

**OPERATING SYSTEMS
(CSEN 2203)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which is not a layer of an operating system?
(a) Kernel (b) Shell
(c) Application Program (d) Critical Section.
- (ii) A process is
(a) Basic entity (b) Passive entity
(c) Static entity (d) Active entity.
- (iii) FCFS may suffers from
(a) starvation (b) deadlock
(c) convoy effect (d) busy waiting.
- (iv) The interval from the time of submission of a process to the time of completion is termed as
(a) waiting time (b) turnaround time
(c) response time (d) throughput.
- (v) An un-interruptible unit is known as
(a) single (b) atomic (c) static (d) none of these.
- (vi) An I/O port typically consists of four registers: status, control, _____ and _____ registers.
(a) bus in, bus out (b) data in, data out
(c) process1, process2 (d) none of the above.
- (vii) The two operations permissible on semaphores are: (choose two)
(a) wait (b) stop (c) hold (d) signal.
- (viii) The time to move the disk arm to the desired sector in a hard disk is known as
(a) rotational latency (b) positioning time
(c) seek time (d) hashed time.

- (ix) Values of which of the following items need not necessarily be saved in PCB on context switch between processes?
 (a) General purpose register (b) Program counter
 (c) Translation Look-aside Buffer (d) All the above.
- (x) System calls are usually invoked by
 (a) software interrupt (b) indirect jump
 (c) polling (d) I/O instruction.

Group – B

2. (a) Draw and explain the microkernel architecture of OS.
 (b) What are the advantages of virtual machine architecture in OS design?
 $6 + 6 = 12$
3. (a) Describe what do you mean by Object and Domain.
 (b) Explain how an Access Matrix can ensure Protection in the scenario of Objects and Domains. Provide a diagram and an illustrative example for your answer.
 $6 + 6 = 12$

Group – C

4. (a) Draw the Gantt chart and find the average waiting time and turnaround time for the following processes using priority scheduling algorithm? (0-zero is of highest priority) [All processes arrive at the same time]

Process	P1	P2	P3	P4	P5
Burst time	5	13	8	6	12
Priority	1	3	0	4	2

- (b) Assume that the jobs arrive for execution as per the data given as follows:

Process	Arrival Time	Burst Time
P_1	0.0	7
P_2	2.0	4
P_3	4.0	1
P_4	5.0	4

Give the Gantt chart illustrating the execution of these jobs using preemptive and non-preemptive SJF scheduling policies. What are the average waiting times for these computing sessions?

$6 + 6 = 12$

5. (a) Answer the following questions:
 (i) An executing process goes into which state when it asks for an I/O operation?
 (a) Ready to run (b) Run (c) Wait (d) None of the above

- (ii) Which types of threads are not scheduled by operating system?
 (a) User (b) Kernel (c) Concurrent (d) All of the above
- (iii) What is the ready state of a process?
 (a) when process is scheduled to run after some execution
 (b) when process is unable to run until some task has been completed
 (c) when process is using the CPU
 (d) none of the mentioned
- (iv) A process can be terminated due to
 (a) normal exit
 (b) fatal error
 (c) killed by another process
 (d) all of the mentioned.

- (b) Consider the following snapshot of a system with 5 processes, P0 through P4 and three resource types A, B and C.

	A	B	C
Instances	10	5	7

At time t_0 , snapshot of the system:

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

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 P1 arrives for (1, 0, 2), can the request be granted immediately?

$$4 + 8 = 12$$

Group - D

6. (a) Suppose our process is allocated **three (0 - 2) page frames** in *physical memory*. The process consists of **nine (0 - 8) pages** that are referenced. Below is the order in which pages are referenced in program execution

Page Ref:	0	1	2	0	1	2	3	4	2	5	0	6	0	7	7	8	0	6
Frame 0:	0*	0	0															
Frame 1:		1*	1															
Frame 2:			2*															

Complete the table given above using FIFO page replacement algorithm. Report the total number of page faults. [Mark the page faults with an * (asterisk) in the table as shown]

- (b) (i) A byte addressable computer that uses paged memory management has 24 bit virtual address space. The lower 9 bits of the virtual address represent the offset. What is the maximum number of entries in the page map table?

(ii) A processor has 4K page of 512 bytes in size in the logical address space. The physical memory contains 1024 frames. How many bits are there in logical address and in physical address?

- (c) Consider a disk queue with requests for I/O on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The head is initially at cylinder number 53 and is moving towards cylinder 199. The cylinders are numbered 0 to 199. What is the total distance (in cylinders) that the disk arm moves to satisfy the pending requests using C-Scan scheduling?

$$5 + 4 + 3 = 12$$

7. (a) Compare the memory organization schemes of contiguous memory allocation, pure segmentation and pure paging with respect to the following issues:

- (i) External fragmentation
(ii) Internal fragmentation.

- (b) What is the effective memory access time, given the TLB hit ratio to be 80 percent and it takes 100 nanoseconds to access memory also assume page table lookup takes one memory access?

- (c) Given a swapping system in which memory consists of the following hole sizes in memory order: 10KB, 4KB, 20KB, 18KB, 7KB, 9KB, 12KB and 15KB. Which hole is taken for successive segment request of 12KB, 10KB, 9KB in order using

- (i) first fit algorithm
(ii) best fit algorithm
(iii) worst fit algorithm?

$$6 + 3 + 3 = 12$$

Group - E

8. (a) With diagram explain the data transfer technique using programmed I/O and Interrupt driven I/O.

- (b) Explain the DMA operation using schematic diagram. Why is it considered very useful? Explain your answer.

$$(2 + 2) + (6 + 2) = 12$$

9. (a) Compare bus arbitration using daisy chain and polling with the aid of schematic diagrams. What is the major difference in the two bus arbitration?

- (b) Differentiate between blocking and non-blocking I/O system. Give examples of both type. Why are buffering and caching required in kernel I/O subsystem?

$$6 + 6 = 12$$

Department & Section	Submission Link
CSE - A	https://classroom.google.com/c/Mjk5ODM0MTMyMjky/a/MzcxNjY5NzQ0MDcz/details
CSE - B	https://classroom.google.com/c/MzEyMzg3MDIzODM3?cjc=xbf722m
CSE - C	https://classroom.google.com/w/MzEyMzAzOTMyNzc0/tc/MzcxNzUwOTk5MTUx