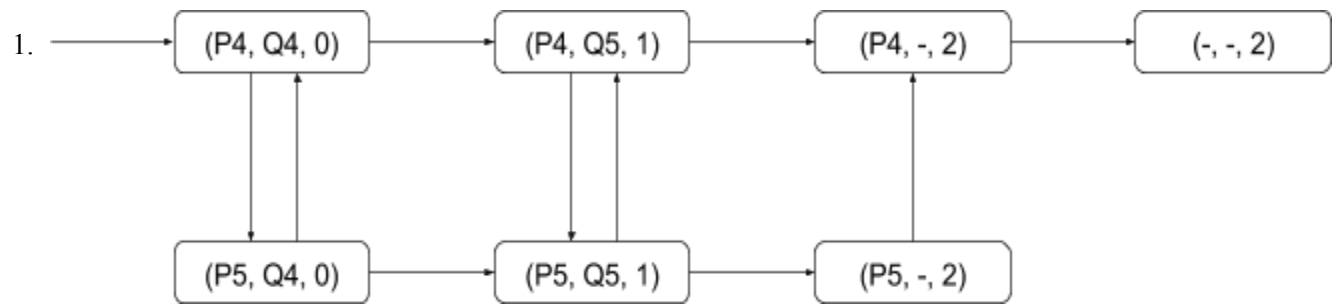


Exercise 1



2.

012: (P4, Q4, 0) → (P5, Q4, 0) → (P4, Q4, 0) → (P4, Q5, 1) → (P5, Q5, 1) → (P4, Q5, 1) → (P5, Q5, 1) → (P5, -, 2) → (P4, -, 2) → (-, -, 2)

002: (P4, Q4, 0) → (P5, Q4, 0) → (P4, Q4, 0) → (P5, Q4, 0) → (P4, Q4, 0) → (P5, Q4, 0) → (P5, Q5, 1) → (P5, -, 2) → (-, -, 2)

02: (P4, Q4, 0) → (P5, Q4, 0) → (P4, Q4, 0) → (P5, Q4, 0) → (P5, Q5, 1) → (P5, -, 2) → (-, -, 2)

3. “2” does not necessarily have to appear in the output, depending on the interleaving. For example, if thread P executes the loop once (printing a “0”), and thread Q is then executed to completion, the loop in thread P will not execute again, thus “2” will not appear in the output.

4. “2” can appear in the output a maximum of one time. This is due to the fact that when “2” is printed, the loop condition will check again and fail, terminating thread P. Furthermore, “2” will only be printed if n is incremented to two *after* the loop condition is checked.

5. “1” can appear in the output an infinite number of times. Looking at the state diagram, the program can continuously cycle between (P4, Q5, 1) and (P5, Q5, 1), which will continue to print “1” until thread Q is allowed to execute further.

6. “0” can appear in the output an infinite number of times. Looking at the state diagram, the program can continuously cycle between (P4, Q4, 0) and (P5, Q4, 0), which will continue to print “1” until thread Q is allowed to execute further.

7. The shortest length of output is zero characters. This will occur when thread Q is allowed to execute to completion before thread P can check the while condition. This is represented by the top flow of the state diagram.