B.Sc. Engg./IID CSE 5th Semester (60)   05 May 2012 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION   WINTER SEMESTER, 2011-2012
DURATION: 3 Hours   FULL MARKS: 150

CSE 4501: Operating Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **8 (eight)** questions. Answer any **6 (six)** of them.
Figures in the right margin indicate marks.

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1. a) What is resource allocation graph and wait-for graph? How is wait-for graph constructed from resource allocation graph?   7

   b) Suppose, there are 5 processes P0 through P4 and 3 resource types A(10 instances), B (5instances), and C (7 instances). Snapshot of the system at time T0 is given below: 18

	Allocation A B C	Max A B C	Available A B C
P_0	0 1 0	8 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 1 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

   i. Determine whether the system is in safe state.
   ii. Can P_1 request for (1,0,1) be satisfied?
   iii. Can P_2 request for (2,2,1) be satisfied after P_1 request is processed?
   iv. Can P_3 request for (0,1,1) be satisfied after P_1 and P_2 requests are processed?

2. a) Differentiate starvation from deadlock using suitable examples.   4
   b) What is Inter Process Communication (IPC)? Describe common techniques to perform IPC.   8
   c) What is context-swithching? Where and when is context-switching done inside the OS?   5
   d) What is a monitor? Describe its advantages and disadvantages.   8

3. a) What is thrashing in paging? Why thrashing occurs?   3
   b) Discuss on Hashed Page Table and Hierarchical page table.   10
   c) Consider a paging system with TLB and hit ratio of 70%. If the memory access time is 120 nanoseconds and the searching time for TLB is 40 nanoseconds, what is the effective memory access time for the following cases?   6
      i.   When the page-table entry is found in the TLB.
      ii.   When the page-table entry is not found in the TLB.
   d) What is multi-level feedback queue? Discuss with an example.   6
   [Example from MINIX3 is most desirable]

4. a) Differentiate between a Process and a Thread with a suitable example.   8
   b) What is memory mapped I/O? Write its advantages.   6
   c) We know the critical aspect of semaphore is that they are executed atomically. It means we must guarantee that no two processes can execute wait/signal operation on the same semaphore at the same time. This is another critical section problem. How the operating system solves the problem? [Hint: Hardware]   6
   d) How dirty bit helps in virtual memory management?   5

5. a) What is valid-invalid bit in the page table? 5

   b) Draw the Gantt chart and find the average waiting time for SJF(pre-emptive). RR. FCFS, Non Pre-emptive Priority Scheduling for the following chart: 20

Process	Burst Time	Arrival Time	Priority
P1	5	0	2
P2	6	3	1
P3	11	4	4
P4	8	7	3
P5	7	7	0

   Consider the lowest number has the highest priority and quantum=3 unit.
   [Hint: Priority is needed only for Non Pre-emptive Priority Scheduling]

6. a) What is a critical section and Race condition? 5

   b) What is semaphore? How it solves the critical section problem. Discuss with an example. 10

   c) Consider the following segment table: 8

Segment	Base	Length
0	256	512
1	1023	1024
2	2048	128
3	3000	512

   What are the physical addresses for the following logical addresses (segment, offset)? Detect if any logical address from the following is incorrect or not.
   i. 1, 2000   ii. 0, 128
   iii. 2, 56   iv. 3, 210

   d) What are the synchronization artefacts in linux operating system? 2

7. a) What is a directory? How directory structures are implemented in unix? 7

   b) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 150 and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is: 18
   21, 86, 50, 1470, 913, 1774, 3000, 930, 1509, 1022, 980, 1750, 130, 4500
   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms?
   i. SSTF
   ii. SCAN
   iii. FCFS

8. a) What is external and internal fragmentation? What are the solutions for eliminating the fragmentations? 7

   b) Consider the following page reference string: 18
   1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
   How many page faults would occur for the following replacement algorithms, assuming 3(three) and 4(four) frames in the memory for this purpose? Assume all frames are initially empty.
   i. LRU replacement
   ii. FIFO replacement
   iii. Optimal replacement