Process $P$ is an endless repetition of a “non-critical section” $PN$ and a “critical section” $PC$. Process $Q$ is similar.

$$
P = PN \cdot PC \cdot P
\quad \quad
Q = QN \cdot QC \cdot Q
$$

They are executed in parallel $(P \parallel Q)$. Specify formally that the two critical sections are never executed at the same time.

(a) by inserting variables that are assigned but never used.

§ I introduce binary interactive variables $a$ and $b$ as follows:

$$
P = PN. \ a := T. \ PC. \ a := \bot. \ P
\quad \quad
Q = QN. \ b := T. \ QC. \ b := \bot. \ Q
$$

Now mutual exclusion is specified as follows.

$$
\neg \exists t': t', .. \infty \cdot a \ t' \land b \ t'
$$

(b) by inserting outputs on channels that are never read.

§ I introduce binary channels $a$ and $b$ as follows:

$$
P = PN. \ a! T. \ PC. \ a! \bot. \ P
\quad \quad
Q = QN. \ b! T. \ QC. \ b! \bot. \ Q
$$

Now mutual exclusion is specified as follows.

$$
\neg \exists i: wa, .. \infty \cdot \exists j: wb, .. \infty \cdot M a_i \land T a_i \leq T b_j < T a_{i+1} \lor M b_j \land T b_j \leq T a_i < T b_{j+1}
$$

If we assume $PC$ and $QC$ take nonzero time we can specify mutual exclusion as follows:

$$
\neg \exists i: wa, .. \infty \cdot \exists j: wb, .. \infty \cdot M a_i \land M b_j \land \ (T a_i \leq T b_j < T a_{i+1} \lor T b_j \leq T a_i < T b_{j+1})
$$