00049

THE OPEN UNIVERSITY OF SRI LANKA
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Bachelor of Technology Honours in Engineering

Final Examination (2016/2017)
ECX5235: Operating Systems

Date: 21st November 2017 (Tuesday) **Time: 1:30 pm – 4:30 pm**

---

1. This paper contains seven (7) questions. Answer any five (5) questions. All questions carry equal marks.
2. 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.
3. You are allowed to use scientific calculators during the exam.
4. You are NOT allowed to use any study material or any other electronic resource during the examination.

Q1.

a) State why it is important for the scheduler to distinguish I/O bound programs from CPU bound programs.

[03 Marks]

b) "CPU scheduling is the basis of multiprogrammed Operating Systems". Do you agree with this statement? Justify your answer.

[03 Marks]

c) Which of the following scheduling algorithms could result in starvation? Justify your answer.
   a. First-Come, First-Served(FCFS)
   b. Shortest Job First(SJF)
   c. Round Robin(RR)
   d. Priority scheduling

[05 Marks]

d) Consider the following set of processes, with the length of the CPU burst given in milliseconds. The processes are assumed to have arrived in the order P1,P2,P3,P4 and P5, at time 0.

Process	CPU Burst Time
P1	10
P2	1
P3	2
P4	1
P5	5

a. Draw Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF and RR(time quantum=1). State all the assumptions.

[03 Marks]

b. What is the turnaround time for each process for each of the scheduling algorithm in part a.

[03 Marks]

c. Which of the algorithms results in the minimum average waiting time over all processes?

[03 Marks]

Q2.

a) Briefly explain what is spooling including how advanced personal computers use spooling as a standard feature.

[04 Marks]

b) On early computers, every byte of data read or written was directly handled by the CPU without the use of Direct Memory Access(DMA). Briefly explain the advantage of using DMA over not using DMA.

[06 Marks]

c) The following *Figure 2.1* shows a simplified layout of a process inside main memory. Briefly explain what is loaded in each section.

[04 Marks]

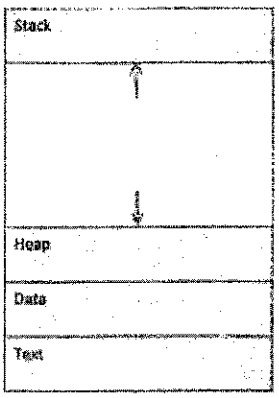

Figure 2.1 : A simplified layout of a process inside main memory

d) System call *fork()* is used to create processes. It takes no arguments and returns a process ID. The purpose of *fork()* is to create a new process, which becomes the child process of the caller. After a new child process is created, both processes will execute the next instruction following the *fork()* system call. Therefore, we have to distinguish the parent from the child. Briefly explain how the parent process and the child process can be distinguished by giving examples.

[06 Marks]

Q3.

a) List four factors that should be considered when designing an Operating System. Briefly explain the importance of considering each of these factors.

[04 Marks]

b) Illustrate the two techniques that can be used to request kernel services when executing a program in user mode in a diagram. Briefly explain the diagrams.

[06 Marks]

c) Distinguish Microkernel over monolithic kernel.

[04 Marks]

d) Briefly explain the differences between each of the following operating system type, one advantage and a disadvantage for each.
   a. Batch Operating System
   b. Time Sharing Operating System
   c. Distributed Operating System
   d. Network Operating System

[06 Marks]

Q4.

a) Explain the behavior of the graph given in Figure 4.1 including the following.
   a. How CPU utilization goes up with the degree of multiprogramming.

[05 Marks]

   b. Reason(s) for the rapid drop in CPU utilization beyond point **A** in the Figure 4.1.

[05 Marks]

   c. A term for the scenario occurring beyond point **A** in the Figure 4.1.

[02 Marks]

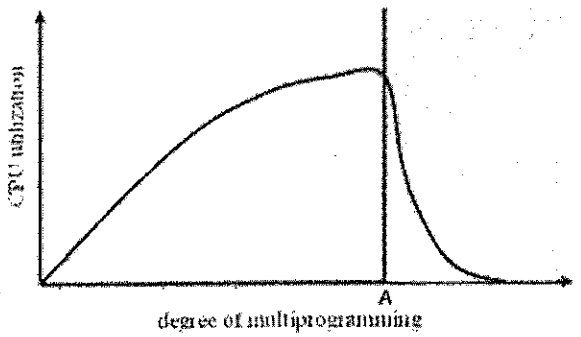

Figure 4.1 : CPU Utilization of a system against the number of programs running simultaneously

b) Distinguish the following
   a. Process vs Thread
   b. User thread vs Kernel thread
   c. Many to one thread model vs Many to many thread model

[06 Marks]

c) State at least two issues in multithreading.

[02 Marks]

Q5.

a) Distinguish *Program Threats* from *System Threats* using examples for each.

[04 Marks]

b) Briefly explain the following terms related to system security
   a. System Survivability
   b. Social Engineering
   c. Phishing
   d. Port Scanning

[08 Marks]

c) Consider locally networked computer laboratory at a large school which is not connected to Internet. What kind of security problems that can exist there? State all the assumptions.

[04 Marks]

d) Suggest solutions to the security problems listed in the part **c** above under the given four categories.
   a. Physical
   b. Human
   c. Operating system
   d. Network

[04 Marks]

Q6.

Consider the following snapshot of a system at time T0. The system is with five processes P0 through P4 and three resource types A, B and C. Resource type A has ten instances, resource type B has five instances and resource type C has seven instances.

	Allocation			**Max**			**Available**		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

a) What is the content of the matrix *Need?*

[04 Marks]

b) Is the system in a safe state?

[05 Marks]

c) Suppose a request from process P2 arrives for (0,0,1). Can the request be granted immediately? Explain.

[05 Marks]

d) Briefly explain the advantages of using Bankers algorithm comparing to wait-die and wound-wait algorithms.

[06 Marks]

Q7.

a) Given five memory partitions of 100kB, 500kB, 200kB, 300kB and 600kB in order.

a. How would the first-fit, best-fit and worst-fit algorithms place processes of 212kB, 417kB, 112kB and 426 kB in order? Illustrate the answers with suitable diagrams. State the assumptions you make.

[06 Marks]

b. Which algorithm makes the most efficient use of memory? Justify your answer explaining in terms of internal and external fragmentation which could occur.

[06 Marks]

b) Briefly explain how paging can be used as a solution to external fragmentation problem using the following figure.

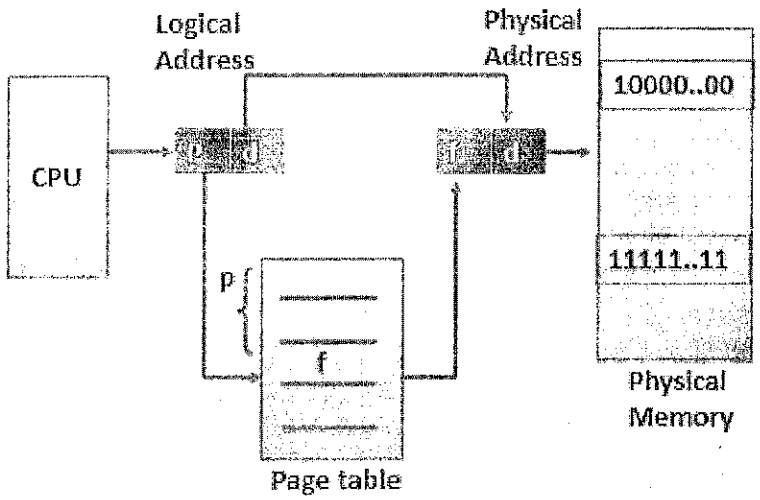

Figure 7.1 : Paging

[05 Marks]

c) Briefly explain how Translation Look-aside Buffer(TLB) is used to enhance paging.

[03 Marks]