CMPS396W

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1 Question 1

Our objective is to fix the mutex to be live using eshmun. In my model, we start at a start state S0 with (N1,N2) where no process is trying to enter its critical section. Afterword, we can transition to either a state where Process 1 is trying to access the critical section or Process 2 is trying to access the critical section. When a process is trying to access the critical state we set F to indicate his turn, so if we have a state where (T1,T2,F1) then Process 1 can enter the critical section. However, after the process enter the critical section it must set the turn to the other process to ensure "No starvation".
The following represents the resulting model:

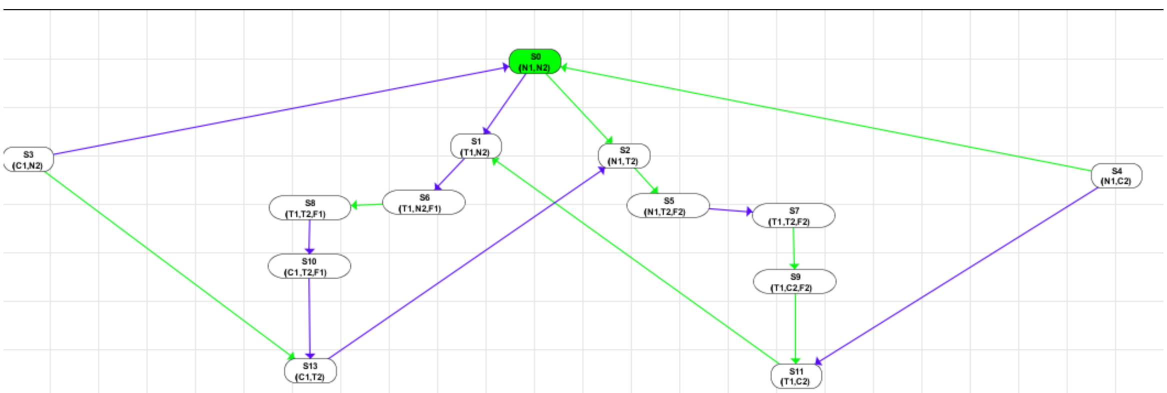

Figure 1: Model

After we repaired the model in Eshmun, the result was the following model:

This repaired model ensures liveness since our concurrent system is making progress despite the fact that its concurrently executing components ("processes") that may have to "take turns" in critical sections.

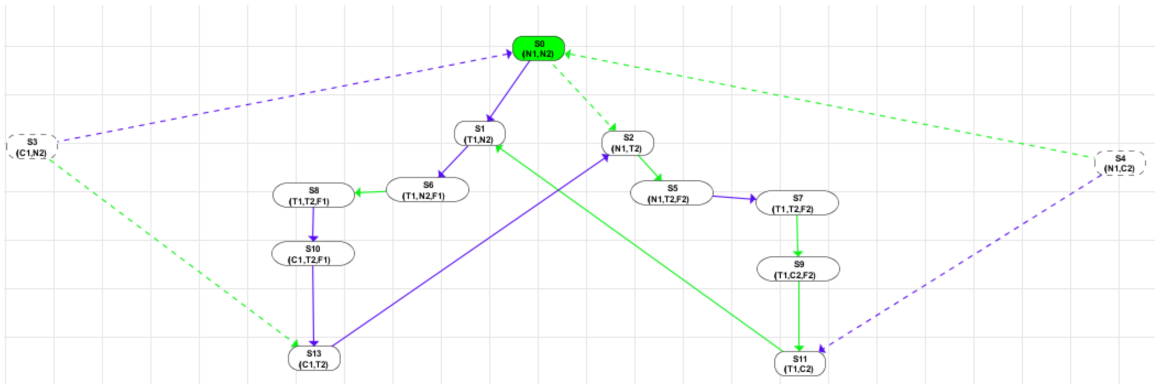

Figure 2: Model repaired

2 Question 2

we have $f = O_1 O_2 ... O_n p$

where each Oi could be either 'F' or 'G' and p belongs to AP.

We first notice that when we have a sequence of F's we can simplify them to a single 'F'. Proof: 'Fp' means that 'p' will be true eventually and 'FFp' means that 'Fp' will be true eventually, thus p will be true eventually. Thus, 'FFFp' also means that 'p' will be reached eventually at a later state. Therefore, a sequence of F's then 'p' is stating that we will eventually encounter p in our branching at a later state and we can simplify the sequence of 'F''s with 'F'.

We also notice that when we have a sequence of G's we can simplify them to a single G. Proof: 'Gp' means that 'p' will be globally true at each branch, and 'GGp' means that 'Gp' will be globally true at each branch meaning 'p' will be globally true at each branch. Therefore, a sequence of G's then 'p' is stating that we will always encounter p and we can simplify the sequence of 'G''s with a single 'G'.

$$f = \left\{ \begin{array}{ll} F, & \text{for every } O_i = F \\ G, & \text{for every } O_i = G \\ (FG)^i, & \text{for i=n/2 and n,} i \in N \\ (GF)^i, & \text{for i=n/2 and n,} i \in N \\ (FGF)^i, & \text{for i=n/2 and n,} i \in N \\ (GFG)^i, & \text{for i=n/2 and n,} i \in N \end{array} \right\}$$