



**PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE (SYSTEMS ADMINISTRATION)	
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COURSE: Operating Systems	COURSE CODE: OPS611S
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DURATION: 3 hours	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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THIS QUESTION PAPER CONSISTS OF 7 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 in []. Do not give too few or too many facts in your answers.

PERMISSIBLE

1. Non programmable Scientific Calculator.

SECTION A (MULTIPLE CHOICE) 20 MARKS

1. _____ is where the data and instructions of a computer must reside to be processed. [1]
 - a. HDD
 - b. SSD
 - c. CPU
 - d. RAM

2. There are two types of real-time systems depending on the consequences of missing the deadline. A _____ real-time system risks total system failure if the predicted time deadline is missed. [1]
 - a. Restricted
 - b. Constrained
 - c. Soft
 - d. Hard

3. The Memory Manager, the Interface Manager, the Processor Manager, and the File Manager are the four essential managers of every major operating system. [1]
 - a. True
 - b. False

4. What is a deadline in real time operating system? [1]
 - a. The expected boot time of the system
 - b. The expected shutdown time of the system
 - c. The expected complete execution of a thread
 - d. No correct answer

5. Computers in the mid-1960s were designed with faster CPUs, but they still had problems interacting directly with the relatively slow printers and other I/O devices. The solution was called _____, which introduced the concept of loading many programs at one time and allowing them to share the attention of the single CPU. [1]
 - a. Multiprocessing
 - b. Multitasking
 - c. Multithreading
 - d. Multiprogramming

6. Compaction should always be performed only when there are jobs waiting to get in. [1]
 - a. True
 - b. False

7. Fixed partitions are also called _____ partitions. [1]
 - a. Complete
 - b. Direct
 - c. Static
 - d. Dynamic

8. In a relocatable dynamic partition scheme, the _____ contains a value that must be added to each address referenced in a program so that the system will be able to access the correct memory addresses after. [1]
- Load register
 - Relocation register
 - Compaction register
 - Dynamic register
9. The release of memory space by the Memory Manager is called _____. [1]
- Fragmentation.
 - Relocation
 - Deallocation
 - Free memory.
10. The algorithm used to store jobs into memory in a fixed partition system requires a few more steps than the one used for a single-user system because the size of the job must be matched with the size of the partition to make sure it fits completely. [1]
- False.
 - True.
11. _____ of memory is performed by the operating system to reclaim fragmented sections of the memory space. [1]
- Deallocation
 - Redirection
 - Reallocation
 - Compaction
12. One of the disadvantages of Best-fit allocation strategy is that it is slower in making allocations. [1]
- True.
 - False.
13. Single-user, fixed partition, and dynamic partition memory schemes share unacceptable fragmentation characteristics that were resolved with the development of _____. [1]
- Null entry accounting.
 - Best-fit algorithms.
 - Deallocation.
 - relocatable dynamic partitions.
14. In a paged memory allocation scheme, a simple _____ has one entry for each page frame that shows its location and its free/busy status. [1]
- Memory Management table
 - Job Table
 - Page Access table
 - Memory Map Table

15. Thrashing is a problem that occurs when there are many jobs and many free pages so that pages are being moved around too much. [1]
a. True
b. False
16. The primary advantage of storing programs in non-contiguous locations is that _____. [1]
a. Multiple programs can run at the same time.
b. Every program will be able to run.
c. Secondary storage is accessed more quickly.
d. Main memory is used more efficiently.
17. The term _____ means that during any phase of its execution, a program references only a small fraction of its pages. [1]
a. Locality of reference
b. Structured programming
c. Dynamic paging.
d. Working set
18. Which of the following is one of the advantages of virtual memory. [1]
a. Code and data sharing allowed
b. Programs are stored in non-contiguous page frames
c. Programs are stored in contiguous page frames
d. Inefficient memory usage.
19. To access a location in memory when using segmented memory management, the address is composed of two entries: _____. [1]
a. the segment number and the line number.
b. the segment number, the line number, and the displacement.
c. the segment number and the displacement.
d. the line number and the displacement.
20. Which of the following algorithm is considered hypothetical? [1]
a. FIFO.
b. First-Fit.
c. LRU.
d. Next-Fit.

SECTION B (THEORY) 20 MARKS

1. At minimum what are the four tasks each essential subsystem manager is expected to perform? [4]
2. How does an Operating System differ from a User Software? Give examples of each. [4]
3. Differentiate between virtual memory and cache memory. [2]
4. Compare the characteristics of a CPU-bound process vs. an I/O-bound process. [2]
5. Compare and contrast a process and a thread. [2]
6. Briefly explain the differences between seek time and search time. [2]
7. Is file deallocation important? Explain your answer. [2]
8. Compare and contrast program files and data files. [2]

SECTION C (ALGORITHMS AND COMPUTATIONS) 60 MARKS

1. Given the following: configuration with jobs arriving in order (Job A, B, C) and with blocks shown in order from low order memory to high order memory: **[8]**

Job List:		Memory Block List:	
Job Number	Memory Requested	Memory Block	Memory Block Size
Job A	990K	Block 1	900K
Job B	275K	Block 2	960K
Job C	760K	Block 3	300K

- Use the first-fit algorithm to indicate which memory blocks are allocated to each of the arriving jobs. **[3]**
 - Use the best-fit algorithm to indicate which memory blocks are allocated to each of the arriving jobs. **[3]**
 - Calculate the amount of internal fragmentation in Block 1 using algorithms from question (a) and (b) above. **[2]**
2. Given Job and the Page Map Table (PMT) below, the system dictates that the jobs must be split into equivalents of 40 bytes and the first page is 0, answer the following questions. **[9]**

Job

Byte 0	START
Byte 32	LOAD CATALOGUE
Byte 54	ADD TO CART
Byte 99	REMOVE FROM CART
Byte 105	CHECK OUT
Byte 124	END

PMT

Page	Page Frame
0	4
1	2
2	8
3	12

- a. Compute the starting addresses of the Page Frames in the given PMT? [4]
- b. Compute the page number and exact displacement of the ADD TO CART instruction. [2]
- c. Compute the CHECK OUT instruction's physical address. [3]

3. Given a system with two page frames and using a Least Recently Used (LRU) algorithms to allocate the requested pages accordingly. Answer the following questions. [12]

	Page Requested									
	1	2	1	3	1	2	4	2	1	3
Page Frame A										
Page Frame B										
Interrupt										

- a. Recreate the table and fill in accordingly [10]
- b. Compute the success rate. [2]

4. Given the information below. Use SRT scheduling algorithm to answer the following questions. Note that the concept of aging is used in this system. [5]

Process	Arrival Time	CPU Cycle
P1	0	2
P2	0	4
P3	2	2
P4	4	4

- a. Draw a timeline analysis. [2]
 - b. Calculate turnaround time for each process. [2]
 - c. Calculate the average turnaround time. [1]
5. For the system described below, given that all the 16 devices are of the same type, and using the Banker's Algorithm, answer the following questions: [4]

Job No.	Devices Allocated	Maximum Required
Job 1	5	8
Job 2	3	9
Job 3	4	8
Job 4	2	5

- a. Calculate the number of available devices. [1]
 - b. Determine the remaining needs for each job in the system. [2]
 - c. Determine whether the system is in a safe state or an unsafe state. [1]
6. Consider the description of the system below and answer the following questions per each system: [10]
- Resource A has 2 instances.
 Resource B has 3 instances.
 Resource C has 3 instances.
- 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, two instances of B, and two instance of C.
- a. Draw the resource allocation graph. [6]
 - 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. [1]

7. Consider a 6 track and 5 sectors per track virtual cylinder with the following characteristics: it takes 4 ms to move the read/write head from track to the next, it takes 2 ms for a virtual cylinder to rotate from one sector position to the next, and it takes is 0.2 ms for a read/write head to read/write data in a sector. Calculate the resulting seek time, search time and data transfer time, and total time for the following request list. If the read/write head is at track 0, at the beginning of sector 4, fill in the missing figures in the table below. **[12]**

Track	Sector	Seek Time	Search Time	Data Transfer Time	Total Time
1	0				
1	4				
3	4				
3	0				
5	3				
4	4				

GOOD LUCK!