BE Information Technology
3rd year, 1st Semester Examination 2018
Subject: Operating Systems

Time - Three Hours

Full Marks – 100

Answer question number 1 and any 5 (five) from the rest.

1.

10x2=20

a) Distinguish between *multiprogramming* and *multi-tasking* environment.
b) How does operating system provide protection?
c) What is a trap?
d) What do you mean by dual mode of operation of an OS?
e) Which page replacement algorithm removes a page containing a heavily used variable that was initialized very early and is in constant use?
f) What is the reason that a segment table must have a page table in a paged segmented scheme?
g) Why does FCFS tend to favor CPU-bound processes over I/O bound ones.
h) Describe the difference between *short-term* and *long-term* scheduler.
i) What is spinlock?
j) How many operations are required to detect a cycle in a RAG ?

2.

a) There is a centralized system which is accessed by multiple groups. The first group accesses the general information for a very short time and there are 15 users in this group. Second group accesses the system the critical computation intensive work and there are only 2 users in this group. Which scheduling algorithm will suit this environment and how?

b) Define following terms i) turnaround time ii) waiting time iii) response time iv) throughput
  v) CPU Utilization vi) fairness.

c) Consider three processes all arriving at time zero with total execution time of 10, 20 and 30 time units respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation and the last 10% of time doing I/O again. The OS uses a SRTF scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?

4+6+6=16

3.

a) Write a program that shows the data access synchronization problem.
b) A buffer has 10 slots. The initial value of empty=10 and full=0. What will be the value of empty and full in the following conditions.
  i) The producer has inserted 5 items and the consumer is not able to consume.
  ii) The producer has inserted 5 more items and the consume.
  iii) The producer has produced 3 more items but cannot insert as the buffer is full.
  iv) The consumer has consumed 5 items.
c) What are the problems in initial implementation of a semaphore? How do you modify it?
d) Consider a system that provides the binary semaphore only. Implement the counting semaphore using binary semaphore.
e) Illustrate file indexing method.

3+2+3+4+4=16

4.

a) Does an unsafe state always lead to a Deadlock? Demonstrate with an example?
b) Explain the deadlock and starvation problems in dining –philosophers' problem
c) Check whether a deadlock is present in the following
    i) Two processes with two files
    ii) Two processes access and lock database records
    iii) Three processes with CD drive , printer, plotter

Process	Max				Alloc			
	R_1	R_2	R_3	R4	R_1	R_2	R3	R_4
P1	3	2	1	1	2	0	1	1
P2	1	2	0	2	1	1	0	0
P3	1	1	2	0	1	1	0	0
P4	3	2	1	0	1	1	1	0
P5	2	1	0	1	0	0	0	1

d) Does this initial allocation lead to a safe state ? Explain with reason. If P2 requests two instances of R1, one instance of R3, and one instance of R4, check whether the system is still in safe state. If it is , find out the safe sequence of process execution.

$$(2+2)+3+3+(2+1+3) = 16$$

5.

a) A process has been allocated 3 page frames. Assume that none of the pages of the process are available in the memory initially. The process makes the following sequence of page references: 1, 2, 1, 3, 7, 4, 5, 6, 3, 1. How many page faults occur for the above reference string if optimal replacement policy is used?

b) In a computer system where the 'best-fit' algorithm is used for allocating 'jobs' to 'memory partitions', the following situation was encountered:

Partition sizes in KB	4K 8K 20K 2K
Jobs sizes in KB	2K 14K 3K 6K 6K 10K 20K 2K
Time for execution	4 10 2 1 4 1 8 6

When will the 20K job complete?

c) i) Suppose the time of servicing a page fault is on the average 10 ms, while a memory access takes 1 μs. What is the average memory access time if the hit ratio is 99.99?
    ii) The address sequence generated by tracing a particular program executing in a pure demand paging system with 100 records per page with 1 free main memory frame is recorded as follows. What is the number of page faults? 100, 200, 430, 499, 510, 530, 560,120,220,240, 260, 320.

d) Explain the term *internal* and *external fragmentation*. Mention the factors affecting the amount of internal and external fragmentation.   3+3+(3+3)+4=16

6.

a) Explain the term *locality of reference*.

b) A demand paged virtual memory system uses 16-bit virtual address, page size of 256 bytes, and has 1 KB of main memory. LRU page replacement is implemented using list, whose current status (page number in decimal) is

17	1	63

For each of the hexadecimal address in the address sequence 00FF, 010D, 10FF, 11B0   indicate

    i)   new status in the list

    ii)   page faults, if any

    iii)   page replacement, if any

c) Describe the notion of *atomic instruction*.

d) Consider the two-dimensional array A: int A[100][100]; where A[0][0] is at location 200, in a paged memory system with pages of size 200. A small process is in page 0 (locations 0 to 199) for manipulation the matrix; thus, every instruction fetch will be from page 0. For three frames, how many page faults are generated for the following array initialization loops, using LRU replacement, and assuming frame 1 has process in it, and the other two are initially empty.

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i)    for(j=0;j<100;j++)      ii)      for(i=0;i<100;i++)
      for(i=0;i<100;i++)               for(j=0;j<100;j++)
         A[i][j]=0;                       A[i][j]=0;                3+4+3+6 =16
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7. Write Short notes on the following

    a) Multi level Feed back scheduling

    b) Challenge in distributed operating system.

    c) Control synchronization

    d) RAG as short note   4 X4 =16