FUNDAMENTALS OF OPERATING SYSTEM
(CSEN 4181)

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) Paging suffers from
(a) Internal fragmentation (b) External fragmentation
(c) both (a) & (b) (d) none of these.

(ii) Linux operating system has
(a) Microkernel structure (b) Layered structure
(c) Monolithic structure (d) None of the above.

(iii) Process scheduling algorithm that is never pre-emptive
(a) SJF (b) Priority (c) FCFS (d) Round Robin.

(iv) A benefit of the microkernel organization is:
(a) Portability (b) Flexibility
(c) Extensibility (d) All of these.

(v) Which one of the following is the correct relation between page size and frame size?
(a) page size = frame size (b) page size < > frame size
(c) page size > frame size (d) frame size > page size.

(vi) A state is safe, if
(a) the system does not crash due to deadlock occurrence
(b) the system can allocate resources to each process in some order and still avoid a deadlock
(c) the state keeps the system protected and safe
(d) all of these.

(vii) In which of the following case Banker's algorithm is used?
(a) Deadlock Avoidance (b) Context Switching
(c) Deadlock Recovery (d) Mutual Exclusion.

(viii) In a file allocation system, which of the following allocation scheme(s) can be used if no external fragmentation is allowed?
(i) Contiguous (ii) Linked (iii) Indexed
(a) (i) and (iii) only (b) (ii) only
(c) (ii) and (iii) only (d) (iii) only.

(ix) The circular wait condition can be prevented by
(a) defining a linear ordering of resource types
(b) using threads
(c) using pipes
(d) all of the above mentioned.

(x) A virus can be attached to a program
(a) at the start of the program (b) at the end of the program
(c) by embedding within the program (d) all of the above.

Group – B

2. (a) Name one essential property of the following types of operating systems:
(i) Batch, (ii) Interactive, (iii) Time-sharing, (iv) Real time, (v) Network.

(b) (i) Compare microkernel system with layered operating system.
(ii) What are the steps involved in booting process?

5 + (4 + 3) = 12

3. (a) (i) What are the main differences between operating systems for desktops and mobile phones?
(ii) What is the main issue that a programmer must take extra care when writing an operating system for real time system?

(b) (i) What do you mean by system calls? What are various types of system calls?
(ii) Define operating system. What are its functions? Discuss about layered approach of operating system.

(2 + 2) + ((1 + 2) + (1 + 2 + 2)) = 12

Group – C

4. (a) What is the difference between pre-emptive and non-pre-emptive scheduling?

(b) Consider the following snapshot of a system:

Process	Allocation				Max				Available			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P1	0	0	1	2	0	0	1	2	2	1	0	0
P2	2	0	0	0	2	7	5	0				
P3	0	0	3	4	6	6	5	6				
P4	2	3	5	4	4	3	5	6				
P5	0	3	3	2	0	6	5	2				

Answer the following questions using Banker's algorithm

(i) Is the system in a safe state? Justify your answer?
(ii) If a request from process P3 arrives for (0, 1, 0, 0), can the request be granted immediately? Explain your answers.

3 + (5 + 4) = 12

5. (a) (i) What is the difference between a user level thread (ULT) and a kernel level thread (KLT)?
(ii) Explain how semaphore solves the critical section problem for n number of processes.

(b) Consider the following set of processes, with the length of the CPU burst time is given in millisecond.

Process	Burst time	Arrival time
P1	6	0
P2	10	3
P3	8	5
P4	5	7
P5	6	10

(i) Draw a Gantt chart for a round robin scheduling policy with time quantum= 4units. Illustrate the execution of these processes using pre-emptive priority (higher number implies a higher priority) scheduling.
(ii) Find the completion time and response time.
(iii) Find the average waiting time and average turnaround time.

(3 + 3) + (2 + 2 + 2) = 12

Group – D

6. (a) Suppose a disk drive has 300 cylinders, numbered 0 to 299.The current head position of the disk is at 90. The queue of pending requests in FIFO order is 36,79, 15,120, 199, 270, 89, 170. Calculate average cylinder movements for the following algorithms.
(i) SSTF (ii) C-SCAN (iii) FCFS

(b) Consider a logical address space of 8 pages of 1024 words each, mapped onto a physical memory of 32-page frames.
Answer the following:
(i) How many bits are there in the logical address?
(ii) How many bits are there in the physical address?

(3 + 3 + 3) + 3 = 12

7. (i) What are the advantages and disadvantages of linked file Allocation technique?

(ii) Write the mechanism of indexed sequential file organization.

(iii) What do you mean by internal and external fragmentation? Explain with example.

(iv) Under which condition does swapping start happening frequently in memory access?

(3 + 3 + 4 + 2) = 12

Group – E

8. (a) Discuss how the asymmetric encryption algorithm can be used to achieve the following goals:
   (i) Authentication: the receiver knows that only the sender could have generated the message
   (ii) Secrecy: only the receiver can decrypt the message
   (iii) Authentication and secrecy: only the receiver can decrypt the message, and the receiver knows that only the sender could have generated the message

   (b) Explain how one-time password system prevents improper authentication due to password exposure.

(3 × 3) + 3 = 12

9. (a) The list of all passwords is kept internally within the operating system. If a user manages to read the list, password protection can no longer be provided. Suggest a method to avoid this problem.

   (b) For each of the following security attacks, does public key encryption help prevent the attack? Justify your answer.
   (i) Spoiler/Denial of Services
   (ii) Abuse of valid privileges
   (iii) Listener or eavesdropper attack
   (iv) Trojan Horse
   (v) Buffer overflow attack.

2 + (5 × 2) = 12

Department & Section	Submission link:
ECE	https://classroom.google.com/c/MTIyMjM3NTc0NTMw/a/Mjc0NzQ0NzY2NTM2/details