Quiz 4

Problem 1: A simplified flowsheet for the Union Carbide oxo process is given below. The reactor operates at a pressure of 200 psia and a temperature of 373 K. The reaction mechanism is as follows:

$$PL + CO + H_2 \rightarrow IBA + NBA \rightarrow HV$$

80% PL is converted and IBA/NBA ratio is 0.1.
1% of IBA is converted.

PL	Propylene	CO	Carbon Monoxide
H_2	Hydrogen	IBA	Isobutyraldehyde
NBA	n-butyraldehyde	HV	Heavy compounds
P	Propane		

Propane is an inert component that does not take part in the reaction. The feed is available at 1 atm and 298 K and has the following composition:

CO	0.5 kgmol/s
H_2	0.5 kgmol/s
PL	0.47 kgmol/s
P	0.03 kgmol/s

Determine the overall conversion of propylene to n-butyraldehyde for a purge rate of 1%. Assume that all the separation steps (distillation) give perfect splits for the components shown.