Assignment 2: Model of Mutual exclusion for two Processes which insures liveness and idle processes.

The model starts with the basic mutual exclusion model.

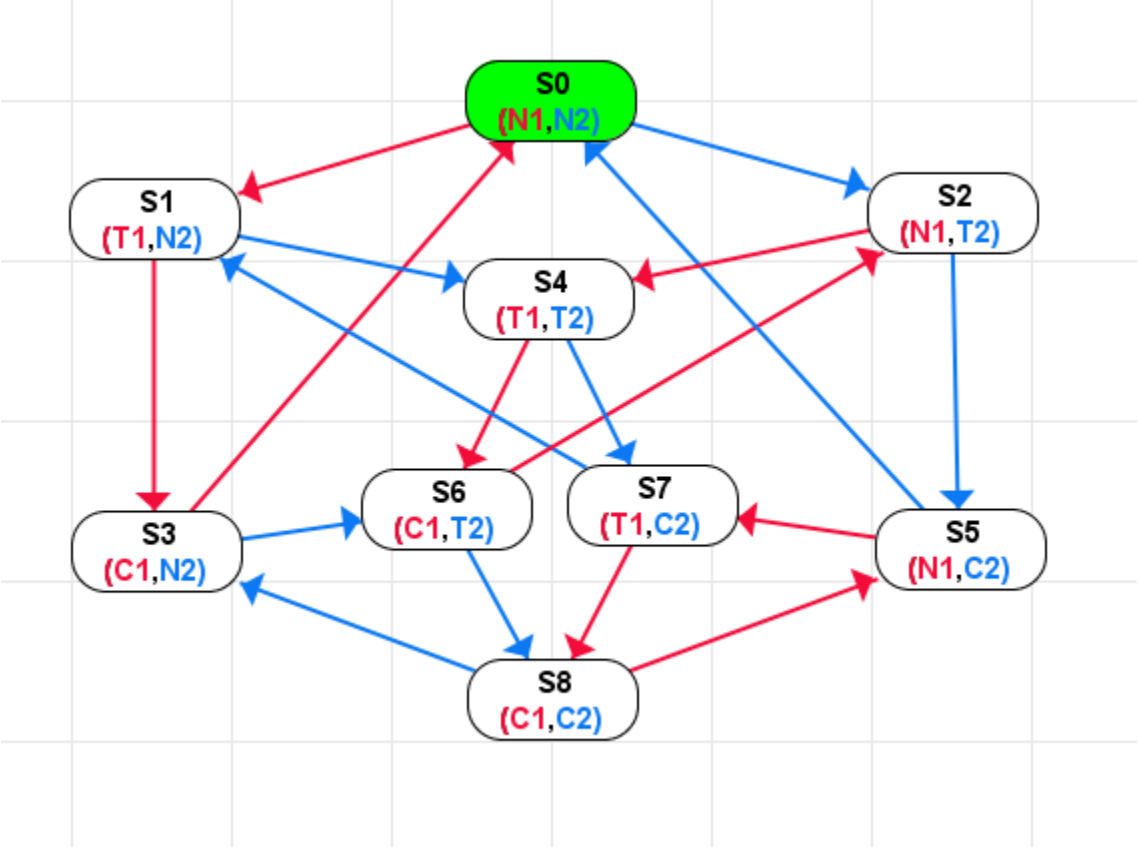

Figure 1- Mutex Model

1. The above model has an erroneous state S8 (violates mutual exclusion), which should be removed.
2. The model also cannot insure liveness. For example: the two cycles (S1->S4->S7->S1) and (S2->S4->S6->S2) have a process stuck with a request.

To fix this issue, we remove the state S4 to break the two cycles, and add a new condition (Fi) which signifies a priority Token based on FCFS.

The new Model has the following properties for processes i : {1,2} :

1. Ni: process i is neutral and has no request.
2. Ti: process i has a request token.
3. Ci: process i has entered its Critical section.

4. Fi: process i has the Priority token.

The additional states are the transition states where the priority token is going to be passed from one process to another.

The new Model is represented as follows:

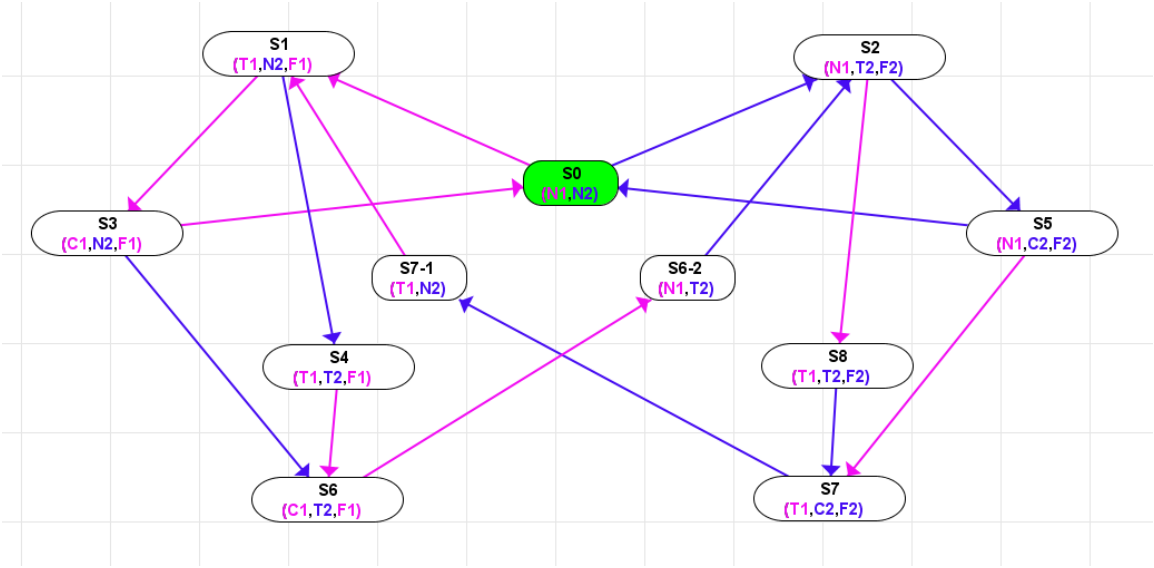

Figure 2- Liveness Model

To prove the liveness of the above model we check the model against the following formula:

(AG(T1 => (AF(C1)))) & (AG(T2 => (AF(C2))))

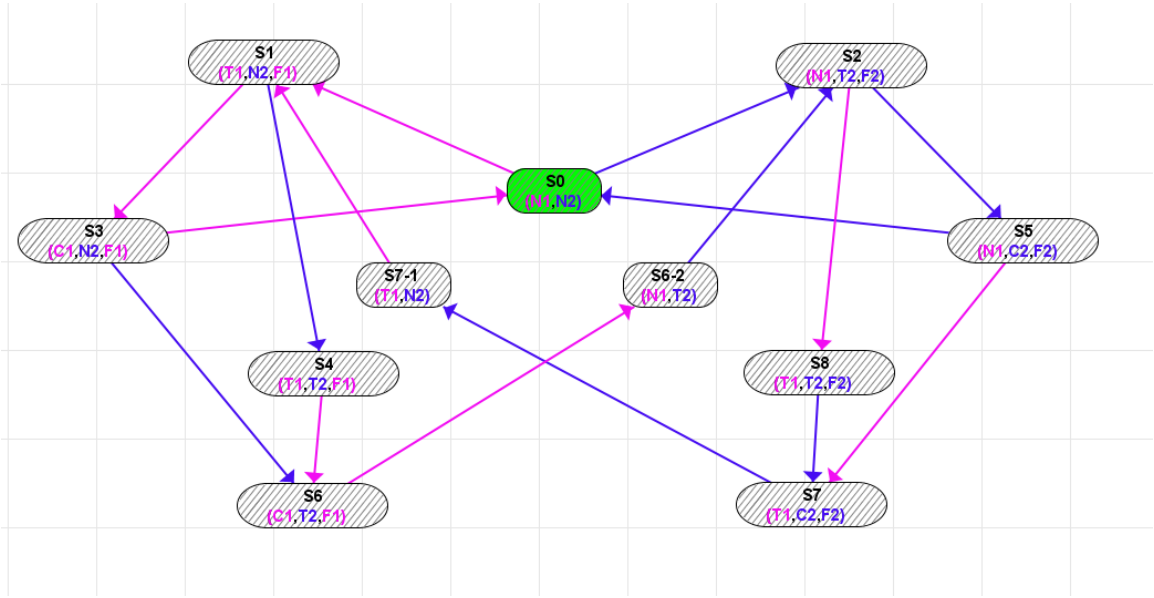

Figure 3- Liveness checking

The result insures the all states can reach a critical section after obtaining a token.

The Token passed does not automatically get swapped so a process can continue to operate if the other is idle.

The following is a check for idle processes: N1 which has a complete cycle for process 2, and N2 which also has a complete cycle for process 1.

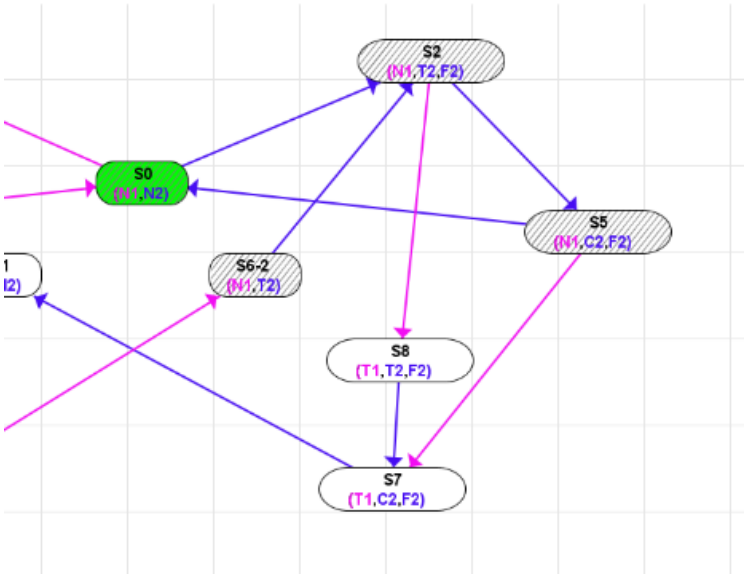

Figure 4- p1 is idle while p2 can complete a cycle

Conclusion:

The attached model insures the liveness while allowing the processes to remain idle.