

OPERATING SYSTEMS

Subject Code: **CS403ES**

Regulations : R16 - JNTUH

Class: II Year B.Tech CSE II Semester



Department of Computer Science and Engineering

BHARAT INSTITUTE OF ENGINEERING AND

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OPERATING SYSTEMS (CS403ES)

COURSE PLANNER

Course Overview:

This course will introduce the core concepts of **operating systems**, such as processes and threads, scheduling, synchronization, memory management, file **systems**, input and output device management and security. ... The goal of the programming assignments is to give students some exposure to **operating system** code.

Objective and Relevance

To understand the basic computer organization, operating system structures, processes and threads.

Course Purpose

This course OPERATING SYSTEMS is an essential part of any Computer-Science education. The purpose of this course is to understand the mechanisms of the Operating Systems like Process Management, Process Synchronization, Memory Management, File System Implementation, Storage Structures used in OS and Protection Principles. How effectively the OS is utilizing the CPU resources with the help of these mechanisms.

Course Outcome

S. No.	Course Outcomes (CO)	Blooms Taxonomy
After completing this course the student must demonstrate the knowledge and ability to:		
CO1	Apply optimization techniques for the improvement of system performance.	L3:Apply
CO2	Ability to understand the synchronous and asynchronous communication mechanisms in their respective OS.	L2:Understand
CO3	Learn about minimization of turnaround time, waiting time and response time and also maximization of throughput with keeping CPU as busy as possible.	L1:Knowledge
CO4	Ability to compare the different OS	L5:Evaluate
CO5	Ability to understand the concepts of input/ output, storage and file management	L2:Understand

Pre –Requisites: Basic idea about the operating systems functionality.

How Program Outcomes are Assessed:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments, Tutorials, Mock Tests

Program Outcomes (PO)		Level	Proficiency assessed by
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments, Tutorials
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Assignments, Tutorials, Mock Tests
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Assignments, Tutorials, Mock Tests
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Assignments, Tutorials, Mock Tests
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	-	-
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	-
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	-	-
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	-
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	-	-

- End-of-course surveys (Quarterly).
- Instructor evaluation reports (Quarterly).
- Department performance report (Quarterly).
- Student exit survey (Yearly).
- Alumni survey (Yearly).
- Alumni Advisory Board (Once or twice yearly).
- Student Advisory Committee (Once or twice yearly).

How Program Specific Outcomes are Assessed:

Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO1	Software Development and Research Ability: Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms. Use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.	3	Assignments, Tutorials, Mock Tests
PSO2	Foundation of mathematical concepts: Ability to apply the acquired knowledge of basic skills, principles of computing, mathematical foundations, algorithmic principles, modeling and design of computer-based systems in solving real world engineering Problems.	2	Assignments, Tutorials
PSO3	Successful Career: Ability to update knowledge continuously in the tools like Rational Rose, MATLAB, Argo UML, R Language and technologies like Storage, Computing, Communication to meet the industry requirements in creating innovative career paths for immediate employment and for higher studies.	3	Assignments, Tutorials, Mock Tests

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

- Employer satisfaction survey (Yearly)
- Alumni survey (Yearly).
- Placement records, higher education records

Course Contents

JNTU Syllabus

UNIT - I

Operating System Introduction: Overview-Introduction-Operating system objectives, User view, System view, Operating system definition ,Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments. Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT – II

Process and CPU Scheduling- Process concepts-The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(),exec(),wait(),exit(), Interprocess communication-ordinary pipes and named pipes in Unix. Process Scheduling-Basic concepts,

Scheduling Criteria, Scheduling algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Thread scheduling, Linux scheduling and Windows scheduling. Process Synchronization, Background, The Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization in Linux and Windows.

UNIT- III

Memory Management and Virtual Memory- Memory Management Strategies- Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table, IA-32 Segmentation, IA-32 Paging. Virtual Memory Management-Background, Demand Paging, Copy-on-Write, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, Virtualmemory in Windows.

UNIT- IV

File System Interface- Storage Management-File System- Concept of a File, System calls for file operations – open (), read (), write (), close (), seek (), unlink (), Access methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection. File System Implementation - File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance. Mass Storage Structure – Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap space Management

UNIT - V

Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock. Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection..

RELEVANT SYLLABUS FOR GATE

Operating System: Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

RELEVANT SYLLABUS FOR IES: NA

LESSON PLAN:

Lect u r e N o	Wee k	Topics	Learning out comes	Teaching Metho dology	References
UNIT -I					
1.	1	Overview-Introduction ,Operating System Objectives, User view, System view	Know about operating system	Chalk and talk	T1
2.		Operating system definition, Computer System Organization Computer	Define OS obejctives	Chalk and talk	

		System Architecture				
3.		Os structure, Os Operations	Understnding Computer system architecture	Chalk and talk		
4.		Process Management, Memory Management	List OS operations	Chalk and talk		
5.	2	Storage Management, Protection and Security	Know about OS concepts	Chalk and talk	T1	
6.		Computing Environments. Operating System services		Chalk and talk		
7.		User and OS Interface		Chalk and talk		
8.		Operating System services, User OS interface	List the OS Systemcalls	PPT		
9.	3	System Calls, Types of System Calls	Define &Design implementation	Chalk and talk	T1	
10.		System Programs	Analysis of OS concepts	Chalk and talk		
11.		Operating System Design and implementation	Analysis of OS concepts through exam	Chalk and talk		
12.		OS structure,		Chalk and talk		
		MOCK TEST # 1		Chalk and talk		
UNIT -II						
13.	4	Process Concepts	Define process and status	Chalk and talk	T1	
14.		The process, Process State	Explain Process concepts	Chalk and talk		
15.		Process Control Block, Threads	Define Scheduling	Chalk and talk		
16.		Process Scheduling-scheduling Queues	Know concept of schedulers	Chalk and talk		
17.	5	Schedulers, Context switch, Operations on Processes	Discussion on process system calls	Chalk and talk		
		System calls- fork(),exec(),wait(),exit(), Interprocess communication-ordinary pipes and named pipes in Unix		Define IPC,Pipes in Linux		Chalk and talk
18.		Process Scheduling-Basic concepts, Scheduling Criteria	Explain Scheduling	Chalk and talk		
19.						

20.		Scheduling algorithms, Multiple-Processor Scheduling	Analysis of scheduling algorithms	PPT	
			Generalize scheduling algorithms	Chalk and talk	
		Tutorial / Bridge Class #1	Explain of Scheduling algorithms	Chalk and talk	
21.	6	Real-Time Scheduling, Thread Scheduling, Case studies: Linux, Windows	Define Thread Scheduling	Chalk and talk	T1
22.		Process Synchronization, The Critical section problem	Define Critical Section Problem	PPT	
23.		Process Synchronization, Background ,Peterson's Solution, Synchronization Hardware		Chalk and talk	
24.		Semaphores, and Classic Problems of Synchronization, Monitors, Case Studies: Linux, Windows		Explain synchronization	
25		Tutorial / Bridge Class #2		Chalk and talk	
UNIT-III					
26	7	Memory Management and Virtual Memory – Memory Management Strategies	Define Memory management	Chalk and talk	T1
27		- Background,Swapping	Explain swapping	Chalk and talk	
28		Contiguous Memory Allocation,	Explain segmentation	Chalk and talk	
29		Segmentation, Paging, Structure of Page Table,	Define Paging	PPT	
		IA-32 Segmentation	Know about virtual memory	Chalk and talk	
30		Tutorial / Bridge Class #3	Know about Demand paging	Chalk and talk	
31		IA-32 Paging Virtual Memory Management-Background,	Define and Analysis of page replacement algorithms	Discussion	
32	Demand Paging, Copy-on-Write	Chalk and talk			
	Tutorial / Bridge Class #4	Chalk and talk			
MID EXAMINATIONS-I(WEEK-9)					
33.	10	Page Replacement Algorithms	Define and Analysis of page replacement algorithms	Chalk and talk	T1
34.		Page Replacement Algorithms		Chalk and talk	
35.		Types of page Replacement Algorithms		Chalk and talk	

36.		Allocation of Frames, Thrashing	Discussion on frames	PPT		
		Tutorial / Bridge Class #4	Know about virtual memory	Chalk and talk		
UNIT-IV						
37.	11	Storage Management-File System- Concept of a File	Define File management	Chalk and talk	T1	
		, System calls for file operations - open	Explain System calls	Chalk and talk		
38.		(), read (), write (), close (), seek (), unlink (),	Discussion on file concepts	Chalk and talk		
39.		Access methods, Directory and Disk Structure,		PPT		
40.		File System Mounting, File Sharing, Protection.	Discussion on file concepts	Chalk and talk		
		Tutorial / Bridge Class #5		Chalk and talk		
41.		12	File System Implementation	Discussion on file system structure		Chalk and talk
42.			File System Structure, File System Implementation			Chalk and talk
43.			Directory	Discussion on allocation methods		PPT
			Implementation, Allocation methods			Chalk and talk
44.			Free-space Management	Explain Free space management		Chalk and talk
	Tutorial / Bridge Class #6			Chalk and talk		
45.	13		Efficiency, and Performance	Explain efficiency and performance	Chalk and talk	
46.		Mass Storage Structure	Explain mass structure	PPT		
47.		– Overview of Mass Storage Structure		Chalk and talk		
48.		, Disk Structure		Chalk and talk		
		Tutorial / Bridge Class #7		Chalk and talk		
		MOCK TEST # 2	Know disk structure	Chalk and talk		
		BRIDGE CLASS #8/SEMINAR/GUEST LECTURER		PPT		
49.	14	Disk Attachment	Discussion of disk management	Chalk and talk		
50.		Disk Scheduling,		Chalk and talk		
51.		Disk Management		Chalk and talk		

52.		Swap space Management		Chalk and talk		
		Tutorial / Bridge Class #9	Discussion of swap space management	Chalk and talk		
UNIT-V						
53.	15	Deadlocks - System Model, Deadlock Characterization	Define Dead Locks	Chalk and talk	T2	
54.		Methods for Handling Deadlocks	Define handling of Dead Locks	Chalk and talk		
55.		Deadlock Prevention	Explanation of Deadlock avoidance and Prevtion	Chalk and talk		
56.		Deadlock Avoidance, Deadlock Detection	Explanation of Deadlock Recovery and Detection	Chalk and talk		
		Tutorial / Bridge Class #10		Chalk and talk		
57.	16	Recovery from Deadlock.	Explanation of Deadlock Recovery and Detection	Chalk and talk		
58.		Protection – System Protection, Goals of Protection	Discussion on protection & Security	Chalk and talk		
59.		Principles of Protection, Domain of Protection		Chalk and talk		
		60.		Access Matrix, Implementation of Access Matrix		Chalk and talk
		Tutorial / Bridge Class #11	Discussion on access rights	Chalk and talk		
61.		Access Control		Chalk and talk		
62.	17	Revocation of Access Rights	Discussion on protection & Security	Chalk and talk		
63.		Capability-Based Systems,		Chalk and talk		
64.		Language-Based Protection.		Chalk and talk		
	Tutorial / Bridge Class #12					
II-MID EXAMINATIONS (WEEK 18)						

BOOKS AND REFERENCES

Text Books

1. Operating System Principles, Abraham Silberchatz, Peter B.Galvin,Greg Gagne,8th Edition, Wiley Student Edition
2. Operating System-Internals and Design Principles, W.Stallings, 6th Edition, Pearson.

Reference Books

1. Modern Operating System, Andrew s Tanenbaum, 3rd Edition, PHI
2. Operating System A concept-based Approach, 2nd Edition, D.M.Dhamdhare, TMH.
3. Principle Of Operating Systems, B.LStuart, Cengage Learning, India Edition
4. Operating system, A.s.Godbole, 2nd Edition, TMH.
5. An Introduction to Operating System, P.C.P.bhatt, PHI.

Mapping Course Outcomes Leading to the Achievement of Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)		P
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	
CO1	3	2	2	3	2	-	-	-	-	3	-	2	2	2	1
CO2	3	2	2	2	2	-	-	-	-	2	-	1	1	2	1
CO3	3	3	3	3	2	-	-	-	-	3	-	1	1	2	1
CO4	2	2	3	2	3	-	-	-	-	2	-	2	1	2	2
CO5	1	2	2	3	2	-	-	-	-	2	-	1	2	2	2
AVG	2	2	2	3	2	-	-	-	-	3	-	1	1	2	1

DESCRIPTIVE QUESTIONS

UNIT- I

Short answer questions

1	Define operating system?	L2:UNDERS TANDING
2	List the advantages of multiprogramming?	L1:REMEM BERING
3	Define virtual machine?	L2:UNDERS TANDING
4	Define multiprocessor system?	L2:UNDERS TANDING
5	Define kernel?	L2:UNDERS TANDING

Long answer questions

1	State and explain various types of computer systems	L1:REMEM BERING
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2	Explain how protection is provided for the hardware resources by the operating system?	L2:UNDERS TANDING
3	Describe the operating system structures?	L6: CREATING
4	Discuss the view of an operating system as a resource manager?	L6: CREATING
5	Explain how operating system services are provided by system calls	L2:UNDERS TANDING

UNIT- II

Short answer questions

1	Define process. What is the information maintained in a PCB?	L2:UNDE RSTANDI NG
2	Explain the use of job queues, ready queues and device queues?	L2:UNDE RSTANDI NG
3	Define CPU scheduling?	L2:UNDE RSTANDI NG
4	Define race condition?	L2:UNDE RSTANDI NG
5	Describe entry and exit sections of a critical section?	L6: CREATIN G

Long answer questions

1	plain the process state transition diagram with examples	L2:UND ERSTAN DING
2	plain the principles of concurrency and the execution of concurrent processes with a simple example?	L2:UND ERSTAN DING
3	plain the infinite buffer producer/consumer problem for concurrent processing which uses binary semaphores?	L2:UND ERSTAN DING
4	List out the various process states and briefly explain the same with a state diagram?	L2:UND ERSTAN DING

5	A scheduling mechanism should consider various scheduling criteria to realize the scheduling objectives? List out all the criteria.	L6: CREATI NG
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UNIT- III

Short answer questions

1	Explain the main function of the memory-management unit?	L2:UNDERS TANDING
2	Define swapping?	L2:UNDERS TANDING
3	Distinguish between MFT and MVT?	L4:ANALYZ E
4	List and define non-contiguous memory allocation schemes?	L1:REMEM BERING
5	Distinguish between demand paging and pure demand paging?	L4:ANALYZ E

Long answer questions

1	Explain in detail the requirements that memory management technique needs to satisfy?	L2:UND ERSTAN DING
2	Discuss briefly the swapping concept with necessary examples?	L6: CREATI NG
3	Explain briefly about paging with neat diagram?	L2:UND ERSTAN DING
4	Explain the basic concepts of segmentation with neat diagrams?	L2:UND ERSTAN DING
5	State and explain about virtual memory concept with neat diagram?	L1 : REMEM BER

UNIT- IV

Short answer questions

1	Define the terms – file, file path, directory?	:UNDERS NDING
2	Distinguish between shared and exclusive lock?	L4:ANAL YZE
3	Explain the information associated with an open file?	L2:UNDE

		RSTANDI NG
4	Describe UFD and MFD.?	L6: CREATI NG
5	State and explain about virtual memory concept with neat diagram?	L1:REME MBER

Long answer questions

1	Explain how disk caching can improve disk performance?	L2:UND ERSTAN DING
2	Explain low-level formatting or physical formatting?	L2:UND ERSTAN DING
3	Define buffering, caching and spooling?	L2:UND ERSTAN DING
4	Explain the concept and techniques of free space management?	L2:UND ERSTAN DING
5	Discuss about a) Disk space management b) Swap -space management	L6: CREATI NG

UNIT- V

Short answer questions

1	Describe the representation of a resource-allocation graph?	L6: CREATI NG
2	Describe the purpose of banker's algorithm?	L6: CREATI NG
3	Describe the purpose of banker's algorithm?	L6: CREATI NG
4	Describe the techniques for recovery from deadlock?	L6: CREATI NG
5	Describe role-based access control?	L6: CREATI NG
6	Define the terms – object, domain, access right?	L2:UNDE RSTANDI

		NG
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Long answer questions

1	Explain briefly resource allocation graph with examples?	L2:UNDE RSTANDI NG
2	Discuss deadlock detection method in detail?	L6: CREATI NG
3	Describe how the access matrix facility and role-based access control facility are similar? How do they differ?	L6: CREATI NG
4	Describe how the access matrix facility and role-based access control facility are similar? How do they differ?	L6: CREATI NG
5	Discuss the access matrix implementation techniques?	L6: CREATI NG
6	Explain various schemes to implement revocation for capabilities?	L2:UNDE RSTANDI NG

OBJECTIVE QUESTIONS

UNIT- I

- CPU fetches the instruction from memory according to the value of
 - program counter
 - status register
 - instruction register
 - program status word
- A memory buffer used to accommodate a speed differential is called
 - stack pointer
 - cache
 - accumulator
 - disk buffer
- Which one of the following is the address generated by CPU?
 - physical address
 - absolute address
 - logical address
 - none of the mentioned
- Run time mapping from virtual to physical address is done by
 - memory management unit

- b) CPU
 - c) PCI
 - d) none of the mentioned
5. The address of a page table in memory is pointed by
- a) stack pointer
 - b) page table base register
 - c) page register
 - d) program counter

Answers

- 1. A
- 2. B
- 3. C
- 4. A
- 5. B

Fill in the blanks

- 1. -----Is known as a main memory.(RAM)
- 2. A memory that requires refreshing of data is -----(Dynamic Ram)
- 3. Cache memory is used in a computer system to -----(Speed up memory Access)
- 4. Program which acts as a interface between a user and the hardware is called -----
(Operating system)
- 5. -----is a program that translates mnemonic statements into executable instructions.(Assembler)

UNIT- II

- 1) A process includes
a)Program counter b)Stack c)Data set d)All the above
- 2) In the following which is not a state of process
a)New
b) Ready
c)running
d) interrupt
- 3) ___ is not a process scheduling queue
a)Job queue
b) Ready queue
c)Schedule queue
d) Device queue
- 4) CPU scheduler decisions may take place when a process
a)Switch from running to wait stage
b) Switch from running to ready state
c)Switch from waiting to ready state
d) Terminate
e)All the above
- 5) The LRU algorithm
a)Pages out pages that have been used recently
b) Pages out pages that have not been used recently
c) Pages out pages that have been least used recently

- d) None of the above

Answers

- 1) d
- 2) d
- 3) c
- 4) e
- 5) c

Fill in the blanks

- 1) A process is a ____ (program in execution)
- 2) Long term scheduler is also called as ____ (job scheduler)
- 3) Process that complete their execution per time unit is called ____ (throughput)
- 4) Homogeneous processes is within a ____ (multi processor)
- 5) Two or more processes are waiting for a event is called ____ (dead lock)

UNIT- III

- 1) Physical memory is broken into fixed-sized blocks called _____.
a) Frames b) pages c) backing store d) none of these
- 2) In segmentation, each address is specified by :
a) a segment number b) an offset c) a value d) a key
- 3) Every address generated by the CPU is divided into two parts : (choose two)
a) Frame bit b) Page number c) Page offset d) Frame offset
- 4) The _____ is used as an index into the page table.
a) frame bit b) page number c) page offset d) frame offset
- 5) The _____ table contains the base address of each page in physical memory.
a) Process b) memory c) page d) frame

Answers

- 1) a 2) a and b 3) b and c 4) b 5) c

Fill in the blanks

- 1) With paging there is no _____ fragmentation.(external)
- 2) Paging increases the _____ time.(context – switch)
- 3) Each entry in a segment table has a :__ and __ (segment base, segment limit)
- 4) The segment limit contains _____ (segment length)
- 5) Time taken in memory access through PTBR is _____ (slowed by a factor of 2)

UNI – IV

- 1) Data cannot be written to secondary storage unless written within a _____.
a) file b) swap space c) directory d) text format
- 2) The information about all files is kept in :
a) swap space b) operating system c) separate directory structure
d) None of these
- 3) The open file table has a/an _____ associated with each file.
a) file content b) file permission c) open count d) close count
- 4) Sequential access method _____ , on random access devices.
a) works well b) doesn't work well c) Both a and b d) None of these
- 5) For a direct access file :
a) there are restrictions on the order of reading and writing

- b) there are no restrictions on the order of reading and writing
- c) access is restricted permission wise
- d) access is not restricted permission wise

Answers

- 1)a 2)c 3)c 4)a 5)b

Fill in the blanks

- 1) The larger the block size, the _____ the internal fragmentation.(greater)
- 2) The direct access method is based on a _____ model of a file, as _____ allow random access to any file block.(disk , disks)
- 3) An unrecoverable error is known as _____.(hard error)
- 4) Using swap space significantly _____ system performance.(decreases)
- 5) It is _____ to reread a page from the file system than to write it to swap space and then to reread it from there.(more efficient)

UNIT- V

- 1) The wait-for graph is a deadlock detection algorithm that is applicable when :
 - a) all resources have a single instance
 - b) all resources have multiple instances
 - c) both a and b
 - d) None of the above
- 2) The disadvantage of invoking the detection algorithm for every request is :
 - a) overhead of the detection algorithm due to consumption of memory
 - b) excessive time consumed in the request to be allocated memory
 - c) considerable overhead in computation time
 - d) All of these
- 3) Every time a request for allocation cannot be granted immediately, the detection algorithm is invoked. This will help identify : (choose all that apply)
 - a) the set of processes that have been deadlocked
 - b) the set of processes in the deadlock queue
 - c) the specific process that caused the deadlock
 - d) All of these
- 4) A system has 3 processes sharing 4 resources. If each process needs a maximum of 2 units then, deadlock :
 - a) can never occur
 - b) may occur
 - c) has to occur
 - d) None of these
- 5) m' processes share 'n' resources of the same type. The maximum need of each process doesn't exceed 'n' and the sum of all their maximum needs is always less than m+n. In this setup, deadlock :
 - a) can never occur
 - b) may occur
 - c) has to occur
 - d) None of these

Answers

- 1)a 2)c 3) a and c 4)a 5)a

Fill in the blanks

- 1) If deadlocks occur frequently, the detection algorithm must be invoked _____.(frequently)
- 2) _____ Principle states that programs, users and even the systems be given just enough privileges to perform their task(principle of least privilege)
- 3) If the set of resources available to the process is fixed throughout the process's lifetime then its domain is(static)
- 4) In I/O protection I/O must be performed via _____(system calls)
- 5) DMA controller Bypasses CPU to transfer data directly between I/O device and _____(memory)

GATE QUESTIONS

1. A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero(the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. Which one of the following is TRUE if the processes have no I/O operations and all arrive at time zero?
(A) This algorithm is equivalent to the first-come-first-serve algorithm
(B) This algorithm is equivalent to the round-robin algorithm
(C) This algorithm is equivalent to the shortest-job-first algorithm
(D) This algorithm is equivalent to the shortest-remaining-time-first algorithm
2. A thread is usually defined as a 'light weight process' because an operating system (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the followings is TRUE?
(A) On per-thread basis, the OS maintains only CPU register state
(B) The OS does not maintain a separate stack for each thread
(C) On per-thread basis, the OS does not maintain virtual memory state
(D) On per thread basis, the OS maintains only scheduling and accounting information
3. Let the page fault service time be 10ms in a computer with average memory access time being 20ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory?
(A) 21ns (B) 30ns (C) 23ns (D) 35ns
4. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.
Process Arrival time Burst Time
P0 0 ms 9 ms
P1 1 ms 4ms
P2 2 ms 9ms
The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?
(A) 5.0 ms (B) 4.33 ms (C) 6.33 ms (D) 7.33 ms
5. Consider the following statements about user level threads and kernel level threads. Which one of the following statements is FALSE?
(A) Context switch time is longer for kernel level threads than for user level threads.

(B) User level threads do not need any hardware support.
(C) Related kernel level threads can be scheduled on different processors in a multi-processor system.

(D) Blocking one kernel level thread blocks all related threads.

6. An operating system uses Shortest Remaining Time first (SRT) process scheduling algorithm. Consider the arrival times and execution times for the following processes:

Process Execution time Arrival time

P1 20 0

P2 25 15

P3 10 30

P4 15 45

What is the total waiting time for process P2?

(A) 5 (B) 15 (C) 40 (D) 55

7. A virtual memory system uses First In First Out (FIFO) page replacement policy and allocates a fixed number of frames to a process. Consider the following statements:

P: Increasing the number of page frames allocated to a process sometimes increases the page fault rate.

Q: Some programs do not exhibit locality of reference.

Which one of the following is TRUE?

- (A) Both P and Q are true, and Q is the reason for P
- (B) Both P and Q are true, but Q is not the reason for P.
- (C) P is false, but Q is true
- (D) Both P and Q are false.

8. A multi-user, multi-processing operating system cannot be implemented on hardware that does not support

- (a) Address translation
- (b) DMA for disk transfer
- (c) At least two modes of CPU execution (privileged and non-privileged)
- (d) Demand paging

9. Which of the following is/are advantage of virtual memory?

- (a) Faster access to memory on an average.
- (b) Processes can be given protected address spaces.
- (c) Linker can assign addresses independent of where the program will be loaded in physical memory.
- (d) Programs larger than the physical memory size can be run.

10. Which of the following actions is/are typically not performed by the operating system when switching context from process A to process B?

- (a) Saving current register values and restoring saved register values for process
- (b) Changing address translation tables.
- (c) Swapping out the memory image of process A to the disk.
- (d) Invalidating the translation look-aside buffer.

OBJECTIVE QUESTIONS

1. Which of the following will determine your choice of systems software for your computer?

- a) Is the applications software you want to use compatible with it?
 - b) Is it expensive?
 - c) Is it compatible with your hardware?
 - d) Both a and c.
2. The operating system manages _____.
- a) Memory
 - b) Processor
 - c) Disk and I/O devices
 - d) All of the above
3. The Hardware mechanism that enables a device to notify the CPU is called _____.
- a) Polling
 - b) Interrupt
 - c) System Call
 - d) None of the above
5. Process State is a part of
- a) Process Control block
 - b) Inode
 - c) File Allocation Table
 - d) None of the above
6. The kernel keeps track of the state of each task by using a data structure called ____
- a) Process control block
 - b) User control block
 - c) Memory control block
 - d) None of the above
7. An optimal scheduling algorithm in terms of minimizing the average waiting time of a given set of processes is _____.
- a) FCFS scheduling algorithm
 - b) Round robin scheduling algorithm
 - c) Shortest job - first scheduling algorithm
 - d) None of the above
8. A binary semaphore
- a) has the values one or zero
 - b) is essential to binary computers
 - c) is used only for synchronization
 - d) is used only for mutual exclusion
9. A process said to be in _____ state if it was waiting for an event that will never occur.
- a) Safe
 - b) Unsafe
 - c) Starvation
 - d) Dead lock
10. Real time systems are _____.
- a) Primarily used on mainframe computers
 - b) Used for monitoring events as they occur
 - c) Used for program development
 - d) Used for real time interactive users

WEBSITES

- http://en.wikipedia.org/wiki/Main_Page
- http://www.webopedia.com/TERM/O/operating_system.html

EXPERT DETAILS

1. Prof. P.C.P. Bhatt, IISc Bangalore
2. Dr. Khaleel Ur RahmanKhan, Ace Engineering.

JOURNALS

1. International journals of computer science
2. International journals of engineering
3. International journals for computer science and engineering

LIST OF TOPICS FOR STUDENTS' SEMINARS

1. CPU Scheduling.
2. Synchronization
3. Memory Scheduling.
4. Disk Scheduling.
5. File Systems.
6. Inter Process Communication.

CASE STUDIES / PROJECTS

1. Prepare a case study on security features comparison of UNIX, LINUX, DOS and Windows operating system.