

Date:

CS 302 HW6

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Q1 a) $G_1 = (V, \Sigma, R, S)$ where $V = \{S, A, B, C, D, E\}$, $\Sigma = \{a, b, c\}$, R :

$$S \rightarrow AE \mid A \mid EB \mid B \mid C$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow Bb \mid b$$

$$C \rightarrow Cc$$

$$D \rightarrow aCb \mid a \mid b \mid c$$

$$E \rightarrow aEb$$

b) $G_2 = (V, \Sigma, R, S)$ where $V = \{S, A, B, C, D, E\}$, $\Sigma = \{a, b, c\}$, R :

$$S \rightarrow AE \mid aA \mid a \mid EB \mid Bb \mid b \mid Cc$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow Bb \mid b$$

$$C \rightarrow Cc$$

$$D \rightarrow aCb \mid a \mid b \mid c$$

$$E \rightarrow aEb$$

c) $G_3 = (V, \Sigma, R, S)$ where $V = \{S, A, B, C, E\}$, $\Sigma = \{a, b, c\}$, R :

$$S \rightarrow AE \mid aA \mid a \mid EB \mid Bb \mid b \mid Cc$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow Bb \mid b$$

$$C \rightarrow Cc$$

$$E \rightarrow aEb$$

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d) CNF:

$$S \rightarrow A \epsilon \mid F A \mid F \mid \epsilon B \mid B H \mid H \mid C I$$
$$A \rightarrow FA \mid F$$
$$\underline{B \rightarrow BH | H}$$
$$C \rightarrow CI$$
$$\varepsilon \rightarrow FH$$
$$F \rightarrow a$$
$$G \rightarrow b$$
$$H \rightarrow FG$$
$$I \rightarrow c$$

e) a's followed by b's where no. of a \neq no. of b's OR string of c's.

Q2. a) $S \rightarrow \{A\} / \{A\} S / [B] / [B] S / () / () S$

$$A \rightarrow [B]A \mid A[B] \mid B \mid e$$
$$B \rightarrow () B | e$$
