Department of Computer Science and Engineering

END SEMESTER EXAMINATION

B. E. (2nd Yr. COE/ 3rd Yr. ENC/ 3rd Yr. ECE)
16th December, 2019
Monday, Time From – 2:00 To 5:00 PM
Time: 3 Hours, Max Marks: 100

Course Code: UCS303
Course Name: Operating Systems
Name of Faculty: Dr. Vinay Arora, Dr. Raman Goyal, D
Tarunpreet Bhatia, Dr. Deepshikha Tiwari, Dr. Amritpa
Singh, Dr. Neenu Garg, Ms. Swati Kumari

Attempt all questions and its part(s) in serial order. Assume any missing data.

Q.1 a) A program has been divided into five modules. Their corresponding length and base address (in decimal) are stored in the segment table as depicted below: (5)

Segment No.	Length	Base Address
0	200	4100
1	700	1000
2	400	3700
3	900	1800
4	1000	2700

Compute the physical memory address for the following logical addresses:

Segment No.	Offset
1	665
3	906
4	770
0	202
2	399

b) For a 16-bit system with a page size of 512 bytes, one sample logical address is as given below: (5)

0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	1

7 9

i. How many bits are used for the page number and offset?
ii. For the given logical address, compute the page number and offset in binary as well as decimal format.
iii. For the given logical address, compute the physical address in binary, when the frame number corresponding to the computed page (in part ii) number is 15 [where frame number starts from 0]. 2^{13}

Q.2 a) Quoting a suitable example of each, draw the diagram for client-server and peer to peer computing environments. (5)

b) Multitasking is an extension of multiprogramming. Explain with suitable depictions. (5)

Q.3 Using the given page-reference string and frame size as 3 and 4 (taking these as separate cases), show whether FIFO, Optimal, and LRU algorithms suffer from *Belady's anomaly*. Provide explanation using a suitable depiction. (12)

t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14	t15	t16	t17	t18
5	0	2	1	0	3	0	2	4	3	0	3	2	1	3	0	1	5

Q.4 Researchers have proposed a new algorithm for disk scheduling and named it as ***FUN-UCS303***, which works as follows: (12)

Algorithm: *Fun-UCS303*

START

1. Sort the requests in the disk queue according to the cylinder/track number requested (sort in ascending order).
2. Calculate the absolute difference between the Initial Disk Head Position (IDHP) and the Lowest cylinder/Track Request (LTR) of disk queue.
3. Calculate the absolute difference of the Initial Disk Head Position (IDHP) and the Highest cylinder/Track Request (HTR) of the disk queue.
4. If (|IDHP – LTR|) > (|IDHP – HTR|), then
   Start scan of requests in ascending order starting from the LTR
5. Else if((|IDHP – LTR|) == (|IDHP – HTR|)) then
   Call Fun() function.
   If (fun()==1)
   then
      Start scan of requests in ascending order starting from the LTR
   Else
      Start scan of requests in descending order starting from the HTR
6. Else
   Start scan of requests in descending order starting from the HTR

END

Algorithm: Fun()

START

1. If [(IDHP%LTR==0) && HTR% IDHP ==0)]
   then
      Return 0
   Else
      Return 1

END

Now, using ***FUN-UCS303***, compute the seek time for following two cases where the seek time for one track move is 2ms.

a) Disk requests are received by disk drive for cylinders 5, 25, 18, 3, 39, 8 and 35 in

IDHP = 20

that order. IDHP for this case is 20.

b) Disk requests are received by disk drive for cylinders 40, 12, 22, 66, 67, 33, 80, 75, 88, 65, and 8. IDHP for this case is 48.

Q5 Consider a system with 4 types of resources R1 (3 units), R2 (2 units), R3 (3 units) and R4 (2 units). A non-preemptive resource allocation policy has been used. At any given time instance, if a request by a process has not been fulfilled, then the specific process goes to the blocked state. The blocked process will shift to the ready state as soon as the required number of instances of the requested resource(s) are available in the system. (12)

Three processes P1, P2, and P3 request the resources independently as given in the table below, and run concurrently starting from the time t=0:

At t=10, will there be any possibility of deadlock in a system or not? List all the intermediate computations involved and justify your answer with proper reasoning.

Process P1:	**Process P2:**	***Process P3:***
t=0: requests 2 units of R2	t=0: requests 2 units of R3	*t=0: requests 1 unit of R4*
t=1: requests 1 unit of R3	t=2: requests 1 unit of R4	*t=2: requests 2 units of R1*
t=3: requests 2 units of R1	t=4: requests 1 unit of R1	*t=5: releases 2 units of R1*
t=5: releases 1 unit of R2 and 1 unit of R1	t=6: releases 1 unit of R3	*t=7: requests 1 unit of R2*
t=7: releases 1 unit of R3	t=8: Finishes	*t=8: requests 1 unit of R3*
t=8: requests 2 units of R4		*t=9: Finishes*
t=10: Finishes		

Q.6 a) With a suitable example define Race Condition. How one can say that the Critical Section is really a critical portion of the program? (5)

b) Write the pseudo-code for Peterson's Solution for two-process synchronization. (5)

Q.7 Consider a system with four processes and having the CPU scheduling attributes as given in the table below: (12)

Process	Arrival Time (ms)	CPU Burst Time (ms)	Priority
P1	2	8	6
P2	0	8	4
P3	5	2	7
P4	10	1	8

Assume a higher priority number indicates the process with high priority. Draw the Gantt chart and calculate the average waiting time for each of the following scheduling algorithms (intermediate computation should include waiting time for each process):

i. Non-preemptive priority
ii. Preemptive priority
iii. Shortest remaining time first (ignoring priority field)

Q.8 a) *"An Access matrix can be viewed as a general model of protection".* Explain any five operations that can be applied on Access Matrix with a suitable depiction. (6)

b) Using suitable diagrams, explain various allocation methods for file systems. (10)

Q.9 Consider a system with four processes P_1 through P_4 and three resources of type A, B and C. Suppose at time t_0 the following snapshot of the system has been taken: (6)

Process	Allocation A B C	Max A B C	Available A B C
P1	0 1 2	2 2 2	1 1 0
P2	6 0 0	8 4 1	
P3	4 4 5	X Y Z	
P4	3 3 2	4 4 2	

5 5 5

Find the maximum value of X, Y and Z for which the system is in a safe state.