Q: $\frac{Y(z)}{R(z)} = k_r C[zI - A + BK]^{-1}B$ 的推导

$$x(k+1) = Ax(k) + Bu(k)$$
$$y(k) = C\ x(k)$$
$$u(k) = -k\,x(k) + k_r\,r(k)$$

Solution ① get k

$K = [0\ 0 \cdots 1]\ W_c^{-1}\alpha_c(A)$ ✓

$W_c = [B\ \ AB]$ ✓

② $u(k)$ 代入 $x(k+1)$

$$x(k+1) = A\,x(k) + B\left(-k\,x(k) + k_r\,r(k)\right)$$
$$= (A - BK)\,x(k) + Bk_r\,r(k)$$

apply z transform

$$zX(z) = (A - BK)X(z) + B\,k_r R(z)$$

$$(zI - A + BK)X(z) = Bk_r R(z)$$

$$\frac{X(z)}{R(z)} = (zI - A + BK)^{-1}Bk_r$$

$Y(z) = C\ X(z)$ $\therefore \frac{Y(z)}{R(z)} = k_r C[zI - A + BK]^{-1}B$