1. Show that the functions $STP^{(n)}$ are primitive recursive.

2. Show that the functions $\Phi^{(n)}(x_1, x_2, \ldots x_n, y)$ are partial recursive.

3. Write LOOP programs for the following functions. Actually write them out, rather than just showing that they exist.
   
   (a) Show $f_2(x) = 2^x$ is in $L_2$.
   (b) Show $f_3(x) = 2^{2^x}$ is in $L_3$.

4. Show that $x \cdot y$ is in $L_2 - L_1$

5. Let $A$ be a recursively enumerable set.
   
   (a) Show that there is a computable function $h$ such that $A = \{ h(x) | x \in \mathbb{N} \}$. (This is probably the way you learned about the r.e. sets.)
   
   (b) We say that $h$ is monotonic if $\forall n, h(n + 1) \geq h(n)$. What can you say about $A$ if $h$ is monotonic?
   
   (c) We say that $h$ is strictly monotonic if $\forall n, h(n + 1) > h(n)$. What can you say about $A$ if $h$ is strictly monotonic?

6. Show that every infinite recursively enumerable set has an infinite recursive subset.

7. Show that there is no computable function $f$ such that $f(x) = \Phi(x, x) + 1$ whenever $\Phi(x, x) \downarrow$.

8. Let $g(x)$ and $h(x)$ be partially computable functions. Show that there is a partially computable $f(x)$ such that $f(x) \downarrow$ for exactly those values $x$ for which either $g(x) \downarrow$ or $h(x) \downarrow$ (or both) and such that when $f(x) \downarrow$ either $f(x) = g(x)$ or $f(x) = h(x)$.

9. Can $f$ be found satisfying all the requirements of the previous problem but such that in addition $f(x) = g(x)$ whenever $g(x) \downarrow$? Hint: use the problem 7.