Solution to Q2

$$\begin{aligned}
\text{Opt}_\alpha &= \forall\beta\,(\beta\to(\alpha\to\beta)\to\beta)\\
\text{None}_\alpha &= \Lambda\beta\,(\lambda n:\beta\,(\lambda s:\alpha\to\beta\,(n)))\\
\text{Some}_\alpha &= \lambda x:\alpha\,(\Lambda\beta\,(\lambda n:\beta\,(\lambda s:\alpha\to\beta\,(s\,x))))
\end{aligned}$$

$$\cfrac{\cfrac{\cfrac{}{\{\alpha,\beta\},n:\beta,s:\alpha\to\beta\vdash n:\beta}\ \text{var}}{\{\alpha,\beta\},n:\beta\vdash\lambda s:\alpha\to\beta\,(n):(\alpha\to\beta)\to\beta}\ \text{fn}}{\cfrac{\{\alpha,\beta\},\emptyset\vdash\lambda n:\beta\,(\lambda s:\alpha\to\beta\,(n)):\beta\to(\alpha\to\beta)\to\beta}{\{\alpha\},\emptyset\vdash\text{None}_\alpha:\text{Opt}_\alpha}\ \begin{array}{l}\text{fn}\\[4pt]\text{gen}\end{array}}$$

$$\text{Lift}_{\gamma\delta} = \lambda f:\gamma\to\delta\,(\lambda g:\text{Opt}_\gamma\,(\Lambda\beta\,(\lambda n:\beta\,(\lambda s:\delta\to\beta\,(g\,\beta\,n\,\big(\lambda x:\gamma\,(s\,(f\,x))\big))))))$$

$$\begin{aligned}
&(\text{Lift}_{\gamma\delta}\,f)\,(\text{Some}_\gamma\,x)\\
\to^2\ &\Lambda\beta\,(\lambda n:\beta\,(\lambda s:\delta\to\beta\,((\text{Some}_\gamma\,x)\,\beta\,n\,\big(\lambda x:\gamma\,(s\,(f\,x))\big))))\\
\to^4\ &\Lambda\beta\,(\lambda n:\beta\,(\lambda s:\delta\to\beta\,(\big(\lambda x:\gamma\,(s\,(f\,x))\big)\,x)))\\
\to\ &\Lambda\beta\,(\lambda n:\beta\,(\lambda s:\delta\to\beta\,(s\,(f\,x))))\\
=\ &\text{Some}_\delta\,(f\,x)
\end{aligned}$$

$$\text{Compose}_{\gamma\delta\epsilon} = \lambda f:\gamma\to\text{Opt}_\delta\,(\lambda g:\delta\to\text{Opt}_\epsilon\,(\lambda x:\gamma\,\big((f\,x)\,\text{Opt}_\epsilon\,\text{None}_\epsilon\,g\big)))$$