Exercise 8.10

Using the product program graph with Q_{PPG} and E_{PPG} we have an execution step

$$(q^1 \cdots q_\circ^i \cdots q^n; \sigma) \xRightarrow{\alpha} (q^1 \cdots q_\bullet^i \cdots q^n; \sigma')$$

whenever

$$\mathcal{S}[\![\alpha]\!]\sigma = \sigma'$$

$$(q^1 \cdots q_\circ^i \cdots q^n, \alpha, q^1 \cdots q_\bullet^i \cdots q_n) \in E_{PPG}$$

and expanding this we get

$$\mathcal{S}[\![\alpha]\!]\sigma = \sigma'$$

$$\forall j \neq i : q^j \in Q_j$$

$$(q_\circ^i, \alpha, q_\bullet^i) \in E_i$$

which is the same as in Definition 8.6 (except that Definition 8.5 is not so precise in saying that $\forall j \neq i : q^j \in Q_j$ as opposed to $\forall j \neq i : q^j \in Q_1 \cup \cdots \cup Q_n$).

Only (E, Q) is linear in the size of the program whereas the size of (E_{PPG}, Q_{PPG}) is a polynomial of degree n.