

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE

BACHELOR OF SCIENCE HONORS DEGREE IN COMPUTER SCIENCE

BACHELOR OF SCIENCE HONORS DEGREE IN SOFTWARE ENGINEERING

BACHELOR OF SCIENCE HONORS DEGREE IN NETWORK ENGINEERING

CS111/NW112/SWE111: OPERATING SYSTEMS CONCEPTS

DURATION: 2HOURS 30 MINUTES

TOTAL MARKS: 100

INSTRUCTIONS TO CANDIDATES

Answer ALL questions.

Question 1

- a) Explain the difference between internal and external fragmentation. [5]
- b) Explain what is meant by the term **swapping**, in memory management. [1]
- c) Consider the following snapshot of jobs in Table 1. Assume all the jobs arrive at 0ms. Execute the jobs below using Round Robin (RR) and Shortest Job First (SJF) scheduling algorithm.

JOB	SERVICE TIME
0	3
1	2
2	1
3	4

Table 1: Jobs for processes

Draw the Gantt charts for each algorithms and the average turn-around time in each case to determine which algorithm shows a better performance. Assume the time slice is 2ms for RR. [10]

d) Explain the difference between segmentation and demand paging. [4]

Question 2

a) A semaphore is a blocking synchronisation primitive. Describe how they work with the aid of pseudo-code. You can assume the existence of a thread_block () and a thread_wakeup () function. [5]

b) Define the difference between pre-emptive and nonredemptive scheduling. [2]

i. State why strict nonpreemptive scheduling is unlikely to be used in a computer centre. [2]

c) Compare I/O based on polling with interrupt-driven I/O. In what situation would you favour one technique over the other? [5]

d) List the sequence of steps that occur when a page fault occurs. [4]

e) Explain mutual exclusion in the context of Operating Systems. [2]

Question 3

a) One major problem about process synchronization is called "Race Condition". Explain what Race Condition is and how it can be prevented. [4]

b) When a page faulty occurs, the operating system has to choose a page to remove from memory to make room for the page that has to be removed. Explain any two-page replacement algorithms. [6]

c) A computer system has a main memory of 1 MB and a virtual address space of 16 MB. The disk block size is 1KB. With help of a complete diagram, briefly describe how the Memory Management Unit maps a virtual address to a physical address. [7]

d) A Process Control Block (PCB) represents each process in the operating system. List and describe three pieces of information found in the Process Control Block. [3]

Question 4

- a) An operating system uses the banker's algorithm for deadlock avoidance when managing the allocation of three resource types X, Y and Z to three processes P0, P1 and P2. Table 2 given below presents the current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution.

	Allocation			Max		
	X	Y	Z	X	Y	Z
P0	0	0	1	8	4	3
P1	3	2	0	6	2	0
P2	2	1	1	3	3	3

Table 2: Resource Allocation

There are 3 units of type X, 2 units of type Y and 2 units of type Z still available. The system is currently in safe state. Consider the following independent requests for additional resources in the current state.

REQ1: P0 requests 0 units of X, 0 units of Y and 2 units of Z

REQ2: P1 requests 2 units of X, 0 units of Y and 0 units of Z

- Which Request (REQ) can be granted illustrate your answer? [10]
- b) Explain the Linked Allocation of disk space to files. [2]
- c) The key issue in implementing files is keeping tracks of which disk blocks go with the file. Describe four methods for the file system implementation. [8]

Question 5

- With the aid of a diagram illustrate the Linux file structure. [6]
- Examine the relationship between Linux and UNIX. [2]
- If Linux is not using all the memory installed, how do you make it use the rest? [6]
- Explain how do you do the following in a Linux environment.

- i. display the permissions for a file or directory. [3]
- ii. change permissions. [3]

****THE END****