[redacted]

Subject: Operating System

Assignment 1

1. Suppose you write any sample C program named as hello.c and executes it in Linux OS to get the a.out file. How many types of internal files are generated in system during the journey to hello.c to a.out. Try to display the assembly code and machine level code of your respective program.

2. How to verify the process identification number of any user created process in Linux environment? (Hint: First write a program the execute with displaying it PID as well as execute that "top" command in run time).

3. In how many ways we can establish proper communication among several terminals with a system? Write your code according and justify your output.

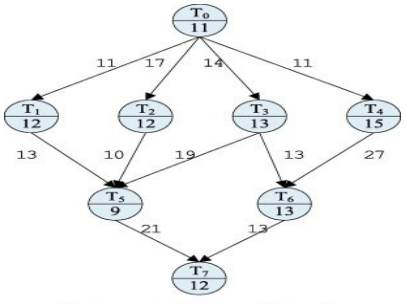
4. How can you get all the resource information of a Linux system.

5. Implement the FCFS, SJF, SRTF, Priority and Round Robin scheduling technique with a proper example provided all the information must be dynamic or should be provided by the system. Also justify which one is better and why.

6. Design a dynamic scheduling algorithm as per the DAG is given in the Figure 5. The source code should:
   – Correctly compute processes actual start time (EST) and earliest finish time (EFT) on the given parameters.

   – Check at every iteration processes should not violate the precedence order.

   — As per your convenience, you can implement any DGA of dynamic scheduling (up to your confidence- as we discussed in class)



T_i	Speed			Cost			Average cost
	P_0	P_1	P_2	P_0	P_1	P_2	
0	1.00	0.85	1.22	11	13	9	11.00
1	1.20	0.80	1.09	10	15	11	12.00
2	1.33	1.00	0.86	9	12	14	11.67
3	1.18	0.81	1.30	11	16	10	12.33
4	1.00	1.37	0.79	15	11	19	15.00
5	0.75	1.00	1.79	12	9	5	8.67
6	1.30	0.93	1.00	10	14	13	12.33
7	1.09	0.80	1.20	11	15	10	12.00

Figure 1: Sample DAG

[h]

Assignment 2

1. Implement the dining philosophers problem using monitors. Minimize the number of executions of signal statements in your solution and observe its effect on the logical complexity of your solution.

2. The statement while flag[1] and turn = 1 in Petersons algorithm is changed to while $flag[1]$ or $turn = 1$, and analogous changes are made in process P1. Which properties of critical section implementation are violated by the resulting system?

3. In the following system:

	R_1	R_2	R_3
P_1	3	6	8
P_2	4	3	3
P_3	3	4	4

Max need

	R_1	R_2	R_3
P_1	2	2	3
P_2	2	0	3
P_3	1	2	4

Allocated resources

	R_1	R_2	R_3
Total alloc	5	4	10
Total exist	7	7	10

   (a) Is the current allocation state safe?

   (b) Would the following requests be granted in the current state by the bankers algorithm?
   i. Process p_1 requests (1, 1, 0)
   ii. Process p_2 requests (0, 1, 0)

4. A road crosses a set of railway tracks at two points. Gates are constructed on the road at each crossing to stop road traffic when a train is about to pass. Train traffic is stopped if a car blocks a track. Two way traffic of cars is permitted on the road and two-way train traffic is permitted on the railway tracks.

   (a) Discuss whether deadlocks can arise in the road-and-train traffic. Would there be no deadlocks if both road and train traffic are only one-way?

   (b) Design a set of simple rules to avoid deadlocks in the road-and-train traffic.

5. Would the following requests be granted in the current state by the bankers algorithm? [h]

	R_1	R_2
P_1	2	5
P_2	3	2

Max need

	R_1	R_2
P_1	1	3
P_2	2	1

Allocated resources

	R_1	R_2
Total alloc	3	4
Total exist	4	5

   (a) Process p_2 requests (1, 0)

   (b) Process p_2 requests (0, 1)

   (c) Process p_2 requests (1, 1)

   (d) Process p_1 requests (1, 0)

   (e) Process p_1 requests (0, 1)

6. Write short note of the following-

   (a) Synchronization primitives

   (b) Deadlock

   (c) Semaphore

Assignment 3

1. A Fibonacci buddy system uses blocks whose sizes are multiples of the terms of the Fibonacci series, for example 16, 32, 48, 80, 128, ... Hence the size of a block is the sum of the sizes of the two immediately smaller blocks. This formula governs the splitting and merging of blocks. Compare the execution efficiency and memory efficiency of the Fibonacci buddy system with the binary buddy system.

2. An OS has 110 MB available for user processes. The maximum memory requirement of a process for its own code and data is 20 MB, while the average memory requirement of a process is 10 MB. If the OS uses contiguous memory allocation and does not know sizes of individual processes, what is the average internal and external fragmentation?

3. Page tables are stored in a memory that has an access time of 100 nanoseconds. The translation look-aside buffer (TLB) can hold 64 page table entries and has an access time of 10 nanoseconds. During operation of a process, it is found that 85 percent of the time a required page table entry exists in the TLB and only 2 percent of the references lead to page faults. The average time for page replacement is 2 ms. Compute the effective memory access time.

4. Execution performance of a process in virtual memory depends on locality of reference displayed during its operation. Develop a set of guidelines that a programmer can follow to obtain good performance of a process. Describe the rationale behind each guideline.

5. A process makes r page references during its operation. The page reference string of the process contains d distinct page numbers in it. The size of the process is p pages and it is allocated f page frames all through its operation.
   (a) What is the least number of page faults that can occur during its operation?
   (b) What is the maximum number of page faults that can occur during its operation?

6. Describe the actions of a virtual memory manager using a working set memory allocator when it decides to reduce the degree of multiprogramming. Clearly indicate how it uses and manipulates its data structures for this purpose.

7. The degree of multiprogramming in a system using virtual memory is varied by changing the memory allocation for processes. Draw a graph of degree of multiprogramming versus CPU efficiency. Explain the nature of the graph in the region of high degree of multiprogramming.

8. Write short note of the following-
   (a) Memory allocation techniques
   (b) TLB
   (c) Virtual memory
   (d) Pages memory schemes
   (e) Page replacement algorithms

Assignment 4

1. Discuss how the throughput of a disk device can be optimized in a file system that performs noncontiguous allocation of disk blocks to files. (Hint: Think of organization of blocks in the free list, data staggering, and cylinder groups.)

2. How do different disk scheduling algorithms influence the effectiveness of I/O buffering?

3. A magnetic tape has a recording density of 80 bits/cm along a track. The tape moves at a velocity of 2 meters per second while reading/writing data. The inter-record gap is 0.5 cm wide, and the access time of the tape is 5 ms. A sequential file containing 5000 records, each of size 400 bytes, is stored on this magnetic tape. Calculate the length of the magnetic tape occupied by the file and the total I/O time required to read the file if the file is recorded (a) without blocking and (b) with a blocking factor of 4.

4. Consider a disk with 200 tracks and the queue has random requests from different processes in the order: 55, 58, 39, 18, 90, 160, 150, 38, 184
   Initially arm is at 100. Find the Average Seek length using FIFO, SSTF, SCAN and C-SCAN algorithm.

5. A hard disk system has the following parameters :

   - Number of tracks = 500
   - Number of sectors/track = 100
   - Number of bytes /sector = 500
   - Time taken by the head to move from one track to adjacent track = 1 ms
   - Rotation speed = 600 rpm.

   What is the average time taken for transferring 250 bytes from the disk ?

6. A magnetic surface has 128 tracks(T0 to T127), One track has 256 sectors and each sector capacity is 512B (0.5KB) motor operated with 3000RPM. Amount of time required to move the head from current trak to its next successive track is 1m.sec. Current position of head is 4th track(T4) ans sector 25 (S25). The amount of time required to read 64KB data from (starting address) sector 153 (S153) of track 36 (T36) in millisec is .

7. A file system with 300 GByte uses a file descriptor with 8 direct block address. 1 indirect block address and 1 doubly indirect block address. The size of each disk block is 128 Bytes and the size of each disk block address is 8 Bytes. The maximum possible file size in this file system is...

8. Write short note of the following-
   (a) SCAN vs CSCAN
   (b) Look vs CLook
   (c) SASD
   (d) DASD

**** ALL THE BEST ****