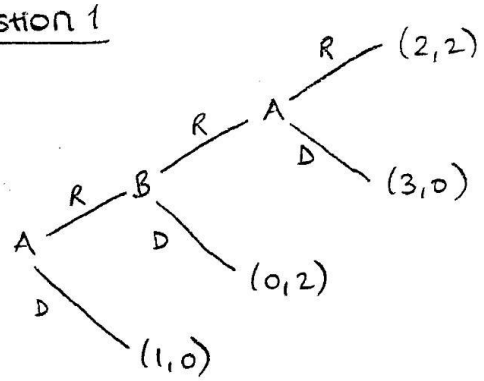
Elif cemre DURGUT - 26493 - Elif

Question 1

a)



Rollback equilibrium is D that is (1,0).

↳ Because in the last step, A would choose D (3,0)
Knowing that, B would choose D (0,2)
And also knowing that, A would choose D (1,0)

b) It is not Pareto efficient. (2,2) is Pareto efficient because moving from (0,2) to (2,2) makes the B the same and A is more.

(3,0) is also Pareto efficient because moving from (1,0) to (3,0) makes the A more and B the same.

c) Rollback equilibrium would be again defecting (D) on the first step. But, as long as the game was played, players will be more likely to choose R and getting (2,2)
(R,R,R)

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Question 2:

a)

PK \ GK	Left	Right
Left	40, 60	70, 30
Right	80, 20	20, 80

(Payoffs should add up to 100)

b)

PK \ GK	L	R
L	40, (60)	(70), 30
R	(80), 20	20, (80)

There is no pure strategy Nash equilibrium.

c)

PK \ GK	L (q)	R (1-q)	
L (p)	40, 60	70, 30	$\rightarrow 40(1-q)+70q$
R (1-p)	80, 20	20, 80	$\rightarrow 80(1-q)+20q$
	$60p+20(1-p)$	$30p+80(1-p)$	

p: probability that PK goes Left.

q: probability that GK goes Right

$60p+20-20p = 30p+80-80p$

$40p+20 = 80-50p$

$90p = 60$

$\boxed{p = 2/3}$

$40-40q+70q = 80-80q+20q$

$40+30q = 80-60q$

$90q = 40$

$\boxed{q = 4/9}$

d) if $p < 2/3$: Right ($q=1$)

if $p = 2/3$: mixed

if $p > 2/3$: Left ($q=0$)

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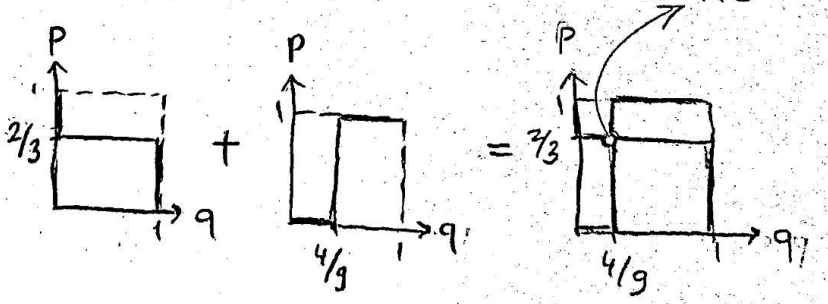
if $q < 4/9$: Right ($p=0$)

if $q = 4/9$: mixed

if $q > 4/9$: Left ($p=1$)



e) Probability of PK to shoot left should be 2/3 so that GK should be indifferent. With this way, PK can surprise GK and score.

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Question 3

a) **Firm A**

$\pi_A = (140-(q_1+q_2))q_1 - 20q_1$

$\pi_A = 140q_1 - (q_1)^2 - q_1 \cdot q_2 - 20q_1$

$\pi_A = 120q_1 - q_1^2 - q_1 \cdot q_2$

$\max(\pi_A) = 120 - 2q_1 - q_2 = 0$

Firm B

$\pi_B = (140-(q_1+q_2))q_2 - 20q_2$

$\pi_B = 140q_2 - q_1 \cdot q_2 - q_2^2 - 20q_2$

$\pi_B = 120q_2 - q_1 \cdot q_2 - q_2^2$

$\max(\pi_B) = 120 - q_1 - 2q_2 = 0$

b)

$120 - 2q_1 - q_2 = 0$ → substitute $120 - q_1 - 2q_2 = 0 \rightarrow q_1 = 120 - 2q_2$

$\Rightarrow$ $120 - 2(120-2q_2) - q_2 = 0$

$120 - 240 + 4q_2 - q_2 = 0$

$3q_2 = 120 \rightarrow q_2 = 40,\ q_1 = 40$

Nash Equilibrium → quantity: $Q_1 = (40),\ Q_2 = (40)$ //

→ price: $140 - (40+40) = (60)$ //

→ profit per firm: $\pi_A = 60 \cdot 40 - 20 \cdot 40 = (1600)$ $\pi_B = (1600)$ //

c)

$\pi = (140-Q)Q - 20Q$

$\pi = 120Q - Q^2$

$\frac{d\pi}{dQ} = 120 - 2Q = 0 \rightarrow Q = 60$ (total)

Nash Eq → quantity: $Q = 60$ → (30) // , (30) //

→ price: $140 - 60 = (80)$ //

→ profit: $\pi = 80 \cdot 60 - 20 \cdot 60 = 3600$ → (1800) //, (1800) //

d) cooperative equilibrium is more profitable but it is NOT stable. Because if one of them switches to low price while the other is high price, it would get more profit. If they trust each other, c) is more preferable for firms. For consumers, b) is obviously better than c).

e)

A \ B	Coop	Non
Coop	1800, 1800	1500, 2000
Non-	2000, 1500	(1600, 1600)

$NE = \{(\text{Noncoop.}, \text{Noncoop.})\}$

$(140-(30+40)) \cdot 40 - 20 \cdot 40 = 2000$

$(140-(30+40)) \cdot 30 - 20 \cdot 30 = 1500$

f) Noncooperative action should be punished.

Punishment should be at least 200. Because it should prevent switching from C to N.

$2000 - 1800 = 200$ //

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Question 4

∴ n = number of years of education

For high type →
$15000 - 500n \geq 10000$
$500n \leq 5000$
$n \leq 10$

For low type →
$10000 \geq 15000 - 1000n$
$1000n \geq 5000$
$n \geq 5$

a) High type individuals will self-select into taking $[5,10] = \{5,6,7,8,9,10\}$ years education to prove that they are high types.

b) Low type individuals will take maximum 4 years education because, otherwise they won't be able to cover the education expenses with their wage.

c) High types will get 5/6,7,8,9,10 years of education and low types will not get that much year education.

d) If education is free then it does not have a signal value no more. so, there is no reason for a person to educate. → Pooling equilibrium.

The average of 10000 TL and 15000 TL will be new wage

$\frac{10000+15000}{2} = 12500$ TL // (for both high and low types)

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Question 5

a)

A \ B	L	H
L	80, 80	40, (110)
H	(110), 40	(60), (60)

NE = (Heavy, Heavy)

For A, Light is dominated strategy

For B, Light is also dominated strategy

→ Prisoner's Dilemma type of game //

b) If they start with cooperating (L, L), in the 3rd month it makes sense to switch H. Knowing that, opponent would switch in 2nd month. Also knowing that, the first one would choose H in the first month. So, roll-back equilibrium is (Heavy, Heavy). For finite games, cooperation is not possible.

c) To sustain cooperating, defecting once should be disadvantaged.

If fisherman A defects once, lost should be more than the returned value.

gain for once: 110 − 80 = 30 , Lost: 80 − 40 = 40 (for once)

r: rate of return
PV: present value

$PV = \frac{40}{1+r} \rightarrow 30 < \frac{40}{1+r} \rightarrow \boxed{r < \frac{1}{3}}$ //

d) To sustain cooperating (L, L), defecting always should be disadvantaged.

Present value should be less than lost.

Gain for once: 110 − 80 = 30 , Lost = 80 − 60 = 20 all future months

If A is defecting, s/he loses: $\frac{20}{1+r} + \frac{20}{(1+r)^2} + \cdots + \frac{20}{(1+r)^n} \Rightarrow PV = \frac{20}{r} \rightarrow 30 < \frac{20}{r}$

$\boxed{r < \frac{2}{3}}$ //

e) ~~Because of return rate being 0,~~ grim strategy is better because player A has a certain probability and player B will guarantee the 60 payoff.

→ $30 < \frac{20}{r}$

$r < \frac{2}{3}$ //

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Question 6:

Choosing industrial area : $P(n) = (9 - 0.1n)10 - 20 = 70 - n$ (1 car = 10 TL)

Choosing residential area: $S(n) = 5.10 = 50$

a) Factories will locate on industrial area as long as $P(n+1) > S(n)$

↳ $70 - (n+1) > 50$

$70 - n - 1 > 50$

$n < 19$ //

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b) For social optimum : $T(n+1) > T(n)$

$T(n) = n \cdot P(n) + (N-n) \cdot S(n)$

$T(n) = n(70-n) + (50-n).50 = 2500 + 20n - n^2$

$T'(n) = 20 - 2n = 0 \rightarrow n = 10$ //

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c) $P(n+1) - tax = S(n) \rightarrow tax = P(n+1) - S(n)$

$= 70 - (n+1) - 50$

$= 19 - n$ (we want n to be 10)

$= 19 - 10$ ↓ socially optimum number

$tax = 9$ //

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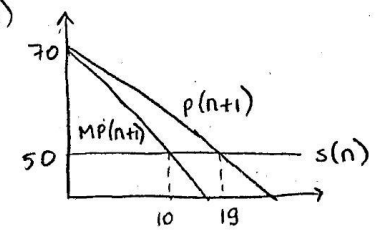
d)



MP(n+1) : marginal social payoff $(T(n+1) - T(n))$

P(n+1) : marginal private payoff for industr. r.

S(n) : marginal private payoff for residential r.

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e) $P(n) = (10 + 0.1n)10 - 20 = 80 + n$

$S(n) = 50$

$P(n+1) > S(n)$

$80 + n + 1 > 50$

$n > -31 \Rightarrow$ so, this means all factories will locate on industrial region. $\Rightarrow$ 50 factories //

Government should not place taxes because there is a positive spillover that is they affect each other positively. Then there is no reason to prevent the usage of industrial region

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Question 7:

a) I think, it is chicken game. In this game, players wants to be the project (or whatever) completed but they do not want to participate.

b) Assurence

c) People do not play Nash Equilibrium because there can be many reasons for that. For example, they may want to be kind to other players or they may be afraid of social punishment. They may misunderstand the game. Also, players' characteristics matter such as gender, age and nationality.