ECES 338: Intro to Operating Systems

Assignment #3

Due: February 19, 1999   100Points

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1. **(The Roller Coaster Problem)**   Suppose there are n passenger processes and one (roller coaster) car process. The passengers repeatedly wait to take rides in the car, which can hold C passengers, C < n. However, the car can go around the tracks only when it is full.

   Write algorithms for the actions of the car and passenger processes, and develop a **semaphore-based solution** to synchronize them. Your answer should employ m car processes, m > 1. Since there is only one track, cars cannot pass each other; i.e., they must finish going around the track in the order in which they started. Again, a car can only go around the tracks when it is full. Explicitly specify any assumptions you make about either the model or the semaphores.

2. **(The Meeting Problem)**   Two kinds of processes, A's and B's, enter a room and "meet" processes of other type. The definition of "meets" we use is: Once a process of one type enters the room, it is considered to have met all the processes of the other type that are in the room. (Another possible definition is: a process of one type enters the room, and starts shaking hands with processes of the other type (in the order of their arrival). Handshaking constitutes an instance of "A meets B". We will *not* use this definition).

   An A process cannot leave until it meets two B processes, and a B process cannot leave until it meets one A process. A process (of type A or B) leaves the room once it has met the required number of the other kind of processes.

   Develop a **semaphore-based solution** to implement this synchronization. Explicitly specify any assumptions you make about either the model or the semaphores.

3. **Searchers/Inserters/Deleters Problem**   Three kinds of processes share access to a singly-linked list: searchers, inserters, and deleters. Searchers merely examine the list; hence they can execute concurrently with each other. Inserters add new items to the end of the list; insertions must be mutually exclusive to preclude two inserters from inserting new items at about the same time. However, one insert can proceed in parallel with any number of searches. Finally, deleters remove items from anywhere in the list. At most one deleter process can access the list at a time, and deletion must also be mutually exclusive with searches and insertions. You are to write an algorithm to synchronize searcher, inserter and deleter processes using **semaphores**. Explicitly specify any additional assumptions you make about the model.