and external fragmentation. [4]

Question 4

4.1 Explain two disadvantages of direct record organisation in file management. [2]

4.2 Explain the roles or the functions of a master file directory (MFD). [2]

4.3 Explain four disadvantages of having a single directory per volume in file management. [4]

Question 5

5.1 Define virtual memory. [2]

5.2 Explain two advantage and two disadvantage of virtual memory. [4]

Question 6

Discuss the four conditions that are required for a deadlock to occur. [8]

Section C [40 marks]

Question 7

Consider a system having resources and processes as described below:
Resource 1 (R1) have 1 unit
Resource 2 (R2) have 1 unit
Resource 3 (R3) have 1 unit

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.

Draw the resource allocation graph for the above described system. [5]

Question 8

For the system below, assume that all the devices are of the same type. The system uses the Banker's algorithm for deadlock avoidance. You are given that the system has 18 devices.

Job No.	Devices Allocated	Maximum Required
Job A	7	10
Job B	4	6
Job C	2	7
Job D	3	17

Answer the following questions:

8.1 Determine the remaining needs of the jobs. [2]

8.2 Determine whether the system is in a safe or unsafe state. In case if you find out that it is unsafe, propose a scenario whereby the system can be changed to a safe state. 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 9

In demand paging, a page replacement policy is used to manage system resources. Given that main memory has 4 page frames (N, U, S, T) available to programs and that a program consisting of 15 pages is to be loaded in main memory. The request pages are provided below in order:

1 0 2 1 4 3 1 0 2 0 4 3 1 2 4

Suppose that all the page frames are initially empty.

Using the following page removal algorithms and do a pages trace analysis indicating page faults.

9.1 Least Recently Used [7]

9.2 Most Recently Used (MRU) [7]

Question 10

You are given a program of size 8650 bytes that need to be loaded in memory. Assume that you are using the paged memory allocation scheme and the size of each page frame is 650 bytes.

Answer the following questions given that 1 byte = 1 line of code:

10.1 How many pages will the program have? [2]

10.2 How much internal fragmentation will be caused? [2]

10.3 The processor (CPU), wants to access the instruction at line 6650. In which page number will it find this instruction and what will be the displacement (offset) value? [2]

10.4 What will be the line number for a line (instruction) on page 7 with a displacement of 400? [2]

Question 11

You are given that it takes 1 ms to travel from one track to the next, and that the arm is originally positioned at Track 53. The request queue (number of tracks) is 0-199. Note that the r/w arm should move towards the high-numbered tracks. (Ignore rotational time and transfer time, just consider seek time).

Compute how long it will take to satisfy the following track requests which are all present in the wait queue:

98, 183, 37, 122, 14, 124, 65, 67

11.1 Use the following seek strategy algorithm to draw/illustrate using a graph how the track requests will be serviced.

C-LOOK [6]

11.2 What is the total seek distance for 11.1? [2]

End of Paper