⑨

$$L = \{a^i b^j c^k d^\ell \mid i+\ell = j+k\}$$

$$M = (\{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7\}, \{a,b,c,d\}, \{A,B,Z_0\},$$
$$\delta, q_0, Z_0, \{q_7\})$$

$\delta(q_0, a, Z_0) = (q_1, A Z_0)$

$\delta(q_0, b, Z_0) = (q_4, B Z_0)$

$\delta(q_0, c, Z_0) = (q_5, B Z_0)$

$\delta(q_0, \varepsilon, Z_0) = (q_7, Z_0)$

$\delta(q_1, a, A) = (q_1, AA)$

$\delta(q_1, b, A) = (q_2, \varepsilon)$

$\delta(q_2, b, A) = (q_2, \varepsilon)$

$\delta(q_2, c, A) = (q_3, \varepsilon)$

$\delta(q_2, b, Z_0) = (q_4, B Z_0)$

$\delta(q_3, c, A) = (q_3, \varepsilon)$

$\delta(q_3, c, Z_0) = (q_5, B Z_0)$

$\delta(q_3, c, Z_0) = (q_7, Z_0)$

$\delta(q_4, b, B) = (q_4, BB)$

$\delta(q_4, c, B) = (q_5, B)$

$\delta(q_4, d, B) = (q_6, \varepsilon)$

$\delta(q_5, c, B) = (q_5, BB)$

$\delta(q_5, d, B) = (q_6, \varepsilon)$

$\delta(q_6, d, B) = (q_6, \varepsilon)$

$\delta(q_6, d, Z_0) = (q_7, Z_0)$