

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



ECX 5235 – OPERATING SYSTEMS

FINAL EXAMINATION – 2012 / 2013

(CLOSE BOOK TYPE)

Date: 09th, August 2013

Time: 0930-1230 hrs

INSTRUCTIONS TO CANDIDATE:

- This paper consists of two (2) sections SECTION A and SECTION B in six (6) pages.
- SECTION A has two (2) mandatory questions. Answer the two questions
- SECTION B has six (6) questions, the total marks allocated to each question is equal. Answer any three (3) questions.
- 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.

SECTION A

Answer all questions in this section.

Question 1 (Marks: 30) Compulsory Question

- a) Graphically illustrate the instruction life cycle. Briefly describe how the instruction fetch and execution happens. (Marks 6)
- b) What are the differences between a trap and an interrupt? Briefly describe how these differences become useful? (Marks 8)
- c) What is the purpose of having a bootstrap loader in an operating system? List down the steps that a typical boot sequence involves. (Marks 8)
- d) Distinguish “Monolithic kernel” and “Microkernel”. State at least one advantage and a disadvantage of Microkernel over Monolithic kernel. (Marks 8)

Question 2(Marks: 10) Compulsory Question

Write the most appropriate short answer (word / phrase) for the following questions in your answer script. It is NOT required to attach the exam paper.

1. _____ is the efficient mechanism used for moving large amounts of data between I/O devices and main memory.
2. A process in the _____ state is loaded into main memory and available for execution.
3. _____ is a technique that allows the execution of processes which are not completely available in physical memory.
4. The problem of, the processor spending the most of its time swapping pages and doing little productive work is called _____.
5. A _____ is an operating system architecture where the entire operating system is working in kernel space and runs only in supervisor mode.
6. _____ that runs on a server provides server the capability to manage data, users, groups, security, applications, and other networking functions.
7. The process of putting data of various I/O jobs in a buffer, which is a special area in memory or hard disk which is accessible to I/O devices, is called _____.
8. A _____ is defined as an entity which represents the basic unit of work to be executed in a system.
9. _____ is a flow of execution through the process code, with its own program counter, system registers and stacks.
10. An address generated by the _____ is a logical address whereas address actually available on memory unit is a physical address.

(Marks 1 x 10)

SECTION B

Answer any three (3) questions in this section

Question 3 (Marks: 20)

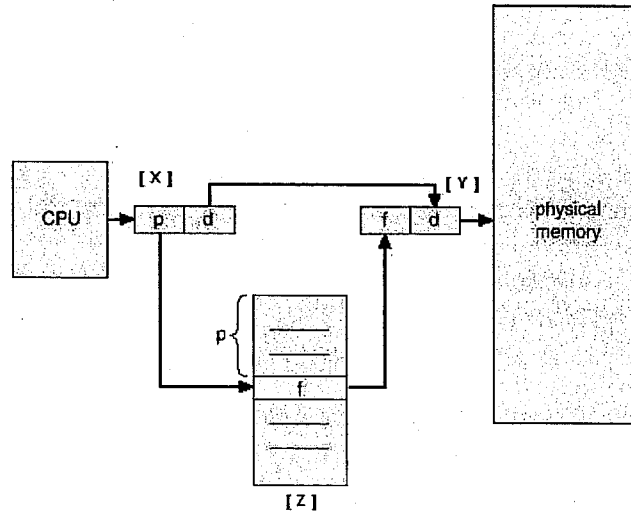
- a) What is scheduling and why is it important? (Marks 4)
- b) Distinguish job scheduling and process scheduling? (Marks 4)
- c) There are four processes A, B, C and D with execution times of 5ms, 6ms, 2ms and 4 ms respectively arrived at the same time in the order of A, B, C and D.
- Calculate the average execution time and average turnaround time for each process, if the scheduling algorithm is shortest job first. (Marks 4)
 - Calculate the average execution time and average turnaround time for each process, if the scheduling algorithm is first come first served. (Marks 4)
 - Based on answers to (i) and (ii) what is the most appropriate scheduling algorithm? Justify your answer. (Marks 4)

Question 4 (Marks: 20)

- a) How is a process represented in an operating system? Write down any five types of information included in a specific process. (Marks 6)
- b) Show the state diagram and state transition of a process. (Marks 5)
- c) Explain the fundamental differences between the UNIX *fork()* and Windows *CreateProcess()* functions. (Marks 4)
- d) Describe the actions taken by a kernel to carryout context switching between processes. (Marks 5)

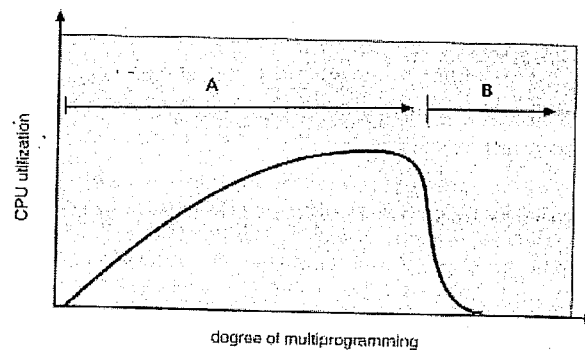
Question 5 (Marks: 20)

- a) What is a page fault? Briefly explain the steps involved in handling a page fault. (Marks 4)
- b) 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 and describe how the extension of the address space happens.



(Marks 6)

- c) 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. (Marks 4)
- d) The following diagram depicts CPU utilization vs degree of multiprogramming. Focus on the regions shown by (A) and (B) and describe the reasons for such a behavior.



(Marks 6)

Question 6 (Marks: 20)

- a) Name and briefly explain at least four methods by which programs cause security breaches. (Marks 4)
- b) How do program threats differ from system threats and network threats? (Marks 6)
- c) State two benefits and two drawbacks of using operating system authentication. (Marks 4)
- d) Buffers are used to achieve better synchronization of movement of data between relatively slow I/O devices and a very fast CPU.
- i. How do bounded buffers differ from unbounded buffer? (Marks 4)
 - ii. Explain the bounded buffer problem. (Marks 2)

Question 7 (Marks: 20)

- i. Consider a system that supports contiguous, linked and indexed file allocation methods. Describe what criteria should be used in deciding which strategy can be best utilized for a particular file. (Marks 8)
- ii. Briefly explain Mounting and Unmounting File Systems operations using suitable file directory tree structure. (Marks 4)
- iii. What is the importance of mounting a USB device to a defined mount point? (Marks 4)
- iv. State two notable benefits that NFS can provide. (Marks 4)

Question 8 (Marks: 20)

Consider the following table where “P” indicates a process and “R” indicates a resource.

Time	Action
1	P1 requests R1, and R1 is allocated to P1
2	P2 requests R3, and R3 is allocated to P2
3	P3 requests R4, and R4 is allocated to P3
4	P1 requests R2, and R2 is allocated to P1
5	P2 requests R1
6	P1 releases R1, and is allocated to P2
7	P3 requests R1
8	P1 requests R3
9	P1 requests R4
10	P2 releases R3, and is allocated to P1

- i. Use Holt's deadlocks modeling method/ resource allocation graph to analyze the above scenario. (Marks 4)
- ii. What are the conditions need to be checked for identifying deadlocks? Describe them briefly. Is there a deadlock in the above system? Justify your answer. (Marks 10)
- iii. Describe race condition and starvation by giving appropriate examples. (Marks 6)