Foundations of Functional Programming

Describe the operation of a graph reducer and its treatment of the combinators K, S, Y, if (for conditional expressions) and mult (integer multiplication). [6 marks]

Describe the operation of the SECD machine, including its treatment of recursive functions. [5 marks]

Exhibit an infinite family $\Phi_n$ of distinct fixed-point combinators. Justify your answer by showing that $\Phi_n \rightarrow F(\Phi_n F)$ for all non-negative integers $n$ and $\lambda$-terms $F$. You must also show that $\Phi_m \neq \Phi_n$ for $m \neq n$, quoting standard results about the $\lambda$-calculus if necessary. [9 marks]