Problem 7-1

$V_o = 5$ V, $V_d = 10$ V to 40 V, $P_o \geq 5$ W, $f_s = 50$ kHz

Find the minimum inductance to keep the converter in the continuous conduction mode under all conditions.

Solution: For a given load and output voltage, the likelihood that the inductor current will fall to zero is increased by lowering the duty ratio and thus increasing the OFF time. The duty ratio is lowest when V_d = 40V. $P_o/V_o = 5W/5V = I_o = 1A$

For continuous conduction from Eq. 7-5, $I_o \geq \frac{D}{2f_sL}[V_d - V_o]$

$$D = \frac{5}{40} = 0.125 \; ; \; L = \frac{D}{2f_sI_o}[V_d - V_o] = \frac{0.125}{2 \cdot 50{,}000 \cdot 1} \quad [40\text{-}5]$$

$$\boxed{L = 43.75\ \mu F}$$