



Arab Academy for Science & Technology and Maritime Transport (AASTMT)

College of Computing and Information Technology (CCIT)

Theory of Computation CS311 – Spring 2014

Dr. Manal Helal

Eng. Nada Mahmoud

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Give the Context Free Grammar (CFG) for the following languages:

1. $\{a^i b^j \mid i, j \geq 1 \text{ and } |i-j| \leq 3\}$
2. $\{a^i b^{2j} c^k d^l \mid i, j, k \geq 1 \text{ and } k \geq 2i\}$
3. $\{x \mid x \in \{a, b\}^*, \text{abb, aab, are substrings of } x\}$
4. $\{a^i b^j \mid i, j \geq 0 \text{ and } i \neq j\}$
5. $\{xycy \mid x, y \in \{a, b\}^*, x^R \text{ is a prefix of } y\}$
6. $\{x_1 x_2 c y \mid x_1, x_2, y \in \{a, b\}^*, (\exists x \in \{a, b\}^*) (x_1 x x_2 = y^R) \}$