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Paper Code : CS-603

OPERATING SYSTEM

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) A computer system has 9 tape drives, with n processes competing for them. Each process may need 3 tape drives. The maximum value of n for which the system is guaranteed to be deadlock free is
   a) 9 b) 7
   c) 8 d) 6.

   ii) The average wait time for five processes P1-P5 with burst of 5, 19, 2, 16 and 7 milliseconds respectively, using SJF is
   a) 5 ms b) 9·8 ms
   c) 28 ms d) 10·6 ms.

[Turn over

iii) A situation where several processes access and manipulate the same data concurrently and the outcome of the execution depends on the particular order in which access takes place is called
a) race condition
b) data inconsistency
c) starvation
d) fatal error.

iv) What are very effective because a mode switch is not required to switch from one thread to another ?
a) Kernel-level threads
b) Alterable threads
c) User-level threads
d) Application level threads.

v) The default remedy of starvation is
a) Ageing
b) Critical section
c) Mutual exclusion
d) All of these.

vi) Which of the following page replacement algorithms suffers from Belady's anomaly ?
a) Optimal replacement
b) LRU
c) FIFO
d) Both (a) and (c).

vii) Which of the following is false ?
a) Segmentation suffers from external fragmentation
b) Paging suffers from internal fragmentation
c) Virtual memory is used only in multi-user system
d) Segmented memory can be paged.

viii) If a process has 32 k bytes logical address space and the page size is 2048 bytes then the number of frames of that process is
a) 4
b) 8
c) 16
d) 32.

ix) In DMA transfer

a) CPU is involved actively during data transfer

b) CPU is involved partially during data transfer

c) DMA controller is actively involved during data transfer

d) Both (b) and (c).

x) Page stealing is

a) a sign of efficient system

b) taking larger disk space's for pages paged out

c) taking page frames from other working sets

d) one of the tuning goals.

xi) Scheduling a process from Ready Queue to CPU is done by

a) Short term scheduler

b) Middle term scheduler

c) Long term scheduler

d) Dispatcher.

xii) Which scheduling policy is most suitable for the time-sharing operating system ?

a) Shortest job first

b) Round Robin

c) First come first serve

d) Multilevel queue.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Prove that linear ordering for denying the "circular wait" condition actually prevents circuits from developing in resource allocation graphs. How can context switch time be reduced ? 3 + 2

3. What is fragmentation ? Explain different types of fragmentation. 1 + 4

4. How to implement a solution to the Readers-Writers Problem with the use of semaphores ?

5. 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 the average cylinder movements for the following algorithms :

   i) SSTF

   ii) C-SCAN

   iii) SCAN

6. What is Bounder Buffer Problem ? Explain with the solution.

7. What are the advantages and disadvantages of Paging and Segmentation ? What is the difference between a page and a frame ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Explain CPU scheduling criteria.

b) Explain the different states of a process using state transition diagram.

c) What are the main reasons to use of Thread rather than process for different applications ?

d) Consider the following set of processes :

Process	CPU Burst Time	Priority	Arrival time
PO	80	3	0
P1	20	1	10
P2	10	3	10
P3	20	4	80
P4	50	2	85

Draw the Gantt chart using RR (ts = 15) and preemptive priority scheduling. Calculate average waiting time and total Turnaround time.

2 + 3 + 3 + 7

9. a) Explain what is Indexed Allocation of file space on disk. What are the advantages and disadvantages of contiguous allocation ?

b) Write down the merits and demerits of a virtual memory system.

c) Explain Belady's anomaly.

d) Compare best fit and first fit algorithm for memory allocation. 4 + 4 + 2 + 5

10. a) "All unsafe states may not lead to deadlock". - Why or why not ?

b) Explain Critical-section problem. How semaphore can be used to solve it ?

c) Consider the following snapshot of a system :

Process	Allocation ABCD	Max ABCD	Available ABCD
PO	0012	0012	1520
P1	1000	1750	
P2	1354	2356	
P3	0632	0652	
P4	0014	0656	

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 ? Justify.

iii) If a request from process P1 arrives for (0, 4, 2, 0) can the request be granted immediately ? Answer with justification.

3 + 4 + 8

11. a) What are the advantages of segmentation over paging ?

b) Explain the difference between Internal and External fragmentation. Which one occurs in paging system ? How the problem of external fragmentation be solved ?

c) What is thrashing ?

d) Consider the following sequence of memory references generated by a single program in a pure paging system :

10, 11, 104, 104, 170, 173, 177, 309, 245, 246, 247, 458, 364.

Determine the number of page faults for each of the following page replacement policies assuming 3 (three) page frames are available and all are initially empty.

The size of a page is 100 words :

i) LRU

ii) FIFO

iii) Optimal page replacement. 2 + 4 + 2 + 7

12. Write short notes on any *three* of the following : 3 × 5

a) Data transfer method of I/O devices.

b) Process Control Block (PCB)

c) Preemptive SJF scheduling

d) Starvation

e) Kernel-Level Thread and User-Level Thread

f) Security and Protection.