

CS 302
QUIZ 8**25 November, 2015****QUESTION** Given a CFG G with the productions:

$$S \rightarrow AE \mid EB$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow Bb \mid b$$

$$E \rightarrow aEb \mid e$$

Compute the **Chomsky Normal Form** of G by first eliminating the null and unitary productions and the useless symbols.

ANSWER

(i) Eliminating null productions

$$S \rightarrow AE \mid EB \mid A \mid B ; A \rightarrow aA \mid a ; B \rightarrow Bb \mid b ; E \rightarrow aEb \mid ab$$

(ii) Eliminating unitary productions

$$S \rightarrow AE \mid EB \mid aA \mid a \mid Bb \mid b ; A \rightarrow aA \mid a ; B \rightarrow Bb \mid b ; E \rightarrow aEb \mid ab$$

(iii) No useless symbols

(iv) Chomsky Normal Form

$$S \rightarrow AE \mid EB \mid KA \mid a \mid BD \mid b ; A \rightarrow KA \mid a ; B \rightarrow BD \mid b ; K \rightarrow a ; D \rightarrow b ; E \rightarrow KM \mid KD ; \\ M \rightarrow ED$$