5. Consider the existence of general competitive equilibrium in a pure exchange economy subject to excise tax on net purchases. All taxes are rebated as lump sums equally to all households. This is the model of Starr’s *General Equilibrium Theory*, problem 12.2 (similar in two editions).

We use the following notation:
- \( p \) is the N-dimensional nonnegative price vector,
- \( x^i \) is the N-dimensional nonnegative vector of household \( i \)'s consumption, \( x^i \) is a decision variable for \( i \)
- \( r^i \) is the N-dimensional nonnegative vector of \( i \)'s endowment
- \( D^i(p) (= x^i) \) is the N-dimensional vector of \( i \)'s consumption as a function of \( p \), based on \( i \)'s budget which is denoted \( M^i(p) \)
- \#H is the finite integer number of households in the economy consisting of the set \( H \)
- \( \tau \) is the N-dimensional nonnegative vector of excise tax rates (on net purchases) in the economy
- \( T \) is the transfer of tax revenue to the typical household.

The budget constraint is
\[
p \cdot x^i + \tau \cdot (x^i - r^i)_+ = M^i(p) \tag{1}
\]
where
\[
M^i(p) = p \cdot r^i + T \quad \text{where} \quad T = (1/#H) \sum_{h \in H} \tau \cdot (x^h - r^h)_+
\]
where the notation \((\cdot)_+\) indicates the vector consisting of the nonnegative co-ordinates of \((\cdot)\) with zeroes replacing the negative co-ordinates of \((\cdot)\). The household is assumed to treat \( T \) parametrically --- as independent of his own expenditure decisions.

Please make the usual assumptions about continuity, convexity, monotonicity of preference, and adequacy of income.

Will a Walrasian competitive equilibrium exist generally in the economy with excise taxation? Explain why or why not. State any additional assumptions you need. Feel free to cite well-known results.

6. Consider a Walrasian competitive general equilibrium in the model of problem 5 above. Will the allocation be Pareto efficient?