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Department of Computer Science and Engineering
3rd Year 1st Semester B.Sc. Engineering Examination-2016
Course No: CSE 302   Course Title: Operating System and System Programming
Total Marks: 60   Time: 3 Hours

N.B.
i) Answer SIX questions taking any THREE from each Section
ii) All questions are of equal values.
iii) Use separate answer script for each section

Section-A

1. a) What is operating system? "An operating system is similar to a government"-justify this statement with proper sketching.   4

   b) Describe the differences between multiprogramming and multitasking operating systems.   3

   c) Mention set of OS functions exists for ensuring the efficient operation of the system itself via resource sharing.   3

2. a) What do you mean by process and process control block? Show a process control block for a particular process.   4

   b) Consider the following set of processes, with the length of the CPU burst given in milliseconds: 6

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

   i) Draw the Gantt chart that illustrates the execution of these processes using the SJF scheduling algorithm.
   ii) Find the response and waiting times of each process for SJF scheduling algorithm.

3. a) Draw the resource-allocation graph for the following criteria: 5
   The sets P, R, and E:
   $P = \{ P_1, P_2, P_3 \}$
   $R = \{R_1, R_2, R_3, R_4\}$
   $E = \{P_1 \rightarrow R_1, P_2 \rightarrow R_3, R_1 \rightarrow P_2, R_2 \rightarrow P_2, R_2 \rightarrow P_1, R_3 \rightarrow P_3, P_3 \rightarrow R_4, R_4 \rightarrow P_2\}$
   Resource instances: $R_1 = 1, R_2 = 2, R_3 = 1, R_4 = 4$.
   Is there exist deadlock?

   b) "A cycle in the graph is a necessary but not a sufficient condition for the existence of deadlock"-explain this by drawing the required resource-allocation graph.   5

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4. a) What is demand paging? Given that the reference string is 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 and page frames are 3. Execute the optimal page replacement algorithm.   6

   b) Explain different types of scheduling queues and types of schedulers.   4

Section-B

5. a) "Processes migrate among the various queues"-describe this by defining process migrates which queue to which queue and when.   3.5

   b) What do you mean by page-faults? When do page-faults occur? Describe the action taken by the OS when page-fault occurs?   4.5

   c) Which CPU scheduling algorithms could result in starvation and convoy effect?   2

6. a) What is safe state? Write down the safety algorithm for deadlock avoidance.   4

   b) Consider a system with five processes p_0 through p_4 and three resource types A, B, C have 10, 5, 7 instances respectively. At time T_0, the following snapshot of the system has been taken: 6

	Allocation			Max		
	A	B	C	A	B	C
P_0	0	1	0	7	5	3
P_1	2	0	0	3	2	2
P_2	3	0	2	9	0	2
P_3	2	1	1	2	2	2
P_4	0	0	2	4	3	3

   i) Find the contents of matrix available and need.
   ii) Can request for (1, 0, 2) by P_1 be granted or not?

7. a) Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?   5

   b) Explain the different operations performed on files.   2

   c) What do you mean by 80% hit ratio? Consider the hit ratio is 75% and if it takes 30 nanoseconds to search the TLB and 90 nanoseconds to access memory. Find the effective memory-access time (EAT).   3

8. a) What is Belady's Anomaly? Explain it.   5

   b) Why thread is called light weight? Explain with proper examples.   2

   c) Explain the functions of various process schedulers.   3

SECTION A

1. a) What is Operating System? — 1.67

   b) What is thread? Why do we need multiple threads instead of multiple processes? — 3

   c) List and explain various types of operating system services. — 5

   d) Define Multiprocessor system. What are the advantages of multiprocessor system? — 1+1

2. a) What is system call? Elaborate different types of system calls. — 1+4

   b) What are the three major activities of an OS in regard to memory management? — 3

   c) What is semaphore? What are the advantages of using semaphore? Write a program using semaphore that can synchronize processes. — 3.67

3. a) What is process? — 1

   b) Define short-term, medium-term and long-term scheduling. — 3

   c) Explain the process control block. — 5

   d) Write down several reasons for providing an environment that allows process cooperation. — 2.67

4. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds. The process are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0. Consider the FCFS. SJF. a nonpreemptive priority(a smaller priority number implies a higher priority) and RR(Quantum=10) scheduling algorithm for the given set of process.

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

   a) What is the turnaround time of each process for each above scheduling algorithms? — 4

   b) What is the waiting time of each process for each above scheduling algorithms? — 4

   c) Which of the above scheduling algorithms results in the minimal average waiting time? — 3.67

SECTION B

5. a) What is deadlock? When does deadlock occur and how can deadlocks be handled? — 1+3

   b) Consider the following snapshot of a system:

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	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? — 2.5

   ii. If a request from process P1 arrives for (0,4,2,0) can the request be granted immediately? Why? — 2.5

   c) What are the differences deadlock prevention and deadlock avoidance? — 2.67

<u>Course No:</u> CSE 362
Full Marks: 70

<u>Course Title:</u> Operating Systems and System analysis
<u>Time:</u> 4 hours

N.B.
i) Answer **SIX** questions, taking any **THREE** from each section.
ii) All questions are of equal values.
iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) What is process? When should an OS create processes and when should an OS terminate processes?   3
  (b) Explain System Call with appropriate figure in user program interacts with the Operating System.   4
  (c) Define System Call. What is the purpose of system calls?   3
  (d) Differentiate between a program and a process. $1\frac{2}{3}$

Q.2 (a) What is thread? Why do we need multiple threads instead of multiple processes?   3
  (b) How does operating system manage threads?   3
  (c) Describe different types of multithreading models.   4
  (d) What are the advantages of thread pool? $1\frac{2}{3}$

Q.3 Five batch jobs A through E, arrive in alphabetical order at a computer center at almost the same time. They have estimated running times of 10, 29, 3, 7, and 12 minutes. Their priorities are 3, 5, 2, 1 and 4 respectively with 5 the highest priority. Consider the FCFS, SJF, a non-preemptive priority queue, and RR (Quantum = 10) scheduling algorithm for the given set of jobs.
  (a) What is the turnaround time of each job?   4
  (b) What is the waiting time of each job?   4
  (c) Which algorithm would give the minimum average waiting time? $3\frac{2}{3}$

Q.4 (a) What is deadlock? When does deadlock occur and how can deadlocks be handled? $4\frac{2}{3}$
  (b) Using the Banker's algorithm, determine if the following system is in deadlock. If it is, which process (es) are deadlocked? If not in deadlock, what is the safe sequence? You need to show all intermediate steps to get full marks. P_1– P_5 are processes, and A, B, C, D are resource types.   7

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_1	0	1	0	2	7	5	3	6	3	3	2	4
P_2	2	0	0	1	3	2	2	3				
P_3	3	0	2	1	9	0	2	1				
P_4	2	1	1	2	2	2	2	3				
P_5	0	0	2	1	4	3	3	4				

  (i) Determine if a request from process P_2 of (1, 0, 2, 1) instances of resource A, B, C and D respectively will be granted immediately or not. Explain your answer.

  (ii) After fulfilling the request of question (a), will the system grant request of P_1 (0, 2, 0, 3)?

SECTION-B

Q.5 (a) How Direct Memory Access works? Explain with an appropriate figure.   5
  (b) How interrupts are handled?   4
  (c) Draw the layers of the I/O system and the main functions of each layer. $2\frac{2}{3}$

Q.6 (a) Briefly describe the disk arm scheduling algorithms.   4
  (b) (b) The disk queue contains the cylinder numbers containing the desire blocks.   5

1

Queue = 98, 183, 37, 122, 14, 124, 65, 67

Head starts at 53

Find the total head movements at FCFS, SSF, SCAN and Circular SCAN algorithms.

(c). What are the differences between logical and physical addresses? $2\frac{2}{3}$

Q.7 (a) Describe different kinds of file structure with proper figure. 3

(b) Suppose a desk has average seek time 2ms, rotational speed 10,000 rmp. There are 512 bytes per sector and 320 sectors per track. If we need to read file with 2560 sectors (= 1.3MB) then which one is better? Fragmented reading or Contiguous reading? Justify our answer. 5

(c) Why we use Redundant Array of Independent Disks (RAID)? Describe the advantages and disadvantages of RAID 0, RAID 1 and RAID 2 $3\frac{2}{3}$

Q.8 (a) What is critical section problem? Write three requirements that a critical section problem must satisfy? 3

(b) You know that your computer is affected by different kinds of virus. Using appropriate figure describe the procedure how virus works. $3\frac{2}{3}$

(c) What are the advantages of using Inodes? Suppose the block numbers are of 4 bytes length and the block size is 1KB. If the directed block is 12 and used single, double and triple indirect block, what will be the maximum file size? 5