Consider the following Petri net.

Q1. Is this ordinary Petri net? Justify your answer.

\textit{Answer. Yes, it is ordinary Petri net since all of its arcs weights are 1’s.}

Q2. Is this pure Petri net? Justify your answer.

\textit{Answer. Yes, it is pure net since it contains no self-loop.}

Q3. Check the following behavioral properties for the Petri net shown in figure and justify your answers.

A. Boundedness
B. Liveness

\textit{Answer.}

A. \textit{It is obvious that each recirculation of occurrence sequence } t_1, t_2, t_3, t_4 \textit{ increases by one the number of tokens in } p_4 \textit{. Now consider infinite occurrence sequence } t_1, t_2, t_3, t_4, t_1, t_2, t_3, t_4, \ldots \textit{. This sequence adds infinitely many tokens in } p_4 \textit{ meaning that } p_4 \textit{ is unbounded place. This is why it is an unbounded net.}

B. One can see that there is no way to block any of the transitions \( t_1, t_2, t_3 \) and \( t_4 \) until these transitions fire continuously. The only possibility to block any transition in the net is through occurrence of \( t_5 \). Occurrence of \( t_5 \) on the other hand removes a token from \( p_4 \) and \( p_3 \). Since occurrence of \( t_2 \) adds a token in
\( p_2, p_3 \) and \( p_4 \), at the same time there will be still enough tokens in other places to enable remaining transitions. This means that there is no way block any transition in the given net. So, all transitions are 4-live and consequently whole net is live as well.

Q4. Is this reversible Petri net? Justify your answer.

**Answer.** Yes, it is. A firing sequence \( t_1, t_2, t_3, t_4 \) (or \( t_1, t_2, t_4, t_3 \)) results in marking \((0 0 0 2 1)\). Now let us fire \( t_5 \). The net will be returned back to the initial marking \((0 0 0 1 0)\). This means that whatever the occurrence sequence you choose there is a way to move the Petri net to the initial marking. Hence, it is reversible Petri net.

Q5. Check whether \((1 0 0 0 0)\) is home state? Justify your answer.

**Answer.** The correct answer is yes. Since the Petri net is reversible and \((0 0 0 1 0)\) is the intermediate marking between the initial marking and any other marking \((0 0 0 2 1)\) there is always a way to move the Petri net to marking \((0 0 0 1 0)\) whatever the present marking is.

Q6. Is this persistent Petri net? Justify your answer.

**Answer.** Concurrently enable transitions are given by the pairs \( t_3 \) and \( t_4 \), \( t_3 \) and \( t_5 \), \( t_4 \) and \( t_5 \). One can easily see that occurrence of any transition in any pair does not affect occurrence of another transition. So, the given Petri net is persistent.

Q7. Is this B-fair Petri net? Justify your answer.

**Answer.** In the given Petri net \( t_1, t_2, t_3 \) and \( t_4 \) can occur infinitely many times regardless of whether \( t_5 \) occurs too. This means that any of these transitions and \( t_5 \) are not in B-fair relation. This is why this Petri net is not B-fair net.

Q8. Is this unconditionally fair Petri net? Justify your answer.

**Answer.** This Petri net is not unconditionally fair net since \( t_1, t_2, t_3, t_4, t_5, t_2, t_3, t_4, \ldots \) is not unconditionally fair occurrence sequence.

Q9. Check the following structural properties for the same Petri net and justify your answer.

A. Conservativeness
B. Repetitivity

**Answer.**

A. Occurrence of \( t_2 \) removes one token from its input place and adds three tokens (one token to each output place) to its output places. This is why this Petri net is not conservative net.
B. Every transition appears infinitely many times in the infinitive occurrence sequence $t_1, t_2, t_3, t_4, t_5, t_1, t_2, t_3, t_4, t_5, \ldots$. So, this is a repetitive Petri net.