



**PAMIBIA UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

**Faculty of Computing and Informatics**

**Department of Computer Science**

<b>QUALIFICATION:</b>	Bachelor of Computer Science in Cyber Security Bachelor of Computer Science Bachelor of Geoinformation Technology Bachelor of Informatics	
<b>QUALIFICATION CODE:</b>	07BCCY, 07BCMS, 07BGEI, 07BAIT	<b>LEVEL:</b> 6
<b>COURSE:</b>	Operating Systems	<b>COURSE CODE:</b> OPS611S
<b>DATE:</b>	July 2025	<b>SESSION:</b> 2
<b>DURATION:</b>	2 hours 30 minutes	<b>MARKS:</b> 80

<b>SECOND OPPORTUNITY / SUPPLEMENTARY EXAMINATION QUESTION PAPER</b>	
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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 [13 marks]

### Question 1

Below are multiple choice questions and true / false questions. Select the correct answer. [13]

- 1.1 A relative filename is a name that is selected by the File Manager when the file is created. (True/False)
- 1.2 The key to the successful implementation of demand paging is the use of a high-speed CPU. (True/False)
- 1.3 Context switching is required by all preemptive algorithms. (True/False)
- 1.4 A large job can have problems with a first-fit memory allocation scheme. (True/False)
- 1.5 A compressed image file can be reconstructed if a lossy compression algorithm is used because the compression process is reversible. (True/False)
- 1.6 Although non-contiguous allocation schemes eliminate external storage fragmentation and the need for compaction, they don't support direct access because there's no easy way to determine the exact location of a specific record. (True/False)
- 1.7 In indexed storage, when a file is created, the pointers in the index block are all set to \_\_\_\_\_.
  - a) The end of the volume
  - b) The beginning of the volume
  - c) Null
  - d) zero
- 1.8 A file's \_\_\_\_ filename includes all path information for that file.
  - a) Extended
  - b) Absolute
  - c) Relative
  - d) Long-form

- 1.9 Which of the following is not an example of embedded system?
- a) Point OF Sale (PoS)
  - b) Pacemakers
  - c) Elevators
  - d) Automobiles
- 1.10 On an optical disc, all sectors are \_\_\_\_\_.
- 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
- 1.11 \_\_\_\_\_ is the policy of allowing only one process to have access to a dedicated resource.
- a) No preemption
  - b) Mutual exclusion
  - c) Circular wait
  - d) Resource holding
- 1.12 The transition from \_\_\_\_\_ is initiated by the Job Scheduler according to some predefined policy. At this point, the availability of enough main memory and any requested devices is checked.
- a) READY to RUNNING
  - b) HOLD to READY
  - c) RUNNING to WAITING
  - d) RUNNING back to READY
- 1.13 \_\_\_\_\_ peripheral devices are assigned to only one job at a time.
- a) Dedicated
  - b) Shared
  - c) Virtual
  - d) Static

## Section B [28 marks]

### Question 2

Define the following terms as used in operating systems:

- 2.1 Compaction [2]
- 2.2 I/O channel [2]

### Question 3

Describe the two benefits and two drawbacks of large and small partition sizes. [4]

### Question 4

- 4.1 Explain two benefits and two disadvantages of using a contiguous file allocation scheme. [4]
- 4.2 Name any three selection considerations that must be considered when choosing the type of file organisation? [3]
- 4.3 List any three items that can be found in a file descriptor table. [3]

### Question 5

- 5.1 Explain why Direct Memory Access (DMA) is considered an efficient mechanism for performing I/O operations. [2]
- 5.2 Explain how buffers are used in DMA? [2]

### Question 6

Given the criteria below, which process scheduling algorithm would best satisfy the following requirements? Motivate your answer.

- 6.1 You want the most important jobs to always be processed first. [2]
- 6.3 You want to minimize the average waiting time for all jobs. [2]
- 6.4 You want to ensure fast completion of short jobs, while performing context switching. [2]

**Section C [39 marks]**

**Question 7**

The system below uses the Banker's algorithm for deadlock avoidance. You are given that the system has 18 devices.

Job No.	Devices Allocated	Maximum Required	Remaining Needs
Job A	7	11	
Job B	4	5	
Job C	2	9	
Job D	3	18	

Answer the following questions:

- 7.1 Fill in the table for the remaining needs of the system. [2]
- 7.2 Determine whether the system is in a safe or unsafe state. In case if you find out that it is unsafe, explain why it is unsafe or what is making it unsafe. Then propose a scenario whereby the system can be changed to a safe state. While if you find out that the system is safe, list the sequence of requests and releases that will make it (the system) possible for all processes to run to completion. [2]

**Question 8**

Given the table below, answer the questions that follow.

Jobs	Required memory (KB)	Memory block	Size (KB)
Job 1	850	1	650
Job 2	370	2	400
Job 3	640	3	1000
Job 4	930	4	950

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

- 8.1 Illustrate with the aid of a diagram how the jobs will be assigned in main memory using fixed partitions. You are required to utilise the first-fit algorithm. [4]
- 8.2 Calculate the total internal fragmentation that will arise. [2]

### Question 9

If a program has 1077 bytes and will be loaded into page frames of 200 bytes each, and the instruction to be used is at byte 507, answer the following questions given that 1 MB = 1 line of code:

- 9.1 How many pages are needed to store the entire job? [2]
- 9.2 Compute the page number and exact displacement for each of the byte addresses where the data is stored. (Remember that page numbering starts at zero). [2]

### Question 10

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

Process	Arrival Time	Burst Time	Priority
P <sub>1</sub>	0	11	4
P <sub>2</sub>	4	7	6
P <sub>3</sub>	2	10	2
P <sub>4</sub>	4	6	4
P <sub>5</sub>	6	12	3

Draw a timeline analysis (Gantt chart) for each of the following scheduling algorithms: Note that the higher the priority number, the more important the process is.

- 10.1 Priority [5]
- 10.2 Round Robin (time slice = 3) [5]
- 10.3 Calculate the average waiting time for Round Robin algorithm. [2]
- 10.4 A student suggests that Round Robin could be improved by reducing the time slice to 2. What effects will this proposal have on the system's performance? [2]

**Question 11**

Given that main memory is composed of page frames (Frame 1, Frame 2, Frame 3) for public use and that a program has been divided into six pages (A, B, C, D, E, F). Given that a program which is running requests pages in the following order:

E F B C B D E F A B C C D E F D B A C D D

Suppose the three page frames are initially empty.

Using the LRU page removal algorithm, do pages trace analysis indicating page faults with asterisks (\*). [5]

**Question 12**

Suppose that a disk drive has 1000 cylinders, numbered 0 to 999. The drive is currently serving a request at cylinder 143. Assume that the read\write head is moving to the right (towards high numbered cylinders). The queue of pending requests, in FIFO order, is:

56, 125, 840, 355, 112, 625, 525, 910, 250

- 12.1 Starting from the current head position, demonstrate how these requests will be serviced by using the C-SCAN seek strategy. [4]
- 12.2 What is the total seek time that the disk arm moves to satisfy all the requests? [2]

**End of Paper**