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	
QUALIFICATION CODE: 07BCMS / 07BCCY / 07BAIT	**LEVEL:** 6
COURSE: Operating Systems	**COURSE CODE:** OPS611S
DATE: June 2022	**PAPER:** THEORY
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]

Question 1

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

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

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

1.2 In _____ several programs are kept in main memory at the same time.

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

1.3 In a paged memory allocation scheme, a simple _____has one entry for each page frame that shows its location and its free/busy status.

a) Memory Map Table
b) Memory Management table
c) Page Access table
d) Job Table

1.4 _____ is when, in modern printing systems, a disk accepts output from several users and acts as a temporary storage area for all output until the printer is ready to accept it. Select one:

a) Lagging
b) Spooning
c) All of the above
d) Spooling

1.5 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

1.6 The scheduler is the part of an Operating System that determines the priority of each process.

a) False b) True

1.7 Thrashing is a problem that occurs when there are a large number of jobs and many free pages so that pages are being moved around too much.

a) True b) False

1.8 The working set model is used to compute the average number of frames a job will need in order to run smoothly without causing thrashing.

a) True b) False

1.9 Shortest Remaining Time First is the best preemptive scheduling algorithm that can be implemented in an Operating System.

a) True b) False

1.10 Paged memory allocation offers the advantage that it doesn't require the entire job to be stored in memory during its execution.

a) True b) False

Section B [30 marks]

Question 2

Define the following terms as used in operation systems:

2.1 Compaction [2]

2.2 Interleaving [2]

2.3 Threads [2]

Question 3

Explain the fundamental differences between multiprocessing and multitasking operating systems. [4]

Question 4

Explain any four (4) objectives of a process scheduling algorithm? [4]

Question 5

5.1 Briefly explain the Process Control Block. [3]

5.2 Identify any three attributes of a Process Control Block. [3]

Question 6

Four (4) conditions need to be present for a deadlock to occur. Explain two conditions namely; no preemption and resource holding. [4]

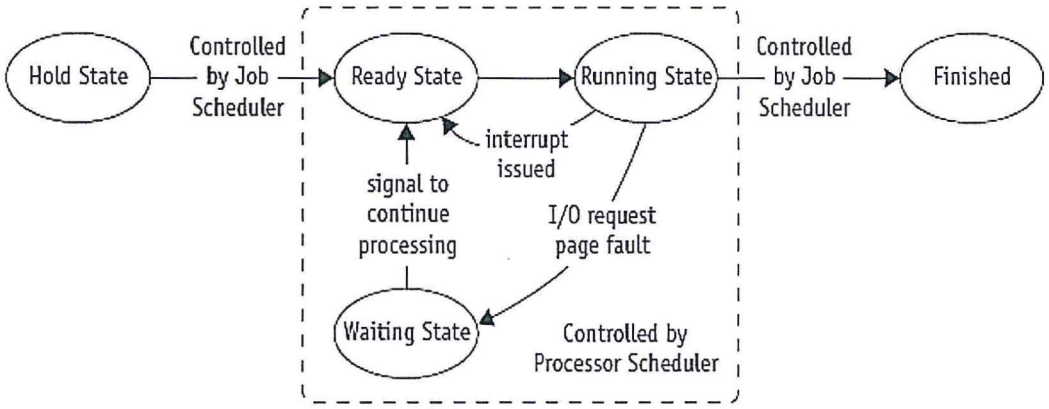
Question 7

Fixed partitions and dynamic partitions are two of the main memory allocation schemes. Describe them and highlight the main distinguishing characteristics. [6]

Section C [40 marks]

Question 8

Consider the process state diagram shown below and answer the questions that follow.



8.1 Explain why there is no transition from the READY state to the WAITING state. [1]

8.2 Explain why there is no transition from the WAITING state to the RUNNING state. [2]

Question 9

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. [6]
b) What is the state of each process? indicate whether 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 10

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)

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

First-fit [4]

10.2 Calculate the total internal fragmentation for each algorithm stated in 10.1. [2]

Question 11

In demand paging, a page replacement policy is used to manage system resources. Given that main memory has 3 page frames (O, P, S) 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:

9 6 5 6 8 7 5 9 7 5 6 8 5 9 8

Suppose that all the page frames are initially empty.

Using the Most Recently Used (MRU) page removal algorithms, do a pages trace analysis clearly indicating page faults.

Show how these pages will be allocated using the following page replacement policies. You are required to do a page trace analysis and clearly indicating when an interrupt or page fault has occurred.

11.1 First In First Out [4]

11.2 Least Recently Used [4]

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 algorithms:

12.1 Priority [3]

12.2 Shortest Job Next [3]

12.3 Calculate the average turnaround time for each algorithm. [1]

12.4 Calculate the average waiting time for each algorithm. [1]

Question 13

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.

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

End of Paper