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## CS344: Operating Systems Lab

Lab # 07 (1 Questions, 109 Points)

Held on 10-Oct-2023

Lab Timings: 09:00 to 12:00 Hours    Pages: 3

Submission: 12:00 Hrs, 10-Oct-2023

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- a. This assignment is based on chapter 3, Process Management in the book Operating System Principles, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne.
- b. In order to perform this assignment, understanding of system calls `ftok()`, `semget()`, `semop()`, `semctl()`, `fork()`, `shmget()`, `shmat()`, `shmctl()`, `shmdt()`, `shmctl()` are essential.
- c. Read the attached resource for a understanding about system V semaphore implementation and system V shared memory implementation
- d. Read chapter 5 on process synchronization.
- e. Carefully read the manual pages for the above system calls.
- f. Read the system architecture given in the question which helps develop the solution.

**Question 1:** (109 points)

**Process Synchronization:** Web Server Simulation

- a. (5 marks) Implement `sem_wait` function which will initialize `sembuf` structure with appropriate values and performs `semop`.
- b. (5 marks) Implement `sem_signal` function which will initialize `sembuf` structure with appropriate values and performs `semop`.

Carefully study the Web server diagram and perform the following:

- c. (50 marks) Web server should perform the following tasks:
  - (2 marks) Obtain a key
  - (2 marks) Create shared memory segment of size 25.
  - (2 marks) obtain another key
  - (5 marks) Declare appropriate semaphores.
  - (5 marks) Initialize the semaphores.
  - (2 marks) Create two children
  - Each child performs the following:
    - i. (4 marks) Attaches the created shared memory segment.
    - ii. (5 marks) Perform appropriate semaphore operations

- iii. (5 marks) Perform de-queue from the shared memory and print the http request number
  - iv. (5 marks) Perform appropriate semaphore operations
  - v. (2 marks) Detach the shared memory
  - (5 marks) Continue handling the http requests in the circular queue till 100 requests are handled by two children together.
  - (2 marks) Remove the semaphores
  - (2 marks) Detach the shared memory
  - (2 marks) Remove the shared memory
- d. (49 marks) 2<sup>nd</sup> C program that is client should perform the following tasks:
- (2 marks) Obtain a key
  - (5 marks) Declare appropriate semaphores.
  - (5 marks) Initialize the semaphores.
  - (2 marks) Obtain another key
  - (5 marks) Get the shared memory object
  - (5 marks) Attach the shared memory object
  - Generate 100 http requests by
    - i. (5 marks) Performing appropriate semaphore operations
    - ii. (5 marks) Performing enqueue of http request (an integer number)
    - iii. (5 marks) Performing appropriate semaphore operations
  - (5 marks) Remove the semaphore
  - (5 marks) Detaches the shared memory object
- e. Execute the web server program
- f. Execute the client program

