Exercises
Semaphores for Process-Coordination and Synchronization

E-1: What operations can be performed on a semaphore?

E-2: What is the difference between binary and general/counting semaphores?

E-3: Is it possible to initialize a semaphore value to '0' if yes when, if not why?

E-4: For N-Process critical section problem, how many semaphores are required and what value is used for initialization?

E-5: Following processes access shared data by using Di statements and perform normal computation by using Si statements. How semaphores could be used to have proper coordination/synchronization among these cooperating processes to satisfy the following conditions.

A) S4 is executed after S23 B) S17 is executed after S7

Process 1: S1, S2, D1, S3, D2, S4, S5, S6, D3, S7, S8, S9

Pprocess 2 S10, S11, D4, S12, S13, D5, S14, S15, S16, D6, S17, S18, S19

Process 3: S21, S22, D7, S23, S24, S25, D8, S26, S27, S28, S29

E-6: For bounded buffer Producer-Consumer problem, following semaphores (also initialized) are used.

```
mutex = 1;    /* for mutual access to buffer  */
Empty = N;   /*  to count empty buffer slots */
Full    = 0;   /*  to count occupied buffer slots */
```

Modify the semaphores and initialization for un-bounded buffer Producer-Consumer problem.

E-7: For N-Process critical section problem using semaphores, at a given time value of mutex semaphore is '-3'. How many processes are waiting to enter the critical section. When the last process will leave the critical section, what will the value of mutex semaphore.

E-8: Considering semaphores of **(E-5)** for bounded buffer Producer-Consumer problem, suppose N=4; After the following sequence of producers (P's)and consumers (C's) what will be value of Empty and Full semaphores.

C1 comes, C2 comes, P1 comes, P2 comes, P3 comes, P4 comes, P5 comes, C3 Comes, P6 comes, P7 comes. P8 comes, C4 comes, P9 comes.

E-9: For Reader-Writer problem with Writers priority using Semaphores, for the following sequence of processes trace the status of processes and value of semaphores:

- R1 comes and is reading
- R2 comes and is reading
- W1 comes, R3 comes, R4 comes
- W2 comes, R5 comes
- At this stage what will be status of processes and semaphores
- Now continue with trace
- R1 is done with reading, R2 is done with reading
- What will be status of processes and semaphores

- At this which process can run to completion, and after that what will be the sequence of processes for completion of the activities.
- When all processes run to completion what will be the status of semaphores

E-10: Using semaphores write the code for Dining Philosopher Pi() (i= 0 to 6) with a restriction to allow only 6 philosophers to be seated around the table.