Domaći 5-1 Kurnov oligopol

$u_i(a_1, \ldots a_n) = p\left(\sum_j a_j\right) a_i - c_i(a_i)$ - F-ja dobiti i-tog

$\frac{\partial u_i}{\partial a_i} = 0 \Rightarrow p'\left(\sum_j a_j\right) a_i + p\left(\sum_j a_j\right) - c_i'(a_i) = 0$

OPTIMALNA PROIZVEDENA KOLIČINA

$c_i(a_i) = C \cdot a_i$ - TROŠKOVI

$p(a) = \max\{d - \sum_i a_i, 0\}$

a) I MONOPOL

$u_1(a_1) = p(a_1) a_1 - C(a_1)$

$\frac{\partial u}{\partial a_1} = p'(a_1) a_1 + P(a_1) \cdot 1 - c'(a_1) = 0$

$P(a_1) = \max\{d - a_1\}$

$C_1(a_1) = c a_1$

$(d - a_1)' \cdot a_1 + (d - a_1) - (C a_1)' = 0$

$-a_1 + d - a_1 - c = 0$

$-2a_1 + d - c = 0 \Rightarrow \boxed{a_1 = \frac{d-c}{2}}$ REŠAVA EKVILIBRIJUM

$u_1 = (d - a_1) a_1 - c \cdot a_1 =$

$= \left(d - \left(\frac{d-c}{2}\right)\right) \frac{d-c}{2} - c \frac{d-c}{2} =$

$= \frac{d-c}{2}\left(d - \frac{d-c}{2} - c\right) = \frac{d-c}{2} \cdot \frac{2d - d + c - 2c}{2} = \frac{d-c}{2} \cdot \frac{d-c}{2}$

$= \boxed{\left(\frac{d-c}{2}\right)^2}$ DOBIT IGRAČA

$p(a_1) = d - a_1 = d - \frac{d-c}{2} = \frac{2d - d + c}{2} = \boxed{\frac{d+c}{2}}$ JEDINIČNA CENA ROBE

II DUOPOL

$$\Pi_i(a_1,a_2) = P(a_1+a_2)a_i - C(a_i)$$

$$\frac{\partial \Pi_1}{\partial a_1} = P'(a_1+a_2)\cdot a_1 + P(a_1+a_2)\cdot 1 - C'(a_1) = 0$$

$$\frac{\partial \Pi_2}{\partial a_2} = P'(a_1+a_2)\cdot a_2 + P(a_1+a_2)\cdot 1 - C'(a_2) = 0$$

$$P(a_i) = \max\{d - \sum_i a_i, 0\}$$

$$C_i(a_i) = Ca_i$$

(Π_1) $(d-a_1-a_2)'a_1 + d - a_1 - a_2 - (Ca_1)' = 0$

(Π_2) $(d-a_1-a_2)'a_2 + d - a_1 - a_2 - (Ca_2)' = 0$

$$-a_1 + d - a_1 - a_2 - c = 0$$

$$-a_2 + d - a_1 - a_2 - c = 0$$

$$-2a_1 = a_2 + c - d \quad / \cdot (-2)$$

$$-2a_2 = a_1 + c - d \quad / \cdot (-2)$$

$$\boxed{a_1 = \frac{d-a_2-c}{2} \qquad a_2 = \frac{d-a_1-c}{2}}$$

$$a_1 = \frac{d - \frac{d-a_1-c}{2} - c}{2} = \frac{\frac{2d-d+a_1+c-2c}{2}}{2} =$$

$$= \frac{d+a_1-c}{4} \quad / \cdot 4$$

$$4a_1 = d + a_1 - c \Rightarrow 3a_1 = d - c \Rightarrow \boxed{a_1 = \frac{d-c}{3}} \quad (1)$$

$$a_2 = \frac{d - \frac{d-a_2-c}{2} - c}{2} = \frac{\frac{2d-d+a_2-c-2c}{2}}{2} = \frac{d+a_2-c}{4} \quad / \cdot 4$$

$$4a_2 = d + a_2 - c \Rightarrow \boxed{a_2 = \frac{d-c}{3}} \quad (2)$$

(1),(2) NE ŠČVI EVNHB.

$$u_2(a_1,a_2)=P(a_1+a_2)\,a_1-ca_1=$$
$$=\left(d-\frac{d-c}{3}-\frac{d-c}{3}\right)\cdot\frac{d-c}{3}-c\frac{d-c}{3}=$$
$$=\frac{3d-d+c-d+c}{3}\,\frac{d-c}{3}-c\frac{d-c}{3}=$$
$$=\frac{(d+2c)(d-c)-3c(d-c)}{9}=\frac{d^2+2dc-dc-2c^2-3cd+3c^2}{9}$$
$$=\frac{d^2-dc+c^2}{9}=\boxed{\frac{(d-c)^2}{9}}\quad \text{PROFIT}$$

$$\boxed{P(a_1+a_2)}=d-a_1-a_2=d-\frac{d-c}{3}-\frac{d-c}{3}=\frac{3d-d+c-d+c}{3}=$$
$$=\boxed{\frac{d+2c}{3}}\quad \text{JEDINIČNA CENA ROBE}$$

III TRIPOL

$$u_1(a_1,a_2,a_3)=P(a_1+a_2+a_3)\cdot a_i-c(a_i)$$
$$\frac{\partial u}{\partial a_1}=P'(a_1+a_2+a_3)\cdot a_1+P(a_1+a_2+a_3)\cdot 1-c'(a_1)=0$$
$$\frac{\partial u}{\partial a_2}=P'(a_1+a_2+a_3)\,a_2+P(a_1+a_2+a_3)\cdot 1-c'(a_2)=0$$
$$\frac{\partial u}{\partial a_3}=P'(a_1+a_2+a_3)\,a_3+P(a_1+a_2+a_3)\cdot 1-c'(a_3)=0$$
$$P(a_i)=\max\{(d-a_1-a_2-a_3),0\}$$
$$c(a_i)=Cd_i$$

$$(d-a_1-a_2-a_3)'a_1+d-a_1-a_2-a_3-c=0 \qquad (a_1)$$
$$(d-a_1+a_2-a_3)'a_2+d-a_1-a_2-a_3-c=0 \qquad (a_2)$$
$$(d-a_1+a_2-a_3)'a_3+d-a_1-a_2-a_3-c=0 \qquad (a_3)$$

$$-a_1 + d - a_1 - a_2 - a_3 - c = 0$$
$$-a_2 + d - a_1 - a_2 - a_3 - c = 0$$
$$-a_3 + d - a_1 - a_2 - a_3 - c = 0$$

$$-2a_1 = c - d + a_2 + a_3 \quad / (-2)$$
$$-2a_2 = c - d + a_1 + a_3 \quad / (-2)$$
$$-2a_3 = c - d + a_1 + a_2 \quad / (-2)$$

$$\boxed{\begin{aligned} a_1 &= \frac{d - a_2 - a_3 - c}{2} \\ a_2 &= \frac{d - a_1 - a_3 - c}{2} \\ a_3 &= \frac{d - a_1 - a_2 - c}{2} \end{aligned}}$$

$$a_1 = \frac{d - \frac{d - a_1 - a_3 - c}{2} - a_3 - c}{2} = \frac{\frac{2d - d + a_1 + a_3 + c - 2a_3 - 2c}{2}}{2}$$

$$= \frac{d + a_1 - a_3 - c}{4} \quad / \cdot 4$$

$$4a_1 = d + a_1 - a_3 - c \Rightarrow \boxed{a_1 = \frac{d - a_3 - c}{3}}$$

$$a_3 = \frac{d - \frac{d - a_1 - a_3 - c}{2} - c - a_1}{2} = \frac{\frac{2d - d + a_1 + a_3 + c - 2a_1 - 2c}{2}}{2} \Rightarrow$$

$$= \frac{d + a_3 - a_1 - c}{4} \quad / \cdot 4$$

$$4a_3 = d + a_3 - a_1 - c \Rightarrow \boxed{a_3 = \frac{d - a_1 - c}{3}}$$

$$a_1 = \frac{d - \frac{d-a_1-c}{3} - c}{3} = \frac{\frac{3d-d+a_1+c-3c}{3}}{3} = \frac{2d+a_1-2c}{9} \,/\cdot 9$$

$$9a_1 = 2d + a_1 - 2c \Rightarrow \boxed{a_1 = \frac{2d-2c}{8} = \frac{d-c}{4}}$$

$$\boxed{a_3 = \frac{d - \frac{d-c}{4} - c}{3}} = \frac{\frac{4d-d+c-4c}{4}}{3} = \frac{3d-3c}{12} = \boxed{\frac{d-c}{4}}$$

$$\boxed{a_2 = \frac{d - \frac{d-c}{4} - \frac{d-c}{4} - c}{2}} = \frac{\frac{4d-d+c-d+c-4c}{4}}{2} = \frac{2d-2c}{8} = \boxed{\frac{d-c}{4}}$$

$$\boxed{a_i(a_1,a_2,a_3)} = \left(d - \frac{d-c}{4} - \frac{d-c}{4} - \frac{d-c}{4}\right)\frac{d-c}{4} - c\,\frac{d-c}{4} =$$

$$= \frac{4d-d+c-d+c-d+c}{4}\cdot\frac{d-c}{4} - \frac{c(d-c)}{4} =$$

$$= \frac{d+3c}{4}\,\frac{d-c}{4} - \frac{c(d-c)}{4} = \frac{d-c}{4}\left(\frac{d+3c}{4} - c\right) =$$

$$= \frac{d-c}{4}\,\frac{d+3c-4c}{4} = \frac{d-c}{4}\cdot\frac{d-c}{4} = \left(\frac{d-c}{4}\right)^2 = \boxed{\frac{(d-c)^2}{16}}$$

DOBIT

$$P(a_1+a_2+a_3) = d - \frac{d-c}{4} - \frac{d-c}{4} - \frac{d-c}{4} = \frac{4d-d+c-d+c-d+c}{4} = \boxed{\frac{d+3c}{4}}$$

JEDNAKA CENA

$-2c$ / g

b) PROIZVOLJAN BROJ IGRAČA (OLIGOPOL)

	MONOPOL	DUOPOL	TRIPOL	OLIGOPOL
q_i	$\frac{d-c}{2}$	$\frac{d-c}{3}$	$\frac{d-c}{4}$	$\frac{d-c}{i+1}$
u_i	$\left(\frac{d-c}{2}\right)^2$	$\left(\frac{d-c}{3}\right)^2$	$\left(\frac{d-c}{4}\right)^2$	$\left(\frac{d-c}{i+1}\right)^2$
p_i	$\frac{d+c}{2}$	$\frac{d+2c}{3}$	$\frac{d+3c}{4}$	$\frac{d+ic}{i+1}$

$\frac{d-c}{4}$

i - BROJ IGRAČA NA TRŽIŠTU