Chittagong University of Engineering and Technology
Department of Computer Science and Engineering
B. Sc. Engineering Level-3, Term-II, Exam. 2017

Course No.: CSE-335
Course Title: Operating Systems
Marks: 210
Time: 3 Hours

The figure in the right margin indicates full marks. The questions are of equal value. Answer any three questions from each section. Use separate script for each section.

SECTION-A

Q.1(a) What are the differences between symmetric and asymmetric multiprocessing systems? 05

Q.1(b) Define the following terms: 08

i) Starvation
ii) Processor Affinity
iii) Throughput
iv) Turnaround Time.

Q.1(c) With the help of proper diagram, explain the process of switching from user mode to kernel mode and vice versa. 08

Q.1(d) Answer the following questions: 14

i) Draw the relationship among an API, the system-call interface and the operating system.
ii) "Context switch time is pure overhead" – justify the statement.
iii) Contrast between program and process. Is it possible to have more than one process associated with a program? Give your justification.

Q.2(a) Draw the state diagram of a process from its creation to termination including all transitions and briefly elaborate every state and every transition. 08

Q.2(b) Answer the following questions: 20

i) Explicate the queuing diagram representation of process scheduling.
ii) How is a new process created using fork() system call? Using the program shown in Fig. 2(b), explain what the output will be at Line A.
iii) Describe the actions taken by a kernel to context-switch between processes.

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
int value = 7;
int main()
{
pid-t pid;
pid = fork();
if (pid == 0)
{
value +=14;
return 0;
}
else if (pid >0)
{
wait(NULL);
printf("PARENT: value %d", value); /*LINE A*/
return 0;
}
}
```

Fig. 2(b): What output will be at LINE A?

Q.2(c) Semaphore S is an integer variable which is manipulated through two operations, wait() and signal() shown in Fig. 2(c). How can you overcome the semaphore definition problem by modifying the definition of wait() and signal() operation? 07

```
Definition of wait():        Definition of signal():
wait(S){                     signal (S){
wait S <= 0;                 S++;
}                            }
```

Fig. 2(c)

Q.3(a) State three requirements that a solution to the critical section problem must satisfy. Briefly describe the Peterson's solution to this problem. 10

Q.3(b) Answer the following questions:
i) What is the major problem of priority scheduling algorithm? State the solution to that problem.
ii) What is the real difficulty with the SJF algorithm?
iii) "The performance of the RR algorithm depends heavily on the size of the time quantum" – justify with an appropriate example. 09

Q.3(c) Distinguish between soft real-time system and hard real-time system. Consider the following two periodic processes.

Process Name	Periods	Processing Time	Deadline
P_1	50	25	50
P_2	90	35	80

Draw the Gantt charts that illustrate the execution of these two processes using
i) Rate-Monotonic Scheduling Algorithm
ii) Earliest-Deadline-First Scheduling algorithm. 06

Q.3(d) Briefly explain the bounded-buffer problem. 06

Q.4(a) What do you mean by process synchronization? Why we need to synchronize processes? 06

Q.4(b) Explain critical section problem. 08

Q.4(c) Does a cycle in a resource allocation graph ensure the existence of a deadlock? Give your explanation. 15

Q.4(d) Explain bankers algorithm to avoid deadlock.

SECTION-B

Q.5(a) Briefly explain how OS protects the memory space of one process from another process. 10

Q.5(b) Differentiate between 15
i) First-fit and best fit
ii) Internal fragmentation and External fragmentation
iii) Logical address and Physical address
iv) Paging and Segmentation
v) TLB and Base register.

Q.5(c) Briefly explain the structure of hashed page table. 10

Q.6(a) Consider a system with 12 magnetic tape drives and three processes P_1, P_2, and P_3. Process P_1 requires 10 tape drives, process P_2 may need as many as 4 tape drives and process P_3 may need up to 9 tape drives. Suppose that at a time t_1, P_1 is holding 5 tape drives, P_2 is holding 2 tape drives and P_3 is also holding 2 tape drives. Answer the following questions using banker's algorithm: 14
i) What is the content of the matrix need?
ii) "The above system is in safe state at time t_1" – do you agree with this statement?
iii) Provide proof for your answer.
iv) Suppose that at time t_2, P_2 requests and is allocated one more tape drive. What will be the safety situation?

Q.6(b) Consider a memory system in which memory consists of the following hole sizes in memory order: 10
600 KB, 100 KB, 200 KB, 380 KB, 700 KB, 125 KB (in order). Which hole is taken for successive segment requests of 375 KB, 200 KB, 350 KB, 490 KB and 115 KB (in order) for first fit?
Now repeat the question for best fit and worst fit. Rank the algorithms in terms of how efficiently they use memory.

Q.6(c) Explain the role of bootstrap program. 05

Q.6(d) Consider a system with 80% hit ratio, 200 nano-seconds time to access memory and 20 nano-seconds time to access TLB. Calculate the Effective Access Time (EAT). 06

Q.7(a) Answer the following questions: (any three) 15
i) Briefly explain the benefits of slab allocation over buddy system.
ii) State the problems of tree-structured directory structure. Briefly discuss how this problem can be solved by acyclic-graph directory structure.
iii) Differentiate between symmetric key encryption and asymmetric key encryption algorithms.
iv) What is an inverted page table? How does it compare to a two-level page table?

Q.7(b) Suppose that a disk drive has 300 cylinders, numbered from 0 – 299. The work queue is: (The queue of pending request) 15

36, 79, 15, 120, 199, 270, 87, 160

Determine the total seek distance for the following disk scheduling algorithms:

i) SSTF
ii) SCAN
iii) FCFS
iv) LOOK
v) C-LOOK
vi) C-SCAN

Also show the head movement for the above algorithms where the current position of head is 90.

Q.7(c) Write short notes on: (Any two) 05

i) Trojan Horse
ii) Race Condition
iii) Logic Bombs.

Q.8(a) Compare RAID0, RAID1 and RAID5 in terms of performance improvement, ability to withstand failure, and space overhead required to implement the particular RAID level. 06

Q.8(b) Given the following reference string: 15

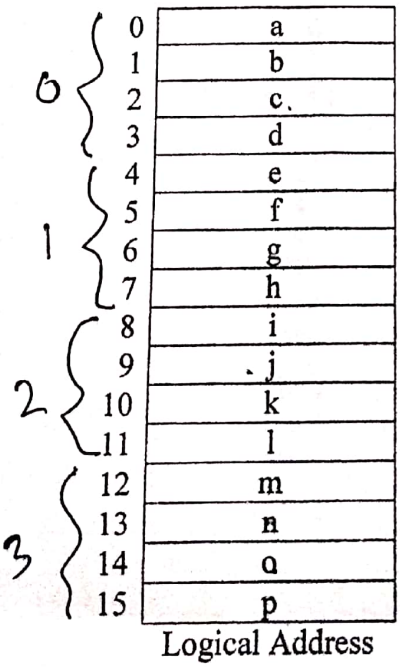
1, 2, 3, 4, 1, 4, 3, 2, 1, 1, 2, 3, 4, 3

Show

i) Page fault occurs during the processing of the reference scheme.
ii) The hit ratio for each of the following policies in a pure demand paging system.
Scheme 1: FIFO with three page of main memory.
Scheme 2: FIFO with four page of main memory.
Scheme 3: LRU with four pages of main memory.
Scheme 4: Optimal with three pages of main memory.
iii) What do you observe when you move from scheme 1 to scheme 2?

Q.8(c) How can access matrix be viewed as model for protection in an operating system? What are the different ways of implementing the access matrix? 09

Q.8(d) Consider the logical memory and its corresponding page table while considering a page size of four bytes as shown below: 05



0	7
1	5
2	1
3	3

Page Table

Fig. 8(d): 32-byte physical memory and 4-byte pages.

If we have a physical memory of thirty two bytes, Identify the physical address of

i) o
ii) c
iii) n
iv) i
v) m

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The figure in the right margin indicates full marks. The questions are of equal value. Answer any three questions from each section. Use separate script for each section.

SECTION-A

Q.1(a) Describe the two general rules of an operating system, and elaborate why these rules are important. 8

Q.1(b) Explain the differences between symmetric and asymmetric multiprocessing. What are three advantages and one disadvantage of the multiprocessor system? 10

Q.1(c) Draw the relationship among an API, the system-call interface, and the operating system. In what ways is the modular kernel approach similar to the layered approach? 10

Q.1(d) Give two reasons why caches are useful. If a cache can be made as large as the device for which it is caching (for instance, a cash as large as disk), why not make it that large and eliminate the device? 7

Q.2(a) Draw the state diagram of a process from its creation to termination including all transitions and briefly elaborate every state and every transition. 8

Q.2(b) What are the differences among short-term, medium-term and long-term scheduling? Describe the actions taken by a kernel to context-switch between processes. 12

Q.2(c) Discuss the differences between the following: 8
- i) Concurrency and parallelism
- ii) Single-threaded and multi-threaded process

Q.2(d) What are three requirements of any solution to the critical sections problem? Why are the requirements needed? 7

Q.3(a) Why it is important for the scheduler to distinguish I/O bound programs from CPU-bound programs? What is dispatch latency? 6

Q.3(b) Suppose that the following process arrive for execution at the time indicated in Table-3(b). Each process will run the listed amount of time. In answering the questions, use preemptive scheduling and base all decisions on the information you have at the time the decision must be made. 18

Table-3(b): Process with the CPU burst time given in *ms*

Process	Arrival Time	Burst Time	Priority
P1	0	8	3
P2	1	10	1
P3	2	5	2
P4	3	3	3
P5	4	2	4

- i) Draw two grant chart using SJF (preemptive) and priority (preemptive) scheduling.
- ii) What is the waiting time and turnaround time of each process for each of the scheduling algorithm in part (i).

Q.3(c) What is the parameter associated with the round robin scheduler? What is the issue in choosing this parameter? 6

Q.3(d) What advantage is there in having different time-quantum sizes at different level of a multilevel queuing system? 5

Q.4(a) Briefly explain banker's algorithm to avoid deadlock. 15

Q.4(b) Is it possible to have deadlock involving only one process? Justify your answer. 6

Q.4(c) What do you mean by process synchronization? Explain two different methods for process synchronization. 14

SECTION-B

Q.5(a) Write short note on:
- i) Compaction
- ii) Worst-fit
- iii) Base register
- iv) Page
- v) Frame

Q.5(b) Briefly explain basic paging mechanism with proper diagram. 12

Q.5(c) Explain buddy system and slab allocation techniques for kernel memory allocation. 13

Q.6(a) What is virtual memory? Explain the procedure taken by an OS upon a page fault. 10

Q.6(b) Explain (i) LRU (ii) Optimal (iii) Second chance algorithms for page replacement. 12

Q.6(c) Suppose you have main memory of 4MB and you have a process of 400MB. Can you execute this process? Justify. 6

Q.6(d) Write short note on TLB. 7

Q.7(a) What characteristics determine the disk access speed? Describe how multiplatter disks are arranged into tracks and sectors. 10

Q.7(b) A disk request queue has requests for blocks of the following cylinders (ordered by time of arrival): 16

1773, 5041, 4502, 6881, 872, 4823, 8994, 4478, 9253

The disk has 10,000 cylinders numbered 0 through 9999. The disk head is currently at cylinder 4617 and moving towards cylinder 9999. Calculate the total seek distance for each of the following disk seek algorithms:

FCFS, SSTF, LOOK, C-LOOK.

Q.7(c) State the problems of tree-structured directory structure. Briefly discuss how this problem can be solved by acyclic-graph directory structure.

Q.8(a) What do you mean by protection domain? How a model of protection can be viewed? Explain the operations "copy" and "owner" in order to change the contents of access matrix. 1

Q.8(b) Differentiate between protection and security. Write short note on the following:
- i) Viruses
- ii) Worms
- iii) Denial of service (DoS)
- iv) Trap Door

Q.8(c) Distinguish between the following:
- i) FAT and NTFS file system
- ii) Windows and UNIX operating system.

-The End-

Chittagong University of Engineering and Technology
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B. Sc. Engineering Level-3, Term-II, Exam. 2015
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SECTION-A

Q.1(a)	Explain dual-mode operation of an OS. Graphically show the transition procedure from user to kernel mode.	10
Q.1(b)	Briefly explain different types of activities those are performed by an OS.	10
Q.1(c)	Explain the concept of cloud computing. Differentiate among public cloud, private cloud and hybrid cloud. In addition explain different types of cloud services.	08
Q.1(d)	Keeping in mind the various definitions of OS. Consider whether the OS should include applications such as web browsers and mail programs. Argue both that it should and it should not support your answer.	07
Q.2(a)	What is system call? Describe three general methods for passing parameters to the operating system.	06
Q.2(b)	Briefly explain implementation procedure of system calls by an OS. Also, explain the use of the following system calls of Unix. (i) fork() (ii) open() (iii) getpid() (iv) abort()	10
Q.2(c)	Briefly explain the structure of UNIX OS.	10
Q.2(d)	Write short notes on (i) process state ~~program~~ diagram (ii) multitasking in mobile systems (iii) message passing approach of interprocess communication	09
Q.3(a)	What do you mean by a socket? With the help of proper diagram explain the execution procedure of Remote Procedure Calls (RPC).	10
Q.3(b)	Differentiate between (i) Data parallelism and Task parallelism (ii) Single-threaded process and multithreaded process (iii) User threads and Kernel threads (iv) Threads Pools and OpenMP	08
Q.3(c)	With the help of examples explain three different multithreaded models.	09
Q.3(d)	Answer the following: (i) Explain the differences between preemptive and nonpreemptive scheduling. (ii) Why it is important for the scheduler to distinguish I/O-bound process from CPU-bound process?	08
Q.4(a)	"The performance of the Round-Robin (RR) algorithm does heavily depend on the size of the time quantum"—Justify.	10
Q.4(b)	Consider the following set of processes with the length of the CPU burst given in milliseconds:	15

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 the order P_1, P_2, P_3, P_4, and P5 all at time 0.

(i) Draw three Gantt charts that illustrate the execution of these processes using FCFS, SJF (non-preemptive) and RR (quantum 01) scheduling

algorithms.

(ii) What is the waiting time and turn-around time of each process for each of the scheduling algorithms in part (i)? 10

Q.4(c) Why do CPU scheduling algorithms require for OS? State different scheduling criteria for comparing CPU scheduling algorithms.

SECTION-B

Q.5(a) What are the necessary conditions for occurring deadlock? Explain two different ways of recovering from deadlock. 17

Q.5(b) Depict a resource allocation graph for the following situation: 11

$P = \{P_1, P_2, P_3, P_4\}$

$R = \{R_1, R_2, R_3, R_4, R_5\}$

$E = \{P_1 \rightarrow R_1, P_1 \rightarrow R_2, R_2 \rightarrow P_2, R_2 \rightarrow P_3, P_3 \rightarrow R_3, P_4 \rightarrow R_4, R_3 \rightarrow P_1, R_3 \rightarrow P_4, P_2 \rightarrow R_3\}$

Resource instances: $R_1(1), R_2(2), R_3(3), R_4(1), R_5(1)$

Also figure out the cycle if it does contain in the graph. 07

Q.5(c) Distinguish between Windows and UNIX operating system. 15

Q.6(a) Consider the following page reference string:

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

How many page faults would occur for the following page replacement algorithms utilizing three page frames which are empty initially?

(i) LRU page replacement

(ii) FIFO page replacement

(iii) Optimal page replacement 10

Q.6(b) Given four memory partitions of 100 KB, 500 KB, 200 KB and 600 KB (in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 180 KB, 430 KB, 80 KB and 360 KB (in order)? Which algorithm does make the most efficient use of the memory? 10

Q.6(c) Suppose a system has 64-bit logical address space. Which paging mechanism is suitable in this situation? Explain. 15

Q.7(a) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2150 and the previous request was at cylinder 1805. The queue of pending requests in FIFO order is: 2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681. Starting from 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 algorithm.

(i) FCFS

(ii) SSTF

(iii) SCAN

(iv) LOOK

(v) C-LOOK 12

Q.7(b) Differentiate between

(i) RAID 5 and RAID 10

(ii) Boot blocks and bad blocks

(iii) NAS and SAN

(iv) Seek time and rotational latency 08

Q.7(c) Compare between

(i) Shared lock and exclusive lock

(ii) Single –level directory and two-level directory

(iii) Index-file and relative-file

(iv) Track and sector 11

Q.8(a) Briefly explain different layers of file systems. 12

Q.8(b) Answer the following:

(i) Write short notes of FAT

(ii) Explain indexed allocation of files

(iii) Consider that a disk size is 1 terabyte and each block size is 4 kilobytes. If we consider bit map approach for free space management, how much memory will be required to store the bit map?

Q.8(c) Write short notes on 12

(i) One-time passwords

(ii) Differentiate security violation methods

(iii) Symmetric and asymmetric encryption

(iv) Digital signatures

Chittagong University of Engineering and Technology
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Section-A

Q.1(a) What do you mean by an operating system? Explain several benefits of operating systems considering both applications' point of view and users' point of view. 10

Q.1(b) Distinguish between 12
- i. Boot sector and bad sector
- ii. Bootstrap program and application program
- iii. Multiprogramming and timesharing OS

Q.1(c) What is the purpose of command interpreter? Why is it usually separate from kernel? 08

Q.1(d) Distinguish between program and process. Is it possible to have more than one process associated with a program? Give your justification. 05

Q.2(a) Briefly explain microkernel structure of OS design. 10

Q.2(a) Write short notes on 10
(i). Shells (ii). API (iii). Emulation (iv). System Calls

Q.2(c) Explain Android OS structure. 07

Q.2(d) Describe the actions taken by a kernel to context-switch between processes. 08

Q.3(a) What advantage is there in having different time-quantum sizes at different level of multilevel queuing system? 06

Q.3(b) Explain five different criteria to compare among different CPU scheduling algorithms. 08

Q.3(c) Explain following CPU scheduling algorithms with their relative advantages and disadvantages. 12
(i). FCFS (ii). PR (iii). RR (iv) SRTF

Q.3(d) Distinguish between soft real-time system and hard real-time system. 09
Consider the following two periodic processes.

Process Name	Periods	Processing time	Deadline
P_1	50	25	50
P_2	80	35	80

Draw the Gantt Charts that illustrate the execution of these two processes using (i) rate-monotonic scheduling algorithm (ii) EDF scheduling algorithm.

Q.4(a) Explain the concepts of memory stall. Also explain the concepts of processor affinity. 08

Q.4(b) Explain the concepts of resource-allocation graph and wait-for graph. Does a cycle in a resource-allocation graph ensure that there is a deadlock in the system? Justify your answer. 10

Q.4(c) Consider the snapshot of the system given in Fig-4(c). 1

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

Answer the following questions using Banker's algorithm.

i. What is the content of matrix need?
ii. Is the system in a safe state?
iii. If a request from process P_1 arrives for (0, 4, 2, 0), can the request be granted immediately?

Section-B

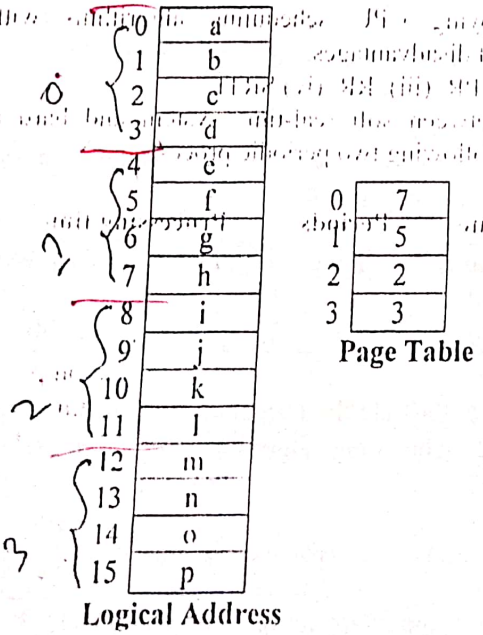
Q.5(a) Write short notes on (i). Relocation registers (ii). Logical address (iii). External fragmentation (iv). Compaction (v) Best fit 12

Q.5(b) Consider the following segment table: 10

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What is the physical address for the logical addresses (i). 0, 430 (ii). 1, 10 (iii). 2, 500 (iv). 3, 400 (v). 4, 112

Q.5(c) Consider the logical memory and its corresponding page table while considering a page size of 4 bytes as shown below:



If we have a physical memory of 32 bytes, identify the physical address of (i). c (ii). g (iii). i (iv). a (v). l (vi). n

Q.5(d) What is the purpose of paging of the page tables? 05

Q.6(a) What is demand paging? How demand paging affects the performance of the computer system? Explain with example. 10

Q.6(b) Write down the basic approaches for page replacement. Consider the following page reference strings: 15

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 following replacement algorithms, assuming there are four frames?

i. LRU replacement
ii. FIFO replacement
iii. Optimal replacement

Remember that all frames are initially empty, so your first unique pages will cost one page fault.

Q.6(c) Consider a logical address space of 64 pages of 1,024 words each, mapped onto a physical memory of 32 frames. 10

i. How many bits are there in the logical address?
ii. How many bits are there in the physical address?

Q.7(a) Explain the concepts of C-SCAN and C-LOOK disk scheduling algorithms. Also explain the factors need to be considered while selecting a disk scheduling algorithm. 12

Q.7(b) What do you mean by RAID? Explain following RAID architectures considering their recommended applications, advantages and disadvantages. 12

(i). RAID0 (ii). RAID 1 (iii). RAID 5 (iv). RAID 10

Q.7(c) Explain tree-structured directories for storing files. 06

Q.7(d) Explain two different approaches for managing free spaces of disks 05

Q.8(a) What is access matrix? Explain access matrix with owner rights. 08

Q.8(b) Distinguish between security and privacy. Write short notes on 12

i. Trap door
ii. Virus Signature
iii. Symmetric cryptosystem
iv. Digital signature

Q.8(c) Show the schematic view of the NFS architecture. 10

Q.8(d) What is the need-to-know principle? Why is it important for a protection system to adhere to this principle? 05

-The End-

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SECTION-A

Q.1(a) Suppose your team in a company plan to develop a new operating system. What are the major issues you need to consider in your analysis prior to its coding. 12

Q.1(b) Differentiate between 15
i. Kernel and bootstrap program
ii. Multiprocessor systems and clustered systems
iii. Distributed computing and cloud computing 08

Q.1(c) Explain two different data structures those can be used for kernel design. 10

Q.2(a) What is system call? What is the purpose of the command interpreter? Why is it usually separate from the kernel? 08

Q.2(b) In what ways is the modular kernel approach similar to the layered approach? In what ways does it differ from the layered approach? 08

Q.2(c) Explain two different ways of inter-process communication. 09

Q.2(d) Distinguish between
i. User threads and kernel threads
ii. CPU bound process and I/O bound process
iii. Convoy effect and aging

Q.3(a) Explain the differences in how much the following scheduling algorithms discriminate in favor of short processes: 08
i. FCFS
ii. RR
iii. Multilevel feedback queues

Q.3(b) Consider the following set of processes with the length of the CPU burst given in milliseconds: 15

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 the order P_1, P_2, P_3, P_4, P_5 all at time 0.
i. Draw three Gantt charts that illustrate the execution of these processes using FCFS, SJF (non-preemptive) and RR (quantum-1) scheduling algorithms.
ii. What is the waiting time and turn-around time of each process for each of the scheduling algorithms in part (i)?
iii. Which of the algorithms results in the minimum average waiting time (over all processes)?

Q.3(c) Differentiate between job scheduler and CPU scheduler. Explain the queuing diagram representation of process scheduling. 12

Q.4(a) What are the necessary conditions of occurring deadlock? 08

Q.4(b) Consider the following snapshot of a system: 15

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P_0	0 0 1 2	0 0 1 2	1 5 2 0
P_1	1 0 0 0	1 7 5 0	
P_2	1 3 5 4	2 3 5 6	
P_3	0 6 3 2	0 6 5 2	
P_4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm

i. What is the content of the matrix Need?
ii. Is the system in a safe state?
iii. If a request from process P_1 arrives for (0,4,2,0), can the request be granted immediately?

Q.4(c) Explain two different ways of recovering from a deadlock. 12

SECTION-B

Q.5(a) Distinguish between 09

i. Segmentation and fragmentation
ii. Logical address and physical address
iii. Page table and segment table

Q.5(b) Briefly explain segmentation mechanism. 10

Q.5(c) Suppose that a process is 72,766 bytes in size. In a paging mechanism, if page size is 2048 bytes, how many frames will be needed to allocate the process in the memory? Is there any fragmentation here? 06

Q.5(d) Is it possible to share code in a paging environment? Justify your answer. 10

Q.6(a) Suppose a system has 64-bit logical address space. Which paging mechanism is suitable in this situation? Explain your answer. 12

Q.6(b) Explain the way of handling a page fault situation. 10

Q.6(c) Explain two different ways of implementing LRU page replacement algorithms. 13

Q.7(a) What is the use of file pointer? Differentiate between direct access and sequential access of a file. 08

Q.7(b) Explain contiguous allocation and linked allocation of disk space. 10

Q.7(c) Suppose that a disk drive has 5,000 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: 17

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130.

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

i. FCFS
ii. C-SCAN
iii. C-LOOK
iv. SCAN

Q.8(a) Write short notes on the followings: 16

i. One time passwords
ii. Biometrics
iii. Trozan horse
iv. Parallel algorithms

Q.8(b) What is access matrix? Explain the access matrix with owner right. 08

Q.8(c) Explain bit vector implementation of free-space management. 06

Q.8(d) Explain RSA algorithm to obtain private key and public key. 05

Department of Computer Sc...
B. Sc. Engineering Level-3, Term-II, Exam...

Course No: CSE-335
Course Title: Operating Systems
Marks: 210
Time: 3 Hours

The figure in the right margin indicates full marks. The questions are of equal value. Answer any three questions from each section. Use separate script for each section.

SECTION-A

Q.1(a) Which program does come into play prior to Operating System (OS) in computer system? Illustrate the components of computer system. 12

Q.1(b) State the basic difference among batch system, time-sharing system, multi-tasking system and multi-programming system. 08

Q.1(c) How does a user program interact with OS? Explain the methods to pass parameters from user program to OS while system calls occur. 15

Q.2(a) What do you mean by dual mode operation of an operating system? Explain process states with pertinent diagram. 10

Q.2(b) Why do CPU scheduling algorithms require for OS? State different scheduling criteria for comparing CPU scheduling algorithms. 10

Q.2(c) Consider the following set of process with the length of the CPU burst time and arrival time given in milliseconds: 15

Process	Arrival time	Burst time	Priority
P_1	3	6	3
P_2	0	5	1
P_3	8	8	4
P_4	12	10	2
P_5	5	4	5

(i) Draw two Gantt charts depicting the execution of these process using SJF (Non Preemptive) and Preemptive priority scheduling algorithms.

(ii) What are the waiting time and turnaround time of each process for each of the scheduling algorithms in part (i).

Q.3(a) Justify the statement, "the performance of the Round-Robin (RR) algorithm does heavily depend on the size of the time quantum". 10

Q.3(b) Consider the exponential averaging method is used to estimate the length of the next CPU burst for a process. Assume $\tau_0 = 10, \alpha = 0.1$ and the sequence of the actually observed CPU burst length so far is: 10, 16, 4, 20, 12. What is the sequence of estimated CPU burst length for the next CPU burst? 10

Q.3(c) Describe the differences among short-term, medium-term, and long-term schedu'er. Why it is important for the scheduler to distinguish I/O bound programs from CPU-bound programs? 15

Q.4(a) What do you mean by inter-process communication (IPC)? Explain the two fundamental models of inter-process communication with sketches. 13

Q.4(b) What is the main disadvantage of the semaphore definition? How can you overcome this problem by modifying the definition of wait () and signal () operations? 12

Q.4(c) What is the real difficulty of implementing the SJF algorithm? How can you overcome this difficulty? 10

SECTION-B

Q.5(a) What do you mean by dead lock? What are the necessary conditions for occurring deadlock? 10

Q.5(b) Consider the following snapshot of a system: 18

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

Answer the following questions using the banker's algorithm:

(i) What is the content of the matrix need?

(ii) Is the system in a safe state?

(iii) If the request from process P_1 arrives for (0, 4, 2, 0), Can the request be granted straight away?

Q.5(c) Depict a resource-allocation graph for the following situation:

$$P = \{P_1, P_2, P_3, P_4\}$$

$$R = \{R_1, R_2, R_3, R_4, R_5\}$$

$$E = \{P_1 \rightarrow R_1, P_1 \rightarrow R_2, R_2 \rightarrow P_2, R_2 \rightarrow P_3, P_3 \rightarrow R_4, P_4 \rightarrow R_4, R_4 \rightarrow P_1, R_3 \rightarrow P_4, P_2 \rightarrow R_5\}$$

Resource instances: R_1 (1), R_2 (2), R_3 (3), R_4 (1), R_5 (1)

And Figure out the cycle if it does contain in the graph.

Q.6(a) State basic differences between logical and physical addresses. 05

Q.6(b) Given four memory partitions of 100 KB, 500 KB, 200 KB, and 600 KB (in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 180 KB, 430 KB, 80 KB, and 360 KB (in order)? Which algorithm does make the most efficient use of memory? 10

Q.6(c) Why page are sizes always power of 2? Consider a logical address space of eight pages of 1024 words each, mapped into a physical memory of 32 frames. 08

(i) How many bits are there in the logical address?

(ii) How many bits are there in the physical address?

Q.6(d) What is the function of memory management unit (MMU)? What is swapping? "The context switch time in a swapping system is fairly high"-Justify the statement with an example. 12

Q.7(a) Why is Translation Look-Aside Buffer (TLB) used in paging? Consider a paging system with the page table stored in the memory: 10

(i) If a memory reference takes 160 nanoseconds, how long does a paged memory reference take?

(ii) If we add TLBs and 80% of all page table references are found in the TLBs, What is the effective memory access time? (Assume searching a page table entry in the TLBs takes 10 nanoseconds) 15

Q.7(b) Consider the following page reference strings:

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

How many page faults would occur for the following page replacement algorithms utilizing three page frames which are empty initially.

(i) LRU page replacement (ii) FIFO page replacement (iii) Optimal page replacement

Q.7(c) What do you mean by thrashing? How can we limit the effect of thrashing in a system? 10

Q.8(a) What is a file? Explain the sequential and the direct access methods of a file with proper diagrams. 08

Q.8(b) Differentiate between protection and security. Explain the following security issues: 10

(i) One-time passwords (ii) Biometrics

Q.8(c) Suppose that a disk drive has 300 cylinders numbered 0 to 299. The drive's current head position is at cylinder 90 and moving towards cylinder 299. Consider the following queue of pending requests: 76, 183, 67, 211, 114, 124, 238, 65, 167, 14. 10

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

(i) FCFS (ii) SSTF (iii) SCAN (iv) LOOK (v) C-SCAN (vi) C-LOOK

Q.8(d) Contrast between FAT and NTFS file systems.