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Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Computer Systems & Network Engineering

Final Examination
Year 2, Semester 2 (2022)

IE2050 – Operating Systems

Duration: 2 Hours

November 2022

Instructions to Candidates:

- This paper has 4 questions.
- Answer all questions in the booklet given.
- The total marks for the paper is 100.
- This paper contains 4 pages, including the cover page.
- Calculators are allowed but electronic devices capable of storing and retrieving text are not allowed.

Question 1 (25 marks)

a. Draw the state diagram of a process from its creation to termination, including all transitions, and briefly elaborate every state and every transition. (10 marks)

b. Enumerate what is meant by semaphore wait/signal. (4 marks)

c. Security and Protection are some of the major roles of an operating system. What is the difference between Security and protection? (4 marks)

d. Micro-kernel moves most of the kernel into user space. List three advantages of Micro-kernels: (3 marks)

e. List two different definitions of the operating system. (4 marks)

Question 2 (25 marks)

a. Five processes A, B, C, D and E arrived in this order at the same time with the following CPU burst and priority values. A smaller value means a higher priority. Fill the entries of the following table with waiting time and average waiting time for each indicated scheduling policy and each process. Ignore context switching overhead. (20 marks)

	CPU Burst	*Priority*
A	4	2
B	6	4
C	2	1
D	5	3
E	3	5

Scheduling Policy	*Waiting Time*					*Average Waiting Time*
	A	*B*	*C*	*D*	*E*	
First-Come-First-Served						
Non-Preemptive Shortest-Job First						
Priority						
Round-Robin (time quantum=2)						

b. Briefly explain what is meant by interrupt latency and how it affects real time systems. (5 marks)

Question 3 (25 marks)

a. What are the necessary conditions for a deadlock to occur? Name these conditions and provide an elaboration. (8 marks)

b. Consider the following snapshot of a system with four resource types R1, R2, R3 and R4, and four processes A, B, C and D. (8 marks)

	Allocation				*Request*				*Available*			
	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4
A	1	0	1	1	0	1	0	0	0	0	0	0
B	1	1	0	0	0	1	1	0				
C	1	0	1	1	0	0	0	0				
D	0	0	0	0	1	0	1	0				

i. Is the system in a deadlock state? If the system is in a deadlock state, list all processes that involve in a deadlock. Show your computation step-by-step.

c. From a hard disk's perspective, what are the three components that make up the data accessing time? Briefly describe the meaning of each component. (5 marks)

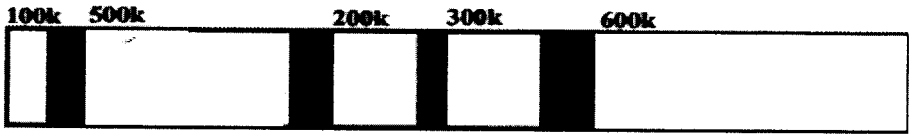
d. What are the different Accessing Methods of a File? (4 marks)

Question 4 (25 marks)

a. Define external and internal fragments. (2 marks)

b. Consider the following memory management schemes: fixed-size partitions, variable-size partitions, and paging. Which schemes have external fragments, and which schemes have internal fragments? Why? Note that there are three questions. Elaborate your answer. (6 marks)

c. Given memory holes (i.e., unused memory blocks) of 100K, 500K, 200K, 300K and 600K (in address order) as shown below, how would each of the first-fit, best-fit and worst-fit algorithms allocate memory requests for 290K, 420K, 110K and 350K (in this order)? The shaded areas are used/allocated regions and are not available. Write your answer into the following diagrams. You should clearly write down the size of each memory block and indicate its status (i.e., allocated or free). (12 marks)



d. A paging system uses 16-bit address and 4K pages. The following shows the page tables of two running processes, Process 1 and Process 2. Translate the logical addresses in the table below to their corresponding physical addresses and fill the table entries with your answers. Consider the logical address 11034 generated by process 1. (5 marks)

Process 1

0	3
1	7
2	1
3	5

Process 2

0	2
1	0
2	6
3	4

Process	*Address*	*Page #*	*Offset*	*Physical Address*
Process 1	11,034			
Process 2	12,345			

--End of the Question Paper--