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: July 2023	**PAPER:** THEORY
DURATION: 3 hours	**MARKS:** 80

SECOND OPPORTUNITY /SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER(S)	**Ms. Teresia Ankome , Ms. Deada Kandjii and Mr. Ericky Iipumbu**
MODERATOR:	**Ms. Loini Iiyambo**

THIS QUESTION PAPER CONSISTS OF 9 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

1.1 The Job Table (JT) contains two values for each active job: the size of the job and the memory location where its Page Map Table is stored.
a)False b) True

1.2 An important function of the Processor Manager is to keep track of the status of each job, process, and thread.
a)False b) True

1.3 In active multiprogramming schemes, a job can monopolize the CPU for a long time while all other jobs waited.
a)False b) True

1.4 A large job can have problems with a first-fit memory allocation scheme.
a)False b) True

1.5 The key to the successful implementation of demand paging is the use of a high-speed CPU.
a)False b) True

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) False b) True

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

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 operating systems:

2.1 Search time [2]

2.2 Cache memory [2]

2.3 Interleaving. [2]

Question 3

Differentiate between fixed length records and variable length records. [4]

Question 4

Discuss how the following pairs of scheduling criteria conflict in certain settings.

4.1 CPU utilization and response time [2]

4.2 Average turnaround time and maximum waiting time [2]

4.3 I/O device utilization and CPU utilization [2]

Question 5

What do you understand by Cloud computing, and what are some of the benefits that it offers?

[4]

Question 6

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

Question 7

You are given a program of size 8650 bytes that needs 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:

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

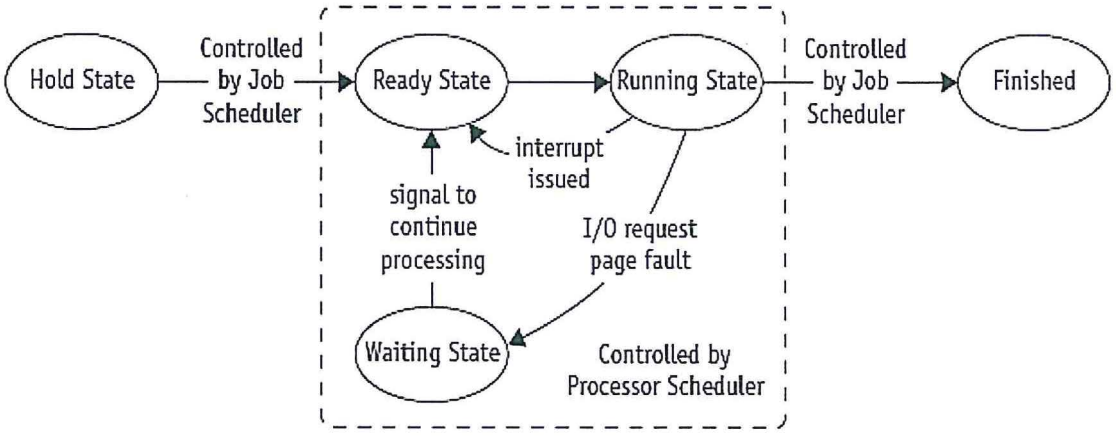
7.2 How much internal fragmentation will be caused? [2]

7.3 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]

Section C [40 marks]

Question 8

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

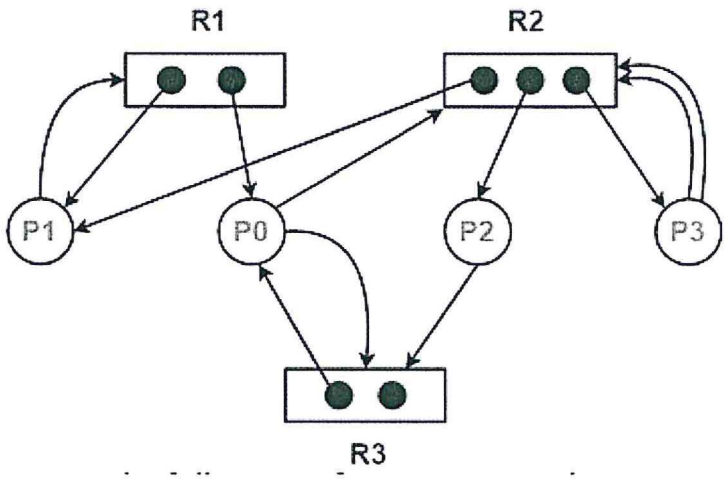


8.1 Explain why there is no transition from the READY state to the WAITING state. [1]

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

Question 9

For the following resource allocation graph, find out and explain whether there is a deadlock or not. [2]



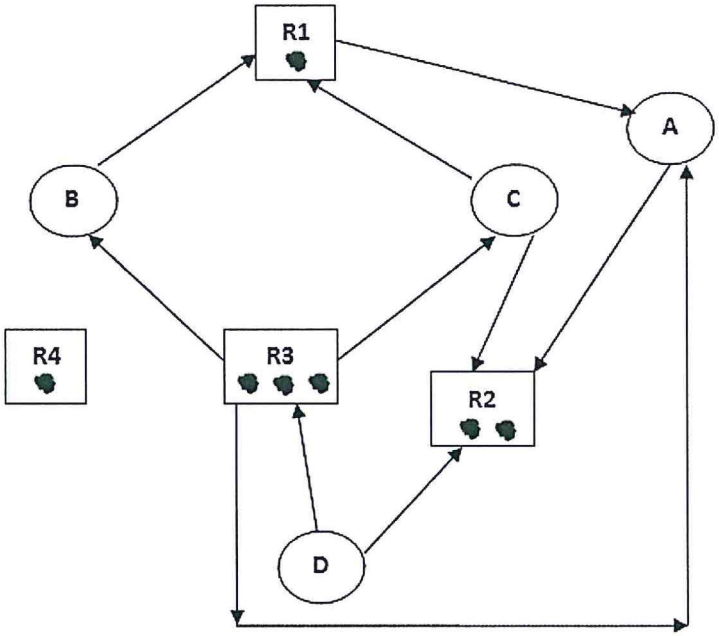
9.2 Given the following information regarding resources in a system:

Resource 1 (R1) has 1 unit
Resource 2 (R2) has 2 units
Resource 3 (R3) has 3 units
Resource 4 (R4) has 1 unit

Process A is holding 1 unit of R1 and 1 unit of R3; and is requesting 1 unit of R2.
Process B is holding 1 unit of R3; and is requesting 1 unit of R1.
Process C is holding 1 unit of R3; and is requesting 1 unit of R1 and 1 unit of R2.
Process D is holding none of the resources; and is requesting 1 unit of R2 and 1 unit of R3.

Draw the resource allocation graph (RAG) for the above described system showing all resources and processes.

[6]



Question 10

Given the following information:

Process	Arrival Time	CPU Cycle
A	0	11
B	3	16
C	7	4
D	4	2
E	10	13

Draw a timeline analysis for each of the following scheduling algorithms. (It might be helpful to first compare a start and finish time for each job). Calculate the average turnaround time and average waiting time for execution of the processes.

a) FCFS [5]

b) SRT [6]

Question 11

In demand paging, a page replacement policy is used to manage system resources. Given that main memory has 3 page frames (F, C, I) 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 [5]

11.2 Least Recently Used [5]

11.3 Calculate the failure rate and success rate for 11.2 [2]

Question 12

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)

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

First-fit [4]

12.2 Calculate the total internal fragmentation for each algorithm stated in 12.1. [2]

End of Paper