'Cournot Duopoly'

$$u_1(s_1, s_2) = s_1(A - C - B(s_1 + s_2))$$

$$u_2(s_2, s_1) = s_2(A - C - B(s_1 + s_2))$$

utility or payoff to Firm 2

Payoff to firm 1

$$s_1^* = BR_1(s_2) = \frac{A - C - Bs_2}{2B}$$

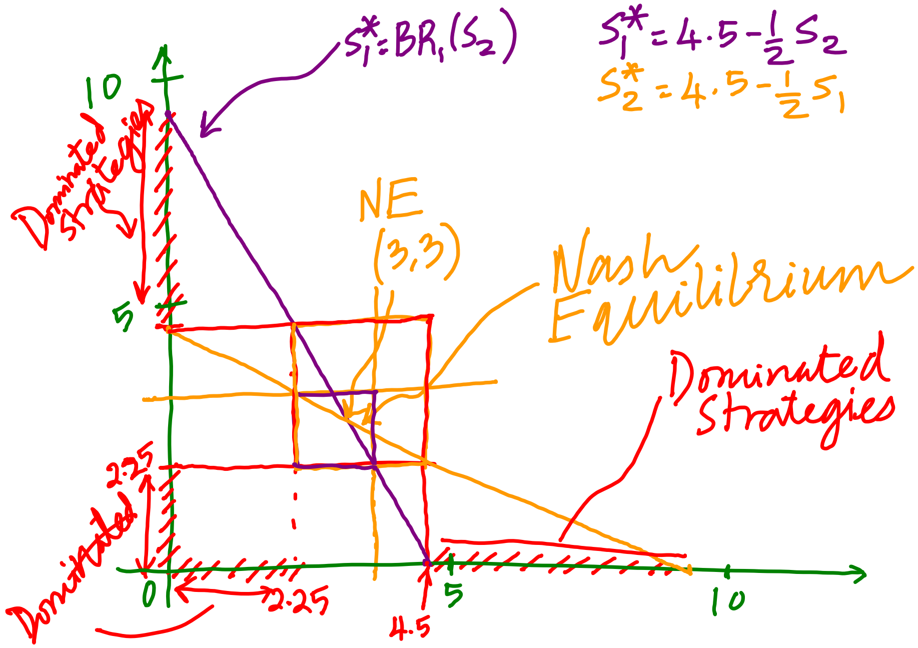
$$= \frac{A-C}{2B} - \frac{1}{2} s_2$$

$$s_2^* = BR_2(s_1) = \frac{A-C}{2B} - \frac{1}{2} s_1$$

$A = 10 \quad B = C = 1$

$$s_1^* = 4.5 - \frac{1}{2} s_2$$

$$s_2^* = 4.5 - \frac{1}{2} s_1$$



$$s_1^* = s_2^* = \frac{A-C}{3B}$$

$$A = 10 \quad B = C = 1$$

$$s_1^* = s_2^* = 3$$

$$u_1(s_1^*, s_2^*) = s_1^*\left(A - C - B(s_1 + s_2)\right)$$
$$= 3\left(9 - 1(6)\right)$$
$$= 3 \times 3 = 9$$

Nash Payoff in Cournot Duopoly is,

$$u_1(s_1^*, s_2^*) = u_2(s_2^*, s_1^*) = 9$$

Is there any outcome which yields a higher payoff for both the players?

$$u_1(s_1, s_2) = s_1\big(A - C - B(s_1 + s_2)\big)$$

$$u_2(s_2, s_1) = s_2\big(A - C - B(s_1 + s_2)\big)$$

$$u_1(s_1, s_2) + u_2(s_2, s_1)$$

$$= \underline{(s_1 + s_2)}\big(A - C - B\underline{(s_1 + s_2)}\big)$$

$$= \underbrace{s_t}_{s_1 + s_2}(A - C - Bs_t)$$

$$u_t(s_t) = s_t(A - C - Bs_t)$$

$$= (A - C)s_t - Bs_t^2$$

$$\frac{\partial u_t(s_t)}{\partial s_t} = (A - C) - 2Bs_t = 0$$

$$s_t^* = \frac{A-C}{2B}$$

$$s_1 = s_2 = \frac{A-C}{4B}$$

$$A = 10 \qquad B = C = 1$$

$$\frac{A-C}{4B} = \frac{9}{4} = 2.25$$

$$u_1\left(\frac{9}{4}, \frac{9}{4}\right) = \frac{9}{4} \cdot \left(9 - 1 \times \frac{9}{2}\right)$$

$$= \frac{9}{4} \times \frac{9}{2} = \frac{81}{8}$$

$$U_1\left(\frac{9}{4}, \frac{9}{4}\right) = \frac{81}{8} = \frac{81}{9} \times \frac{9}{8}$$

$$= 9 \times (>1)$$

$$> 9$$

outcome $s_1 = \frac{9}{4} = 2.25$

$s_2 = \frac{9}{4} = 2.25$

yields a higher payoff for both!

$s_1^* = 4.5 - \frac{1}{2} s_2$

$s_2^* = 4.5 - \frac{1}{2} s_1$