Question Paper Code : 50902

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fourth Semester

Computer Science and Engineering

CS 3451 – INTRODUCTION TO OPERATING SYSTEMS

(Common to : Information Technology)

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How does an interrupt differ from a trap?

2. What is the purpose of system calls?

3. Define the process states.

4. What are the threading issues?

5. What is the purpose of paging the page tables?

6. Define the benefits of virtual memory.

7. Write short notes on free space management.

8. State the functions of file system.

9. What is paravirtualization?

10. What is the major design goal for the android platform?

PART B — (5 × 13 = 65 marks)

11. (a) (i) What is the main difficulty that a programmer must overcome in writing an operating system for a real-time Environment?   (7)

        (ii) Describe three general methods for passing parameters to the operating system.   (6)

Or

(b) (i) Consider a computing cluster consisting of two nodes running a database. Describe two ways in which the cluster software can manage access to the data on the disk. Discuss the benefits and disadvantages of each. (7)

(ii) List five services provided by an operating system, and explain how each creates convenience for users. In which cases would it be impossible for user-level programs to provide these services? Explain your answer. (6)

12. (a) (i) Describe how processes are created and terminated in an operating system. (7)

(ii) Give an example of a situation in which ordinary pipes are more suitable than named pipes and an example of a situation in which named pipes are more suitable than ordinary pipes. (6)

Or

(b) (i) Describe how deadlock is possible with the dining-philosopher's problem. (7)

(ii) Consider the following snapshot of a system. (2+2+2)

	Allocation	Max	Available
	ABCD	ABCD	ABCD
T_0	0012	0012	1520
T_1	1000	1750	
T_2	1354	2356	
T_3	0632	0652	
T_4	0014	0656	

Answer the following questions using the banker's algorithm:

(1) What is the content of the matrix Need?

(2) Is the system in a safe state?

(3) If a request from thread T1 arrives for (0,4,2,0) can the request be granted immediately

13. (a) (i) Explain the difference between internal and external fragmentation. (7)

(ii) On a system with paging, a process cannot access memory that it does not own. Why? How could the operating system allow access to additional memory? Why should it or should it not? (6)

Or

(b) (i) Illustrate how pages are loaded into memory using demand paging. (7)

(ii) Under what circumstances do page faults occur? Describe the actions taken by the operating system when a page fault occurs. (6)

14. (a) (i) Is disk scheduling, other than FCFS scheduling, useful in a single-user environment? Explain your answer. (7)

    (ii) Describe three circumstances under which blocking I/O should be used. Describe three circumstances under which nonblocking I/O should be used. (6)

Or

(b) (i) Consider a file system in which a file can be deleted and its disk space reclaimed while links to that file still exist. What problems may occur if a new file is created in the same storage area or with the same absolute path name? How can these problems be avoided? (7)

    (ii) Contrast the performance of the three techniques for allocating disk blocks (contiguous, linked, and indexed) for both sequential and random file access. (6)

15. (a) (i) Describe four virtualization-like execution environments, and explain how they differ from "true" virtualization. (7)

    (ii) Why are VMMs unable to implement trap-and-emulate-based virtualization on some CPUs? Lacking the ability to trap and emulate, what method can a VMM use to implement virtualization? (6)

Or

(b) (i) Describe the three types of traditional hypervisors. (7)

    (ii) Discuss about the mobile operating system with suitable example. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Assume that a program has just referenced an address in virtual memory. Describe a scenario in which each of the following can occur. (If no such scenario can occur, explain why) (3+4+4+4)

    (i) TLB miss with no page fault

    (ii) TLB miss with page fault

    (iii) TLB hit with no page fault

    (iv) TLB hit with page fault

Or

(b) Apply the (i) FIFO, (ii) LRU, and (iii) optimal (OPT) replacement algorithms for the page-reference strings: (5+5+5)

    4, 2, 1, 7, 9, 8, 3, 5, 2, 6, 8, 1, 0, 7, 2, 4, 1, 3, 5, 8

    Indicate the number of page faults for each algorithm assuming demand paging with three frames.

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