Task

Consider the following algorithm presented in Ben-Ari's notation.

Algorithm Y			
bit $b[2] \leftarrow \{0, 0\}$			
	p		**q**
	loop forever		loop forever
p1:	non-critical section	q1:	non-critical section
p2:	$b[0] \leftarrow 1$	q2:	$b[1] \leftarrow 1$
p3:	while $b[1] = 1$	q3:	while $b[0] = 1$
p4:	$b[0] \leftarrow 1$	q4:	$b[1] \leftarrow 0$
p5:	await $(b[0] = 1)$	q5:	await $(b[0] = 0)$
p6:	$b[0] \leftarrow 1$	q6:	$b[1] \leftarrow 1$
p7:	critical section	q7:	critical section
p8:	$b[0] \leftarrow 0$	q8:	$b[1] \leftarrow 0$

Question 1

[**40 marks**] Use Spin to check whether Algorithm Y is a solution to the critical section problem. Address all four desiderata from the lectures (mutual exclusion, eventual entry, absence of deadlock, absence of unnecessary delay).

Answer:

Question 2

[**40 marks**] Encode Algorithm Y as a parallel composition of two transition diagrams. Define an assertion network Q such that the assertions at the locations representing the critical sections express mutual exclusion. Prove that Q is inductive. (It is ok to focus on the processes after the initialisation of b. It is not ok to make the assertions at the entry locations unreasonably strong.)

Answer:

Question 3

[**20 marks**] Identify any superfluous statements in the algorithm. That is, can any statements be replaced by *skip* without changing the behaviour of Algorithm Y? Justify your answers, preferrably using your transition diagram and assertion network.

Answer: