Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90071

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fourth Semester

Computer Science and Design

AL 3452 — OPERATING SYSTEMS

(Common to: Computer Science and Engineering (Artificial Intelligence and Machine Learning)/Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. OS is designed in different ways. In what ways modular kernel approach is similar to the layered approach? In what way they differ?

2. Under what circumstances would a user be better off using a time sharing system rather than a PC or a single – user workstation?

3. What is suspended state? List the reasons for suspending the process.

4. How process differs from threads?

5. Differentiate internal and external fragmentation.

6. Consider a logical address space of 8 pages of 1024 words mapped into memory of 32 frames. (a) How many bits are there in the logical address? (b) How many bits are there in physical address?

7. What type of file organization is used for the following situations with respect to efficient usage of CPU time?

   (a) Update the records one by one

   (b) Access the record directly by key

   And write about the merits and demerits of these types of file organization.

8. Why is the average search time to find a record in a file is less for an indexed sequential file than for a sequential file?

9. What do you mean by virtualization?

10. Compare the features of Android and iOS.

PART B — (5 × 13 = 65 marks)

11. (a) What you do mean by System calls? How operating system makes use of these system calls? Simple system calls (eg: getpid) are generally invoked. What is sequence of steps involved in providing the result, from the point of calling the function in the C library to the point where that function returns?

Or

(b) Describe in detail the four generations of computing and how operating systems developed as a result.

12. (a) (i) Explain the state transitions of the process in 7-state model. (8)

(ii) What is the state of process in the following situations? Explain them in detail. (5)

(1) Process ID is created

(2) Fopen is executed

(3) Load A instruction is executed and the page containing A is not found in the main memory.

(4) The process creation cannot be denied by the OS, but there is no space to create process in the main memory

(5) The process is waiting for file to open, meanwhile the OS executed medium-term scheduler

Or

(b) Explain the types of threads. If a thread is blocked, what happen to the process and other threads? Explain your answer by considering the scenario for all types of threads.

13. (a) (i) A process has four page frames allocated to it. The time of the last loading of a page into page frame, the time of last access to the page in each page frame, virtual page # in each page frame, R-bit and M-bit from each page frame are shown

Virtual page #	Page frame	Time loaded	Time referenced	R bit	M bit
2	0	60	161	0	1
1	1	130	160	0	0
0	2	26	162	1	0
3	3	20	163	1	1

A page fault occurred for virtual page 4. Which page will be selected as victim page using (1) FIFO (2) LRU (3) Clock (7)

(ii) Consider the following page reference string: 4, 0, 0,0, 2, 4, 2, 1, 0, 3, 2

How many page faults would occur if the resident set size is 3 using LRU stack and counter algorithm? (6)

Or

(b) (i) Consider the following memory snapshot: (6)

100 K Free	Process A	500 K Free	Process B	200 K Free	Process C	300 K Free	Process D	600 K Free

In which partition the process 215k, 450k, 200k and 500k are allocated using

Fixed partition unequal sized using single queue

Fixed partition unequal sized using separate queue

Dynamic partition using first-fit, best-fit, next-fit, worst-fit and quick-fit

(ii) Explain segmentation in detail. (7)

14. (a) Explain about the directory structure and the record blocking.

Or

(b) If the request sequence is 98, 183, 122, 14, 124, 65, 67 and the current servicing is at cylinder 53. Explain about the number of disk movements using FIFO, SSTF, SCAN, C-LOOK algorithms.

15. (a) Discuss in detail various types of virtual machines and its implementation.

Or

(b) Discuss in detail the features of mobile OS – iOS and Android with respect to process and memory management.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Illustrate the difference between deadlock starvation and race condition using a simple scenario? A resource allocation system that uses the Banker's algorithm for 3 resource types (A, B, C) and 5 users (P0, P1, P2, P3, P4) is currently in the following state.

Alloc: resources held by each user.

Max: max need of each user.

Reg: ongoing request of each user.

Avail: free resources.

AVAIL: A: 3, B:3, C:2

	ALLOC			MAX			REQ			NEED		
	A	B	C	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	2	2	7	4	3
P1	2	0	0	3	2	2	0	2	1	1	2	2
P2	3	0	2	9	0	2	6	0	0	6	0	0
P3	2	1	1	2	2	2	0	1	0	0	1	1
P4	0	0	2	4	3	3	4	3	1	4	3	1

(i) Is the state safe. If you answer yes, give a sequence of process ids that leads to all processes completed. If you answer no, give a sequence of activities that results in a deadlocked state.

(ii) Is there an ongoing request other than P2's that cannot be granted immediately. Justify your answer.

Or

(b) Name five major activities of an OS with respect to process management, and briefly describe why each is required. Explain about the current process states and its transition state in the following situation.

(i) A PCB of the highest priority process is being initialized

(ii) A process is waiting for CPU to be allocated in HDD

(iii) A process gets interrupted because of I/O completion of another lowest priority blocked process.

(iv) A KLT of a process issues blocking system call

(v) A process with priority 5 is created where the process with priority 4 is being executed. (Larger the number higher the priority)