

$$G = \{X_1, X_2, X_3\}, \{a, b\}, P, A$$

Step 1

$$\begin{cases} X_1 \rightarrow \underline{X_3} X_3 & \text{acceptable} \\ X_2 \rightarrow X_3 X_1 | b & \text{acceptable} \\ X_3 \rightarrow \underline{X_1} X_2 | a & \text{not acceptable} \end{cases}$$

Step 2

$$\underline{X_3} \rightarrow \underline{X_3} X_3 X_2 | \cancel{X_3 X_2} a$$

$$\underline{X_3} \rightarrow \underline{X_3} X_1 X_3 X_2 | b X_3 X_2 | a. \quad \times$$

Derivation

$$X_1 \rightarrow X_2 X_3$$

$$X_2 \rightarrow X_3 X_1 | b.$$

$$X_3 \rightarrow X_3 \overset{X_3 X_2}{\underset{\wedge}{X_1}} | b X_3 X_2 | a.$$

Step 3

$$\underline{X_3} \rightarrow \overset{X_3 X_1}{\underline{X_3}} X_2 | b X_3 X_2 | a.$$

$$\underline{X_3} \rightarrow \underline{b X_3 X_2} | a.$$

$$\underline{X_3} \rightarrow b X_3 X_2 B_3 | a B_3$$

$$B_3 \rightarrow X_3 X_1 X_3 X_2$$

$$B_3 \rightarrow X_3 X_1 X_3 X_2 B_3$$

$E \rightarrow E + E \mid E * E \mid (E) \mid id$ is ambiguous

GNF \boxed{ax}

$x_3 x_1$

Result

$$x_1 \rightarrow x_2 x_3$$

$$x_2 \rightarrow \underline{x_3 x_1} \mid b$$

$$x_3 \rightarrow \underline{b x_3 x_2} \mid \underline{a} \mid \underline{b x_3 x_2 B_3} \mid \underline{a B_3} \text{ (GNF)}$$

$$B_3 \rightarrow \underline{x_1 x_3 x_2} \mid x_1 x_3 x_2 B_3$$

$$x_2 \rightarrow b x_3 x_2 x_1 \mid a x_1 \mid b x_3 x_2 B_3 x_1 \mid a B_3 x_3 x_1 \mid \underline{b x_3}$$

$$x_1 \rightarrow b x_3 x_2 x_1 x_3 \mid a x_1 x_3 \mid b x_3 x_2 B_3 x_1 x_3 \mid a B_3 x_3 x_1 x_3 \mid b x_3$$

$$x_3 \rightarrow b x_3 x_2 \mid a \mid b x_3 x_2 B_3 \mid a B_3$$

$$B_3 \rightarrow b x_3 x_2 x_1 x_3 x_3 x_2 \mid a x_1 x_3 x_3 x_2 \mid b x_3 x_2 B_3 x_1 x_3$$

$$x_3 x_2 \mid a B_3 x_3 x_1 x_3 x_3 x_2 \mid b x_3 x_3 x_2 \mid b x_3 x_2 x_1 x_3$$

$$x_3 x_2 B_3 \mid a x_1 x_3 x_3 x_2 B_3 \mid b x_3 x_2 B_3 x_1 x_3 x_3 x_2 B_3 \mid$$

$$a B_3 x_3 x_1 x_3 x_3 x_2 B_3 \mid b x_3 x_3 x_2 B_3$$