

$$3.1) a) S \rightarrow \epsilon \mid xX_1 \mid yY_1$$

$$X_1 \rightarrow yX_1 \mid x$$

$$Y_1 \rightarrow xY_1 \mid y$$

$$S \rightarrow S_m \mid S_n$$

$$b) S_m \rightarrow OS_m^{\text{??}} \mid 1S_m^{\text{??}} S_2$$

$$S_2 \rightarrow \epsilon \mid OS_3 \mid 1S_4$$

*needs work

$$3.3) a) S \rightarrow S_2 \mid \epsilon$$

$$S_2 \rightarrow AS_2A \mid BS_2B$$

$$b) S \rightarrow A$$

$$A \rightarrow \epsilon \mid aAB$$

$$B \rightarrow b$$

$$c) S \rightarrow SQ \mid P$$

$$SQ \rightarrow [S]S \mid [S] \mid \epsilon$$

$$P \rightarrow (S) \mid (S) \mid (C)$$

d) same as (c) with

$$S \rightarrow SQ \mid P \mid SP$$

$$SP \rightarrow [S] \text{ ??}$$

e) The grammar would be too long to write, ??

$$f) S \rightarrow (E)$$

$$E \rightarrow E; B \mid B$$

$$B \rightarrow \text{stmt} \mid (E)$$

$$g) S \rightarrow \{E\}$$

$$E \rightarrow EB \mid B$$

$$B \rightarrow \text{expr}; \mid \{E\}$$