

**THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING**



ECX 5235 – OPERATING SYSTEMS

FINAL EXAMINATION – 2014 / 2015

(CLOSED BOOK TYPE)

Date: 30th, August 2015

Time: 0930-1230 hrs

INSTRUCTIONS TO CANDIDATE:

- i.) This question paper contains eight (8) questions.
- ii.) Answer any five questions. All questions carry equal mark.
- iii.) Assume reasonable values or any suitable assumptions for any data not given in or if any doubt as to the interpretation of the wording of a question. Clearly state such assumptions made on the script.
- iv.) You are allowed to use scientific calculators during the exam.
- v.) You are NOT allowed to use any study material or any other electronic resource during the examination.

Question 1

i.) It is not enough for each manager of an operating system to perform its individual tasks. Let's say a user types a command to execute a program. What are the steps involved by different managers in sequence to perform the task.

[04 Marks]

ii.) Briefly explain by giving an example of each of the following.

- a) Exception
- b) Input/output interrupt
- c) System Call

[06 Marks]

iii.) What is a microkernel and state at least one advantage and one disadvantages of the microkernel approach?

[06 Marks]

iv.) What is the difference between a monolithic kernel based OS and a microkernel based OS?

[04 Marks]

Question 2

Memory requirements for a series of processes are given below;

Process No.	Memory Requirement (kB)
P1	150
P2	60
P3	620
P4	50
P5	25
P6	650
P7	515

Available memory is 2MB. Processes will be requested in the sequence of P1, P2, P3..... P7.

i.) Compute *internal* and *external fragmentation* under *best fit* and *first fit* allocations for the following memory allocation schemes

- *single user contiguous scheme*
- *fixed partitions* and
- *dynamic partitions*

[12 Marks]

ii.) Decide which memory placement strategy is suitable to serve the above requirement. Draw suitable diagrams to justify your answer. You are expected to write down the assumptions you make.

[08 Marks]

Question 3

Consider the following scenario which many processes compete for relatively few resources and the system is unable to service all of the processes in the system. The operating system makes sure that all requested resources are available and allocated to a process before moving the process to the READY queue. The system does not release these resources until the process is completed.

A list of available resources with the number of instances available and the possibility of sharing among the processes are given below.

Resource	No. of instances	Access
R1	2	Non sharable
R2	1	Sharable
R3	1	Non sharable

The following sequence of events has occurred when allocating the resources to perform a function of a processor. "P" indicates a process and "R" indicates the resources mentioned above.

Event	Action
1	P1 requests R1
2	P2 requests R1
3	P1 gets R1
4	P2 gets R1
5	P3 requests R2
6	P3 gets R2
7	P2 requests R2

Event	Action
8	P2 gets R2
9	P2 releases R2
10	P3 requests R1
11	P1 requests R3
12	P1 gets R3
13	P3 requests R3

i.) Draw a directed resource graph to analyze the above scenario.

[05 Marks]

ii.) State one way to prevent a possible deadlock.

[06 Marks]

iii.) Is this system, as a whole, deadlocked?

If "yes", justify your answer.

If "not", is there any action next which could cause a system deadlock? Justify your answer.

[05 Marks]

iv.) Illustrate the following four conditions by giving suitable examples for each.

[04 Marks]

- (a) Mutual exclusion
- (b) Resource holding

Question 4

- i.) Why is it important for the scheduler to distinguish I/O bound programs from CPU bound programs?

[02 Marks]

- ii.) Scheduling is done in Microsoft Windows versions based on the "Priority Scheduling" with Multiple Queues algorithm. Windows desktop editions use a time quantum of 6 cycles while Windows Server edition use a time quantum of 12 cycles.

Why is it desirable to have a long time quantum in Windows Server edition than in the Windows desktop edition?

[06 Marks]

- iii.) Consider a system running ten I/O bound tasks and one CPU bound task. Assume that the I/O bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context switching overhead is 0.1 millisecond and that all processes are long running tasks.

What is the CPU utilization for a round robin scheduler when

- a.) The time quantum is 1 millisecond

[06 Marks]

- b.) The time quantum is 10 milliseconds

[06 Marks]

Question 5

- i.) State at least two advantages of using *paging* in operating systems?

[02 Marks]

- ii.) What is the major difference between paged memory allocation and segmented memory allocation schemes?

[04 Marks]

- iii.) What is the cause of thrashing?

[02 Marks]

- iv.) How does the system detect thrashing? Once it detects thrashing what should the system do to eliminate this problem?

[04 Marks]

- v.) Briefly describe the difference between logical and physical address space and explain the process of swapping.

[04 Marks]

- vi.) Describe virtual memory and the importance of it in relation to memory management.

[4 Marks]

Question 6

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i.) What is a page fault? Briefly explain the steps involved in handling a page fault.

[04 Marks]

ii.) Memory paging is a feature that permits extending the address space far beyond the available memory. [X] and [Y] denotes different addresses. Name the components given as [X], [Y] and [Z] in the following diagram (Figure 1).

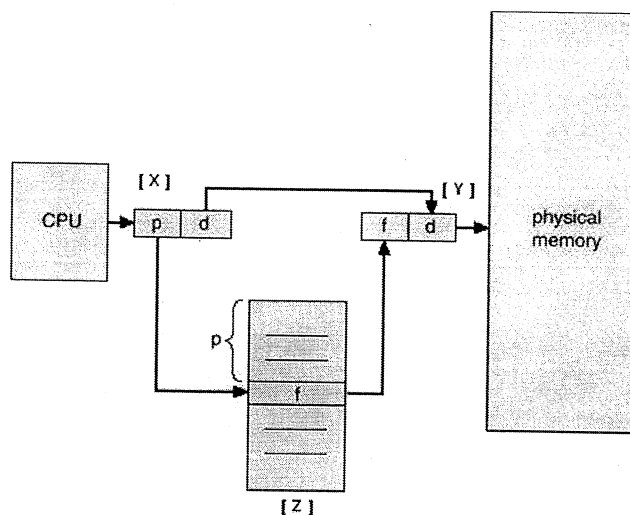


Figure 1: Memory Paging

[06 Marks]

iii.) Page size is one of the parameters of a virtual memory. State one advantage and one disadvantage of choosing a large page size rather than a small one.

[04 Marks]

iv.) The following diagram (Figure 2) depicts CPU utilization vs degree of multiprogramming. Focus on the regions shown by (A) and (B) and describe the reasons for such a behavior.

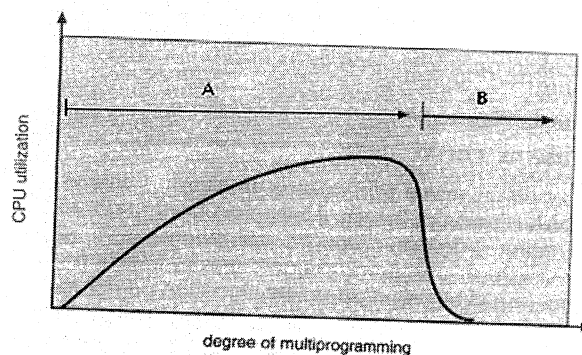


Figure 2: CPU Utilization vs Degree of multiprogramming

[06 Marks]

Question 7

i.) What is **the most significant limitation** of the Network-Operating System?

[06 Marks]

ii.) How does a distributed operating system view the computer system? Briefly explain.

[06 Marks]

iii.) Write a pseudo code program to illustrate the prevention of circular waits in distributed operating system.

[08 Marks]

Question 8

i.) Briefly describe the key aspects of a security system.

[04 Marks]

ii.) Explain the following terms related to system security?

- a) System Survivability (2 marks)
- b) Social Engineering (2 marks)
- c) System Protection Methods (2 marks)
- d) Phishing (2 marks)

i) If you are a system administrator for a network how are you going to address the above issues with regard to the role of the operating system in security?

[08 Marks]