EECS 510, homework assignment #5

9c

$$S \to AT \mid TB$$
$$T \to aaTb \mid a \mid \lambda$$
$$A \to aA \mid a$$
$$B \to bB \mid b$$

6c

$$L = \{a^n b^m c^{n+m} : n \geq 0,\ m \geq 0\}$$

$$M = (\{q_0, q_1, q_2\}, \{a, b, c\}, \{P, S\}, \delta, q_0, S)$$

$$\delta(q_0, a, S) = \{(q_0, PS)\}$$
$$\delta(q_0, b, S) = \{(q_1, PS)\}$$
$$\delta(q_0, \lambda, S) = \{(q_0, \lambda)\}$$
$$\delta(q_0, a, P) = \{(q_0, PP)\}$$
$$\delta(q_0, c, P) = \{(q_2, \lambda)\}$$
$$\delta(q_1, b, P) = \{(q_1, PP)\}$$
$$\delta(q_1, c, P) = \{(q_2, \lambda)\}$$
$$\delta(q_2, c, P) = \{(q_2, \lambda)\}$$
$$\delta(q_2, \lambda, S) = \{(q_2, \lambda)\}$$
$$\delta(q_0, b, P) = \{(q_1, PP)\}$$

6h

$$L = \{w : n_a(w) = 2\,n_b(w)\}$$

$$M = (\{q_0, q_1\}, \{a, b\}, \{S, A, B\}, \delta, q_0, S)$$

$\delta(q_0, \lambda, S) = \{(q_0, \lambda)\}$

$\delta(q_0, a, S) = \{(q_1, S)\}$

$\delta(q_1, a, S) = \{(q_0, AS)\}$

$\delta(q_0, b, S) = \{(q_0, BS)\}$

$\delta(q_1, b, S) = \{(q_1, BS)\}$

$\delta(q_0, a, A) = \{(q_1, A)\}$

$\delta(q_0, b, B) = \{(q_0, BB)\}$

$\delta(q_1, a, A) = \{(q_0, AA)\}$

$\delta(q_1, b, B) = \{(q_1, BB)\}$

$\delta(q_0, b, A) = \{(q_0, \lambda)\}$

$\delta(q_1, b, A) = \{(q_1, \lambda)\}$

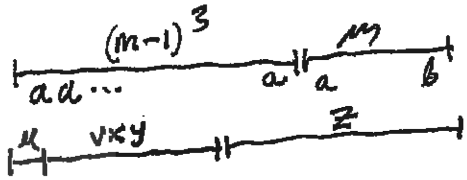
$\delta(q_0, a, B) = \{(q_1, B)\}$

$\delta(q_1, a, B) = \{(q_0, \lambda)\}$

7b

$L = \{ a^n b^j : n \geq (j-1)^3$

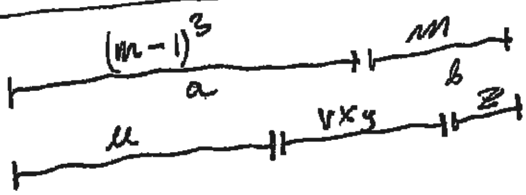
$W = a^{(m-1)^3} b^m$

1) 

$|v| = k, \; |y| = l$

for $i=0$, $W_0 = (m-1)^3 - (k+l) \ngeq (m-1)^3$

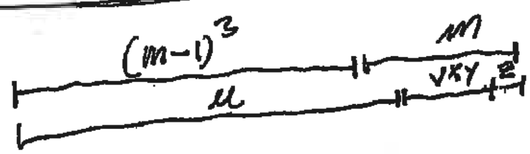
$l=0, \; k>0$

2) 

$k>0$
$l>0$

$W_i = a^{(m-1)^3 + i \cdot k} b^{m + i \cdot l}$

$(m-1)^3 + ik \ngeq (m + il - 1)^3$ for some i

3) 

$k=0$
$l>0$

$W_1 = a^{(m-1)^3} b^{m + (k+l)}$

$(m-1)^3 \ngeq (m + l - 1)^3$

so L is not context-free

8c

$L = \{a^n b^j a^j b^n : n \geq 0, j \geq 0\}$

corresponing grammar:

$S \to aSb \mid A$

$A \to bAa \mid \lambda$

therefore L is context-free