Computer Operating Systems

Problem #1

Define page-based memory allocation. Differentiate logical and physical memory address. Explain transition look-aside buffer (TLB) and how it is used for memory access. Differentiate TLB hit from TLB miss.

Problem #2

Describe a process control block (PCB) and how it is used. List typical contents of a PCB. Describe what process queue is and how PCBs are related to process queues. Differentiate device (I/O) queue and ready queue. Explain how both types of queues are used by the process scheduler.

Problem #3

Describe the need for synchronization in OS design. Define semaphores and two operations that are available on each semaphore. Define the bounded buffer (producer-consumer) problem. Given the following code for producer:

```
while (true){
  // produce item for the buffer
  wait(empty);
     wait(mutex)
     // add item to the buffer
     signal(mutex)
     signal(full);
}
```

Reconstruct the data structures (semaphores and their initialization) and the code for consumer. Explain the operation of your code.