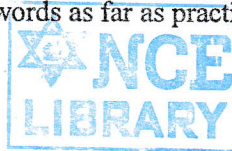


TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT 656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. Define Operating System. What is the purpose of a system call in an operating system? Explain. [1+3]
2. Explain why exo-kernel doesn't require re-mapping of resources? Is layered structure of operating system is better than monolithic structure? Explain. [2+4]
3. Explain Context Switching with an example. Consider the following set of processes with length of the burst time given in millisecond. [2+8]

Process	Arrival Time	Burst Time
P1	0	4
P2	2	5
P3	4	3
P4	6	6
P5	8	3

With the given information, draw the Gantt Chart and calculate the average waiting time(AWT), average turnaround time (ATAT), CPU Utilization and throughput for the

- i) Round Robin (RR) (Quantum Time=2)
 - ii) Highest Response Ratio Next (HRRN)
4. What is Critical Section Problem? Explain. How can solve "Producer Consumer problem" using Semaphore? Explain along with Pseudocode. [2+6]
 5. What is Demand paging? Consider the following page reference Strings; 2,3,4,2,1,3,7,5,4,3,1,5. Find how many page faults occur according to OPTIMAL, LRU (least recently used) and LFU (least frequently used) page replacement algorithm assuming 3-page frames. [1+6]
 6. Describe File System for operating system. Why are output files for the printer normally spooled on disk before being printed? Explain how RAID level 1 does differ from RAID level 0. [4+2+2]
 7. Explain about Programmed I/O. Consider a disk queue having 200 cylinders from 0 to 199 with requests for I/O to blocks on cylinders are 23, 89, 132, 42, and 187. Assume disk head initially at 100 and a seek takes 6ms/cylinder. How much seek is needed for FCFS, SSTF, SCAN, and LOOK disk arm scheduling algorithms? [2+8]
 8. What are the necessary conditions for deadlock? Consider a system with five processes p0 through p4 and three resource types A, B and C. Resource A has 5 instances, B has 5 instances, and type C has 4 instances. Suppose at time t = 0, following snapshot has been taken.

Process	Allocation			Maximum Claim		
	A	B	C	A	B	C
P0	0	3	1	3	3	1
P1	3	2	1	4	2	1
P2	1	0	1	1	1	1
P3	0	0	0	2	2	0
P4	0	0	0	1	0	0

Let the available number of resources be given by available vectors as (1, 0, 1). Is the system in safe state? If yes, then write the safe sequence.

[2+8]

9. Describe how Access Control List is used. What are the roles of System Administrator for change management?

[3+5]

10. Write short notes on:

[3×3]

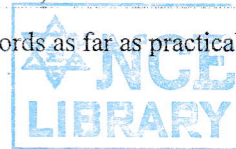
- Protection Domain
- Compaction and Coalescing
- Belady's Anomaly

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (EX 652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



- What is an Operating system? Explain the statement "operating system acts as a Broker between hardware and application program". [1+4]
- Explain why Exo-kernel doesnot require Re-mapping of resources? Is layered structure of operating system is better than monolithic structure? Explain. [2+3]
- What information does a process control block contain? Write the difference between thread and process. [5]
- Consider following set of process with given arrival and CPU burst time.

Process	Arrival Time	Burst Time
P0	0	13
P1	1	6
P2	4	4
P3	6	20

Calculate the average waiting time for each of process for non-primitive shortest job first (SJF) and Round Robin Scheduling Algorithms with quantum size 4. [5]

- What is race condition and Mutual Exclusion? Explain how Sleep () and Wakeup () solution is better than busy waiting solution for critical section problem. [2+3]
- How semaphore is used in process synchronization? Do you think semaphore is best solution for producer consumer problem? Explain using it in producer consumer problem. [5]
- Differentiate between internal and external fragmentation? Suppose that we have memory of 1000 KB with 5 partitions of size 150 KB, 200 KB, 250 KB, 100 KB, and 300 KB. Where the processes A and B of size 175 KB and 125 KB will be loaded, if we used Best-Fit and Worst-Fit strategy? [5]
- Explain the types of Network Attacks. What is ACL? Why 'HASH' function is called Message Digestor? [5]
- What is file attribute? List the File System performance indicator. Explain the file allocation methods with its advantages and disadvantages. Also suggest which file organization technique is most appropriate for "tape storage". [1+2+6+1]
- What is DMA? Explain how I/O takes place through DMA? Suppose the head of a moving – head disk with 200 tracks, numbered 0 to 199 is currently serving a request at tracks 143 and has finished a request at track 125. The queue it requests is kept in the FIFO order 25, 17, 119, 197, 194, 15, 182, 115, 183. What is the total movement needed to satisfy these requests for the following disk-scheduling algorithms? [10]
- How unsafe state differs from deadlock state? Consider following initial state and identify whether requested resource is and granted or denies for the given cases. [5]

Process	Has	Max
A	2	6
B	1	5
C	2	3
D	3	8

Free Resource = 2

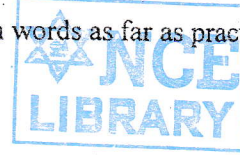
- a) What will happen if process A request 1 Resource?
 - b) What will happen if process D request 1 Resource?
12. What is deadlock prevention? Explain deadlock prevention techniques. [5]
13. What are the strategies for memory management? Consider the following page-reference string 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults would occur for LRU and FIFO replacement algorithm assuming 4 frames? [5]
14. What is group policy? What can we do with AWK? Explain. [5]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: -Operating System (CT 656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. What is the role of system call in an operating system? Write down the major differences between following types of operating system. [2+8]
 - a) Batch system
 - b) Interactive system
 - c) Real time system
 - d) Time sharing system
2. State 5- State process model. From the given following information: [2+8]

Process	Burst Time	priority
p ₁	10	3
p ₂	1	1
p ₃	2	3
p ₄	1	4
p ₅	2	2

Assume the processes arrived in the order p₁, p₂, p₃, p₄ and p₅ all time 0, priority 1 as highest and 4 as lowest.

- a) Draw the gantt chart
- b) Calculate average waiting time and average turnaround time for the following scheduling algorithm.
 - (i) Round robin (quantum= 1)
 - (ii) priority preemptive
 - (iii) preemptive SJF
 - (iv) FCFS
3. What is critical section problem? Why must the executing the critical section be mutually exclusive? Describe how race condition occurs in producer- consumer problem and use semaphore to solve it. [2+2+6]
4. Define page fault and demand paging. Consider logical address spaces of eight pages of 1024 words, each mapped onto a physical memory of 32 frames then, [4+6]
 - a) How many bits are in logical address and physical address?
 - b) How paging will be done?
5. What is the role of file system? How can files be Implemented? List any three of them with advantages and disadvantages of each. [2+6]

6. What are the principles of I/O software? Suppose that a disk drive has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43 and previous request was at cylinder 25. The queue of pending request, in FIFO order is: 86, 70, 13, 74, 48, 9, 22, 50, 30

[2+6]

Produce the schedules to satisfy all the pending requests for each of the following disk scheduling algorithms: 1. FCFS 2. C-SCAN 3. SSTF

7. Write four conditions for deadlock. Consider the following snapshot of a system:

[2+6]

Process	Allocation			Maximum Claim		
	A	B	C	A	B	C
p ₀	0	1	0	7	5	3
p ₁	2	0	0	3	2	2
p ₂	3	0	2	9	0	2
p ₃	2	1	1	2	2	2
p ₄	0	0	2	4	3	3

Let the available number of resources be given by available vectors as (3,3,2). Use Bankers algorithm to claim that the system is in safe state and show the safe sequence.

8. Describe, how access control list is used? What are the roles of system administrator for change management?

[4+4]

9. Write short notes on (Any Two):

[2×4]

- Public key cryptography
- Resource allocation graph
- Process Vs thread

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT 656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What do you mean by System call in Operation System? Justify how does OS function as Manager. [4]
2. What do you mean by Shell? Discuss about Microkernel and Monolithic structuring with their advantages and disadvantages. [4]
3. Difference between process and thread. Explain how multi threading provide better solution than single threading solution. [1+3]
4. Consider the following set of process, with the length of the CPU burst time and arrival time given in millisecond. [6]

Process	Arrival Time	Burst Time
P0	0	3
P1	2	6
P2	4	4
P3	6	5
P4	8	2

Draw Gantt chart illustrating RR (quantum = 2) and highest rank ratio next (HRN) scheduling. Also find average waiting time and average turn around time for each of the algorithm.

5. How does a 'race condition' arrive in IPC? Explain the 'Sleeping Barber' problem. When such problem happen in system? Write a solution using any type of your own technique with pseudocode example. [2+2+6]
6. What is associative memory and thrashing? Write the difference between coalescing and compaction. [1+1+2]
7. What is Demand paging? Consider the following page reference Strings; 2, 3, 4, 2, 1, 3, 7, 5, 4, 3, 1, 5. Find how many page fault occur according to OPTIMAL, LRU (least recently used) and LFU (least frequently used) page replacement algorithm assuming 3 page frames. [1+5]
8. Define file system and list out some attributes of file. Differentiate between relative and absolute pathnames. [3+3]
9. What are the disadvantages of Programmed I/O? Suppose that a disk has 200 tracks, numbered from 0 to 199. The read / write head of drive is currently serving a request at track 143, and has just finished the request at track 125. The queue of pending request in FIFO order is:

86, 147, 91, 177, 94, 160, 102, 175, 130

Suppose seek takes 10ms per cylinder moved. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending request, for FCFS, SSTF, C-SCAN and C-LOOK algorithm? Also calculate seek time needed to serve these request for each algorithm.

[2+8]

10. Explain in detail how you can detect deadlock in operating system. Consider a system with 5 processes P0 through P4 and three resources type A, B and C. Resources A has 7 instances, B has 2 and C has 6 instances. Suppose at time t0 we have following state: [3+7]

Process	Allocation			Request		
	A	B	C	A	B	C
P0	0	1	0	0	0	0
P1	2	0	0	2	0	2
P2	3	0	3	0	0	0
P3	2	1	1	1	0	0
P4	0	0	2	0	0	2

- Is the state safe? If so, show the safe execution of the processes.
 - Suppose P2 makes additional request of (1, 0, 1, 0), what will be the effect of this request to the system?
11. Explain the types of Network Attacks? What is ACL? Why 'HASH' function is called Message Digester? [2+2+2]
12. Write short notes on: [2×5]
- Semaphores
 - UNIX File System

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating Systems (CT 656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Define Operating system. Explain OS as resource manager. [1+3]
b) Discuss the properties of batch system and real time system. [4]
2. Differentiate between process and thread. a) Consider the following set of processes, with arrival time and the length of CPU burst time given in millisecond as below: [2+6]

Processes	Arrival time	Burst time
A	0	3
B	1	6
C	4	4
D	6	2

- i) Draw Gantt chart illustrating the execution of these processes using FCFS, SRTN and RR (Quantum = 2) scheduling.
- ii) What is the waiting time and Turnaround time of each process for each of the scheduling algorithm?
3. List some differences between internal fragmentation and external fragmentation. Define virtual memory and explain how it is achieved by demand paging. [2+2+4]
4. Define page fault. Why you need page replacement algorithms? How many page fault occurs for following given reference string for three page frames: 7,0,1,2,0,3,0,4,2,3,0,3 for
 - i) Least Recently Used page replacement algorithm.
 - ii) First in First Out page replacement algorithm
 - iii) Optimal Page Replacement algorithm[2+6]
5. Define directory and file path. Explain I node approach of file implementation with its advantages and disadvantages. [2+6]
6. What do you mean by disk arm scheduling? Explain shortest seek first and elevator algorithm with their advantages and limitations. [2+6]
7. What do you mean by critical region problem? What requirements should be met by its solution? Explain Peterson's solution to avoid race condition. [2+2+4]
8. Define deadlock. What are the conditions for resource deadlock? Explain some methods for recovering from deadlocks. [1+2+5]
9. What are the security problems associated with OS? Explain ACL with its use in security. [2+6]
10. List out some system administration tasks in OS. Describe the roles and responsibilities of system administrator with example of each administrative task you listed. [2+6]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT 656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What is an Operating system? Explain the functions of Operating System. [1+3]
 b) What is System Call? Explain the Monolithic and layered Architecture of operating system. Explain which architecture is better among them and why? [1+2+1]
2. Define Process and Threads. consider the following set of processes, with arrival time and the length of CPU burst time given in millisecond as below: [2+4+4]

Processes	Arrival time	Burst time
A	0	3
B	1	6
C	4	4
D	6	2
E	7	3

- a) Draw Gantt chart illustrating the execution of these processes using FCFS, SRTN and RR (Quantum = 3) scheduling.
- b) What is the waiting time and Turnaround time of each process for each of the scheduling algorithm?
3. Compare and contrast between monitor and semaphore. Write for solving Dining Philosophers' Problem using any one technique at the pseudocode level illustration. [4+4]
4. How DMA (Direct Memory Access) increases the system consistency? Suppose a disk drive with 150 cylinder numbered from 0-149. The drive is currently serving a request at 35. The queue of pending request is 98, 103, 38, 122, 10, 128, 65, 75. Starting from the current head position, Calculate the total head moment (in cylinder) that the disk arm moves to satisfy all the pending request for SSF, SCAN and LOOK Disk Arm Scheduling Algorithm. [2+6]
5. Prepare a comparative note on the followings: [4×3]
 - a) Virtual memory management using Paging versus Segmentation
 - b) File implementation using 'Linked list Allocation with Table' versus I-node
 - c) Spooling versus Deadline Scheduling
6. What is Indefinite postponement? Is it different than dead lock? Write a brief comparison. Consider a system with 5 concurrent processes (P₁, P₂, P₃, P₄, P₅) and four resource types (R₁, R₂, R₃, R₄) and their maximum availability are (6, 4, 5, 3) respectively. Allocation table and Maximum claim table are as follows: [4+8]

	R ₁	R ₂	R ₃	R ₄
P ₁	2	0	1	1
P ₂	1	1	0	0
P ₃	1	1	1	0
P ₄	1	0	1	0
P ₅	0	1	0	1
Allocation				

	R ₁	R ₂	R ₃	R ₄
P ₁	3	2	1	1
P ₂	1	2	0	2
P ₃	1	1	3	0
P ₄	3	2	1	0
P ₅	2	1	0	1
Maximum Claim				

Is the system state safe? If so show the safe execution of the processes.

7. a) What are the security issues associated with OS? Discuss them. [4]
b) Describe the roles and responsibilities of system administrator. [4]
8. What is a 'File System' in any OS? What are the major operations required in any file?
How it is different with 'Directory'? [2+2+2]
9. Write short notes on: [2×4]
a) Demand paging
b) Virtual machine
c) USB Storage
d) Protection matrix

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Differentiate between I/O bound process and CPU bound process? What is process scheduling? Why do we need thread? [2+3+3]
2. Define process in OS and explain possible states. Consider the following set of processes, with the length of the CPU burst time in millisecond. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0. [Lowest Number being Highest Priority] [8]

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	5
P4	1	4
P5	5	2

Draw Gantt chart illustrating priority and RR (quantum = 1) scheduling. Also find average waiting time and average turn-around time for each of the algorithms.

3. Consider a disk queue with requests for I/O to blocks on cylinders 23, 89, 132, 42, 187. Assume disk head initially at 100 and a seek takes 6m/sec/cylinder. How much seek is needed for FCFS, SSF and SCAN disk arm scheduling algorithms. [8]
4. Explain inode approach of file system implementation with its advantages and disadvantages. [8]
5. What are the differences between fixed partitioning and variable partitioning system of memory for multiprogramming? [3+5]

Given reference to the following pages by a program:

0,9,0,1,8,1,8,7,8,7,1,2,8,2,7,8,2,2,8,3

How many page faults will occur if the program has 4 frames for Optimal Page Replacement algorithm?

6. Explain private and public key used in asymmetric cryptography. What is the use of ACL? [5+3]
7. What is critical section problem? Why must the executing the critical section be mutually exclusive? Describe how semaphore can be used to solve the critical section problem. [2+2+4]
8. What is the significance of system administration? Describe the role and responsibilities of system administrator to keep the system updated and efficient. Explain with an example. [3+5]

9. Consider a system with 5 concurrent processes (P0,P1,P2,P3,P4) and 4 resources types (R0,R1,R2,R3). The number of instances of each resources type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows: [4+4]

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

Maximum claim

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

- Calculate Need matrix as per Banker's algorithm.
- Is the state safe? If so, show the safe execution of the processes

10. Write short notes:

- Thrashing
- Shell programming

[2×4]

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What is an Operating system? Explain the functions of Operating System. [4]
b) What is a system call? Illustrate the execution of system call read () to read a file. [6]
2. What is the real time scheduling? Consider the following set of process, with the length of the burst time given in milliseconds: (Assume the system has two processors P₁ and P₂).

Process	Burst time	Priority
P ₁	10	3
P ₂	1	1
P ₃	2	3
P ₄	1	4
P ₅	5	2

The processes are assumed to have arrived in order p₁, p₂, p₃, p₄, p₅ all at time 0.

Compute the AWT and ATAT for each of the scheduling algorithms. (1) FCFS (2) SJF (3) Pre-emptive priority (4) RR (q=1) scheduling. [2+8]

3. a) What is race condition and Mutual Exclusion? List the requirements that a solution to solve race condition should satisfy? [2+3]
b) How can semaphore be used to enforce mutual exclusion? Give a suitable example. [5]
4. a) What is TLB and Thrashing? Write the differences between Coalescing and Compaction. Provide examples of both. [2+2+2]
b) What is the impact of size of page in virtual memory management performance? Define internal and external fragmentation. [2+2]
5. What is File attribute? List the File System performance indicator. Explain all the ways how file system can be implemented and suggest which implementation of file system is better and why? [1+2+6+1]
6. Suppose a disk drive with 150 cylinder numbered from 0-149. The drive is currently serving a request at 35 and previous request was at 120. The queue of pending request is 98, 103, 38, 122, 10, 128, 65, 75. Starting from the current head position, Calculate the total head moment (in cylinder) that the disk arm moves to satisfy all the pending request for SSTF, SCAN, C-SCAN, LOOK and FCFS Disk Arm Scheduling Algorithm. [10]

7. Write four necessary conditions for deadlock. Consider the following snapshot of a system.

Process	Allocation			Max		
	A	B	C	A	B	C
P ₀	0	1	0	7	5	3
P ₁	2	0	0	3	2	2
P ₂	3	0	2	9	0	2
P ₃	2	1	1	2	2	2
P ₄	0	0	2	4	3	3

Let the available number of resources be given by available vectors as (3, 3, 2). Use Banker's algorithm to claim that the system is in safe state and show the safe sequence.

8. Briefly explain the responsibilities of a System Admin.

9. Write short notes on:

- Public Key Cryptography
- Protection Domain

[10]

[4]

[2×3]

Exam.	Regular	
Level	BE	Full Marks 80
Programme	BCT	Pass Marks 32
Year / Part	III / II	Time 3 hrs.

Subject: - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain multiprogramming, multiprocessing and distributed operating system. [6]
b) Explain the virtual machine structure. What are the benefits over other operating system structure? [2+2]
2. a) Difference between process and thread. Explain how thread based execution minimizes context switching problem of process based execution. [2+2]
b) Suppose 5 processes are submitted at time 0.

Process	A	B	C	D	E
Burst Time	35	10	15	5	20
Priority	3	2	4	5	1

Show the execution timeline of the processes using Gantt Chart for FCFS, SJF and Round Robin ($q=5$). Also calculate mean turnaround time in each case. [6]

3. a) What is race condition? Explain how Sleep() and Wakeup() solution is better than busy waiting solution for critical section problem. [2+3]
b) What is TSL? Why it is used? Explain the major operations of semaphore with a simple implementation as a class. [5]
4. What is thrashing? Consider the following page-reference string-
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. How many page faults would occur for the following page replacement algorithms, assuming 3 frames:-
a) FIFO b) Optimal c) LRU d) LFU [2+8]
5. Discuss various file allocation and access methods. Compare their advantages and disadvantages. [4+6]
6. A disk drive has 50 cylinders, numbered 0 to 49. The drive is currently serving a request at cylinder 15, and the queue of pending requests, in FIFO order is 4, 40, 11, 35, 7, 14. What is the total distance that the disk arm moves for the following algorithms:-
a) FCFS b) SSTF c) SCAN d) LOOK e) C-SCAN [10]
7. What is Deadlock and indefinite Postponement? Explain the necessary conditions for deadlock and Explain how deadlock can be prevented? A system has 2 process and 3 resources. Each process need maximum of two resources, IS deadlock possible? Explain. [1+1+3+3+2]
8. How authentication is an essential mechanism for maintaining security? Explain. [4]
9. Write short notes on: [2×3]
 - a) Caesar Cipher
 - b) Administration tasks

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT565)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Why Operating system is termed as virtual machine? Briefly mention the function of Operating system. [5]
- b) What is System Call? Explain in brief about the given architecture of operating system. [2+3]
 - i) Monolithic Architecture
 - ii) Virtual Machine

2. a) Define process. Describe the various states of process. How significant is the process hierarchy? [1+2+2]
- b) Make a schedule as per Rate Monotonic (RM) algorithm for the following set of real time tasks: [5]

Task, T	Period, P	Execution time, E	Phase, ϕ
T ₁	4	1	0
T ₂	5	2	0
T ₃	20	5	0

3. Define race condition. What are the requirements of mutual exclusion? Solve producer consumer problem using semaphore and message passing. [2+2+6]
4. Under what circumstances do page fault occur? Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6 how many page faults would occur for the LRU replacement, FIFO replacement and optimal replacement algorithms by assuming three frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each. [4+6]
5. Suppose a disk drive with 200 cylinders numbered from 0 to 199. The drive is currently serving a request at 53. The queue of pending request is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, Calculate total head movement (in cylinder) that the disk arm moves to satisfy all the pending request for FCFS, SSF and SCAN disk scheduling algorithm. [6]
6. What is File Attribute? Write the difference between Single level directory system and Hierarchical directory system. Explain how operating system manages free blocks of Secondary storage. [1+3+6]
7. List four essential conditions for deadlock. Explain each of them briefly. What would be necessary (in operating system) to prevent the deadlock? How deadlock is recovered? Explain. [10]
8. Write short notes on: [3.5×4]
 - i) Protection Domain
 - ii) Cryptography
 - iii) System administration
 - iv) Dining philosopher problem

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT656)

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- ✓ Attempt All questions.
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1. a) What are the primary purposes of an operating system? Explain. Why should the operating system prevent users from accessing the boot sector? [3+2]
b) Explain in brief any four types of OS. [5]
2. Assume the system having two processors of same configuration, schedule the following set of processes according to preemptive priority and round robin algorithm (Time quantum = 3) and calculate average waiting time and average turnaround time. [5+5]

Process	Arrive Time	CPU Time (ms)	priority
A	0	12	1
B	2	8	2
C	5	7	4
D	3	9	3
E	4	6	2
F	8	5	1
G	7	7	3
H	3	4	4
I	4	2	3

3. a) Explain Critical Section problem. Why is it important for a thread to execute a critical section as quickly as possible? [5]
b) Define Semaphore and explain the major operations in semaphore including pseudocode. [5]
4. a) Differentiate compaction and Coalescing technique. How logical address is mapped to physical address by Paging Technique? Explain with suitable example. [2+3]
b) With an example, show that FIFO page replacement algorithm suffers from Belady's anomaly. What is thrashing? [3+2]
5. Briefly mention the structured I/O software with suitable diagram. Compare the throughput (overall performance) of SCAN with SSTF [6]
6. a) In what ways is file system management similar to virtual memory management? What are the advantages and disadvantages of a contiguous file allocation scheme? Which file organization technique is most appropriate for tape storage? Why? [3+3]
b) List the file system performance indicators with brief explanation. [4]

7. What is the difference between deadlock and indefinite postponement? Consider a system with 5 concurrent processes (P0,P1,P2,P3,P4) and 4 resource types (R0,R1,R2,R3). The number of instances of each resource type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows:

[3+7]

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

Maximum claim

Is the state safe? If so, show the safe execution of the processes.

8. Write short notes on:

[3.5×4]

- Duties and responsibilities of system administration
- Types of security Attack
- Principle of I/O Software
- UNIX file system

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Is layered structure of operating system better than monolithic structure? If yes, explain with an example. If no, why? [10]
2. a) What is process? Differentiate between process and thread. [1+3]
- b) Assume you have the following processes to execute with one processor. [5]

Process	Arrival time	CPU burst	Priority
P1	0	10	3
P2	2	7	2
P3	3	8	4
P4	5	6	1

Priority is defined as $1 > 2 > 3 > 4$.

- i) Make the GANTT chart of the execution of these processes using preemptive priority and Shortest remaining time first algorithm.
- ii) Find out turnaround time, waiting time, and their average time of each process.
3. Why processes need to be synchronized? Explain Peterson's Solution and TSL instruction approaches used in mutual exclusion with busy waiting. [2+4+4]
4. What is page fault? Consider following page reference string [2+8]
 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
 How many page faults would occur in LRU, FIFO and Optimum replacement algorithm?
5. Explain the role of each layer in a file system. Compare and contrast the linked list allocation and linked list allocation using index method. [4+5]
6. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order is: [10]
 56, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
 Starting from the current head position, what is the total distance (in cylinder) that the disk arm moves to satisfy all the pending requests, for each of the following algorithms:
 FCFS, SCAN, LOOK, CSCAN, SSTF
7. What is deadlock avoidance and detection? Explain all possible deadlock prevention techniques. [2+6]
8. The use of internet is possible cause of a security breach. Describe the major threats by which a system connected to the internet is always prone to attack. Explain. [6]
9. Write short notes on: [4+4]
 - a) Role of system Administrator
 - b) Shortest Seek Time First Algorithm with example

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Subject: - Operating System (CT656)

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1. a) Explain the Virtual Machine Structure. What are the benefits over other operating system structure? [2+2]
- b) What is operating system? Briefly explain the function of operating system. [1+4]
2. a) Differentiate between process and thread. Explain the advantages of multithreading. [2+2]
- b) Schedule the following set of processes according to HRRN and Round Robin algorithm (Time quantum=4) and calculate average waiting time and average turnaround time. [5]

Process	Arrival Time	CPU Time (ms)
A	0	12
B	2	8
C	5	7
D	10	9

3. What is TSL instruction? Why it is used? Solve producer-consumer problem using monitors. [1+2+7]
4. Define page fault and demand paging. Consider a paged memory system with eight pages of 8KB page size each and 16 page frames in memory. Using the given page table, compute the physical address for the logical address 18325. [3+6]

7	10
6	4
5	0
4	7
3	13
2	11
1	14
0	5

5. What is file system layout? Explain how operating system manages free blocks of secondary storage. [3+7]
6. What is disc scheduling? Explain details about the device independent I/O software with example. [3+6]
7. What is deadlock? Explain the essential condition for deadlock. How you detect deadlock? Explain with example. [2+4+4]
8. Explain the types of attacks. Explain, how can you implement security and protection on all components of a system. [3+6]
9. What is system administration? How is a special user different from a general user? Explain. [2+3]

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 Attempt All questions.
 The figures in the margin indicate Full Marks.
 Ass. me suitable data if necessary.

- What is operating system? Briefly mention the type of operating system. [1+4]
 - Differentiate between monolithic and micro-kernel structure of operating system. [5]
- What is process? From the given following information: [2+8]

Process	Arrival time	Burst time	Priority
P ₁	0	3	3
P ₂	1	6	5
P ₃	2	1	2
P ₄	3	4	1
P ₅	4	2	4

- Draw the Gantt chart.
 - Calculate average waiting time and average turn around time for the following scheduling algorithm.
 - Round Robin ($q = 1$)
 - Priority Preemptive
 - Preemptive SJF
- Why do we need pipe() function? Define Semaphore and explain the major operations in semaphore. Can semaphores be used in distributed system? Explain why or why not. [3+4+3]
 - What is residence monitor? Consider logical address spaces of eight pages of 1024 words, each mapped onto a physical memory of 32 frames then. [5+5]
 - How many bits are in logical address?
 - How many bits are in physical address?
 - What is file and their attributes? Briefly explain the file allocation methods. [3+7]
 - Consider a disk drive having 200 cylinders, numbered from 0 to 199. The head is currently positioned at cylinder 53 and moving toward the cylinder 60. The queue of pending requests are 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, what is the total head movement (in cylinders) to service the pending requests for each of the following disk arm scheduling algorithms? (a) FCFS (b) SSTF (c) SCAN (d) LOOK (e) C-SCAN. [11]
 - Explain the necessary conditions of deadlock? How can a system detect deadlock and what does it do after detection? [4+6]
 - Write short notes on: [3×3]
 - Shell Scripts
 - Cryptography
 - Security Policy

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- What is the role of supervise call in an operating system? Write down the major differences between following types of operating system. [2+8]
 - Batch System
 - Interactive System
 - Real Time System
 - Time Sharing System

- Define Context Switching. Discuss 5-state model of process. Schedule the following set of process according to multilevel feedback queue scheduling algorithm and compute AWT and ATAT. [2+3+5]

Process	P1	P2	P3	P4
Arrival Time	0	12	25	32
CPU Burst (ms)	25	18	4	10

Assume that there are three ready queues Q1, Q2 and Q3. The CPU time slice for Q1 and Q2 is 5 ms and 10 ms respectively and processes are scheduled on FCFS basis in Q3.

- Define race condition with example. Explain Peterson's Algorithm. [3+7]
- Differentiate compaction and coalescing techniques. How logical address is mapped to real physical address by paging technique? Explain with suitable example. What is the role of TLB? [4+4+2]
- Describe different file allocation methods. Explain free disk space management with example? [6+4]
- Consider a system with 5 processes P₀ through P₄ and three resources types A, B, C. Resources types A has 7 instances, B has 2 and C has 6 instances. Suppose at t₀ time we have following state: [10]

Process	Allocation			Request			Available		
	A	B	C	A	B	C	A	B	C
P ₀	0	1	0	0	0	0	0	0	0
P ₁	2	0	0	2	0	2			
P ₂	3	0	3	0	0	0			
P ₃	2	1	1	1	0	0			
P ₄	0	0	2	0	0	2			

- Is the given system in deadlock state?
- Suppose P₂ makes an additional request (0, 0, 1) what will be the effect of this request to the system?

7. A disk with 1000 cylinders, numbered 0 to 999, compute the number of tracks the disk arm must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving towards track 0 (zero). The queue in FIFO order contains request for the following tracks:

[10]

123, 874, 693, 475, 105, 376

Perform the computation for the following scheduling algorithms:

- a) FIFO
- b) SSTF
- c) SCAN

[5+5]

8. Write short notes on:

- a) Types of network security attack
- b) Duties and responsibilities of system administrator

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
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Subject: - Operating System (CT656)

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1. Explain operating system as an extended machine? Distinguish between Kernel and Micro-Kernel. Explain the purpose of system call. [2+3+3]

2. For the process listed in following table, what is the average turnaround time using: [10]

(a) FCFS (b) RR (quantum=4) (c) SJF (d) SRT (e) HRRN

Process	Arrival Time (ms)	Processing Time (ms)
A	0	3
B	2	6
C	4	4
D	6	5
E	8	2

3. Define critical section and mutual exclusion with respect to multiple-process system. Solve producer and consumer problem using semaphore. [3+5]

4. What is page fault? Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the FIFO, Optimal, LFU and LRU replacement algorithms having five frames? Remember all frames are initially empty, so your first unique page will cost one fault each. [2+8]

5. What are the different methods for allocating disk space for file? Explain free space management techniques. [2+6]

6. Suppose that a disk drive has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43, and previous request was at cylinder 25. The queue of pending request, in FIFO order is: [10]

86, 70, 13, 74, 48, 9, 22, 50, 30

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms?

- a) First-come, First served
- b) Shortest Seek Time First
- c) Look
- d) C-Scan
- e) Scan

7. What is deadlock? How it occurs? Explain various deadlock avoidance methods with examples. [2+2+6]

8. What are the roles of system administrators for an organization? How can you increase operating system performance if you are selected as a system administrator? [4+4]

9. Write short notes on: (any two) [4+4]

- a) Information security model
- b) Security attack

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1. List the essential properties for the Batch-oriented and Interactive operating system. For each of the following application which system (Batch or Interactive) is more suitable? State the reason. [4+6]

- a) Word Processing
- b) Generating monthly bank statements
- c) Computing pi to million decimal places
- d) A flight simulator
- e) Generating mark statement by University
- f) Data acquisition from temperature sensor

2. Consider the following set of process with the length of the CPU burst time given in millisecond. [4+4]

Process	P1	P2	P3	P4	P5
Burst time	10	1	2	1	2
Priority	3	1	3	4	2

Assume the processes arrived in the order P1, P2, P3, P4 and P5 all at time 0, priority 1 as highest and 4 as lowest.

- a) Draw the Gantt chart for FCFS, SJF, Priority and Round Robin (Quantum = 2)
 - b) Which algorithm results in the maximum average waiting time?
3. What is race condition and critical section problem? Explain all possible approaches to handle the situation "while one process is busy updating shared memory, no other process will enter its critical section and cause trouble". [2+8]
4. Calculate Hit and Faults using various page replacement algorithm policies. (FIFO, LRU, Optimal) for the following page sequence (The page frame size is 3) [2+6]
- 2 3 5 4 2 5 7 3 8 7
5. Explain file system layout in detail. What are the major differences between file system interfaces and file system implementation? [6+4]
6. What are the disadvantages of programmed I/O? Explained about DMA. What are the functions of device independent I/O software? [2+2+4]
7. What is deadlock? State the necessary conditions for deadlock to occur. Give reason, why all conditions are necessary. [10]
8. Explain the domain-object and ACL. How these mechanisms are implemented for security? [4+4]
9. Write short notes:
- a) Roles of System Administration [4]
 - b) Shell Scripts [4]

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- How operating system creates abstraction? Explain with reference to OS as an extended machine. Define system call and explain its working mechanism with suitable example. [5+5]
 - What is Process Control Block? Explain scheduling algorithms in interactive system. [2+8]
 - What are conditions to get mutual exclusion? Define semaphore and solve the producer-consumer problem using semaphore. [2+8]
 - What is page fault? Assume that a virtual memory of size 64K is mapped to physical memory of 32K with page frame 4K. Initially, pages are mapped as: 0,1,2,3,4,5,9,11 correspond to 2,1,6,0,4,3,5,7 respectively. Calculate outgoing physical address for incoming virtual address 20482 with necessary mapping diagrams. [2+8]
 - How file system can be implemented using linked list? Explain impact of block size selection on data rate and disk space utilization with necessary diagram and illustration. [4+6]
 - Explain working mechanism of device driver? Suppose a disk drive with 200 cylinders, numbered from 0 to 199. The drive is currently serving a request at cylinder 53. The queue of pending requests is: 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, calculate total distances (in cylinders) that the disk arm moves to satisfy all a pending requests for FCFS, SSF and SCAN disk scheduling algorithms. [4+6]
 - Write four conditions for deadlock. A system has four processes P1, P2, P3, P4 and three resources R1, R2, R3 with existing resource $E = (15 \ 9 \ 5)$. After following allocation, resource available becomes $A = (3 \ 2 \ 0)$. Use Banker's algorithm to test whether the given state is safe or not. If it is safe state, show the sequence of execution of processes. [2+8]
- | | Allocation | | | Maximum | | | Need | | |
|----|------------|----|----|---------|----|----|------|----|----|
| | R1 | R2 | R3 | R1 | R2 | R3 | R1 | R2 | R3 |
| P1 | 3 | 0 | 1 | 3 | 2 | 2 | 0 | 2 | 1 |
| P2 | 5 | 4 | 1 | 6 | 8 | 2 | 1 | 4 | 1 |
| P3 | 2 | 2 | 0 | 3 | 2 | 4 | 1 | 0 | 4 |
| P4 | 2 | 1 | 3 | 4 | 2 | 3 | 2 | 1 | 0 |
- Explain protection domain and access control list (ACL). Suppose you are employed as a system administrator of CIT, Pulchowk campus. Detail your roles and also suggest the blowing ideas to maintain secure and reliable system. [5+5]

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Subject: - Operating System

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1. What is pipe and shell? Describe the role of an operating system as a resource manager. [4+4]
2. Explain dining philosopher problem. How can it be solved? [3+5]
3. What is deadlock? Discuss the necessary conditions for deadlock with examples. [4+4]
4. What are the performance criteria for CPU? Assume you have the following jobs to execute with one processor. [2+6]

Job	Burst Time	Arrival Time
0	75	0
1	50	10
2	25	10
3	20	80
4	45	85

Suppose a system uses round-robin scheduling with quantum of 15 sec.

- a) Draw the Gantt chart
- b) Find the average wait and turnaround time
5. What is optimal page replacement algorithm? Suppose that a total of 64MB memory is available in a system. This memory space is partitioned into 8 fixed size slots of 8MB each. Assume 8 processes are currently requesting memory usages with size indicated below. [2+6]

2MB, 4MB, 3MB, 7MB, 9MB, 1MB, 8MB

Calculate the size of memory wasted due to external and internal fragmentation and memory utilization ratio.
6. What is LRU algorithm? How many page faults would occurs for the following reference string for page frames using LRU algorithm. [2+6]

1,2,3,4,5,5,3,4,1,6,7,8,7,8,9,5,4,5,4,2
7. State the advantages and disadvantages of placing the functionality in a device controller than in kernel. Explain in detail about DMA. [3+5]
8. What are the attacks from inside? Explain about Malware and Spyware. [4+4]
9. What is file system layout? Compare I-Node with linked list. [3+5]
10. What are the advantages of UNIX? Draw the structure of Unix operating system. [2+6]

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1. What are the functions of an operating system? Explain about microkernel. [3+5]
2. What is a monitor? Solve dining philosopher man's problem using semaphore. [8]
3. Describe the difference between preemptive and non- preemptive scheduling algorithm. Explain about scheduling in real time. [4+4]
4. A system that uses the Banker's Algorithm deadlock avoidance has five processes (1, 2, 3, 4 and 5) and four types of resources (A, B, C and D). There are multiple resources of each type. Is the following state safe or not? If it is, show how the processes can complete. If not, show how they can deadlock. [8]

Process	Current loan	Max need	Current claim
	A B C D	A B C D	A B C D
1	1 0 2 0	3 2 4 2	2 2 2 2
2	0 3 1 2	3 5 1 2	3 2 0 0
3	2 4 5 1	2 7 7 5	0 3 2 4
4	3 0 0 6	5 5 0 8	2 5 0 2
5	4 2 1 3	6 2 1 4	2 0 0 1

Resources Available	Total Resources
A B C D	A B C D
3 4 0 1	13 13 9 13

5. What is a critical reason and race condition? What are the limitation of optimal page replacement algorithm? [4+4]
6. What is segmentation? Suppose a machine has 48 bit virtual addresses and 32 bit physical address. [3+5]
 - a) If pages are 4KB, How many entries are in the page table?
 - b) Suppose the same system has a TLB (Translation Look a side buffer) with 32 entries. Furthermore suppose that a program contains instructions that fit into one page and it sequentially reads long integer elements from an array that spans thousands of pages. How effective will the TLB for this case?
7. What is a file system layout? Explain about I- Node and file system backup. [3+5]
8. What is a interleaving? Consider a Winchester – style hard disc with 100 cylinders, four double – sided platters and 25 sectors per track. The following is the (time – ordered) sequence of requests for disc sectors: {3518, 1846, 8924, 6672, 1590, 4126, 107, 9750, 158, 6621, 446, 11} The disc arm is currently at cylinder 10, moving towards 100. For each of SSTF, SCAN and C-SCAN, give the order in which the above requests would be served. [2+6]
9. What is a trap door? Explain in firewalls and access control lists. [2+6]
10. What are the goals of UNIX? Explain about NFS protocol and draw the structure of NFS. [2+6]