

Answer Key

Problem Set 10

Normal Form Games

For each of the games below, find the Nash equilibrium (or equilibria). You should assume that each of these games is a simultaneous move game, and that each player has all of the information contained in the game matrix.

1.

(B)

	U	D
U	A: 10 B: 10	A: 7 B: 4
D	A: 4 B: 7	A: 6 B: 6

A ⇒ U
D ⇒ U is the NE.

2.

(B)

	L	R
U	A: 10 B: 4	A: 2 B: 3
M	A: 7 B: 4	A: 6 B: 3
D	A: 10 B: 4	A: 1 B: 8

A ⇒ U
B ⇒ L is the N.E.

3.

(2)

	VH	H	M	L
H	1: 10 2: 0	1: 7 2: 1	1: 8 2: 5	1: 20 2: 9
M	1: 14 2: 4	1: 1 2: 2	1: 3 2: 8	1: 22 2: 22
L	1: 9 2: 62	1: 4 2: 100	1: 6 2: 1,000	1: 18 2: 400

① ⇒ L is dominated.

① ⇒ H
② ⇒ L is the NE.

4

Bob

	Red	Yellow
Blue	J: 7 B: 7	J: 9 B: 8
Green	J: 7 B: 800	J: 7 B: -800

Joe

(J) ⇒ Green is a N.E.
 (B) ⇒ Red is a N.E.

For games 4 and 7:

Find the NE(s); then determine/discuss the likely outcome if this game were played in an experimental setting.

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	H	M	L
M	G: 800 F: 800	G: 500 F: 700	G: 100 F: 600
M	G: 700 F: 500	G: 600 F: 600	G: 200 F: 500
L	G: 600 F: 100	G: 500 F: 200	G: 300 F: 300

GM

⇒ There are 3 N.E.

1. Ford ⇒ H
GM ⇒ H
2. GM ⇒ M
Ford ⇒ M
3. GM ⇒ L
Ford ⇒ L

6

Drew

	Mall	Park
Mall	L: 200 D: 200	L: 100 D: 150
Park	L: 150 D: 100	L: 175 D: 175

Lewis

- ⇒ 2 N.E.
1. Lewis ⇒ Mall
Drew ⇒ Mall
 2. Lewis ⇒ Park
Drew ⇒ Park

7

President

	S	V
B1	C: 100 P: -300	C: 0 P: 300
B2	C: 500 P: 100	C: -100 P: 0
B3	C: 200 P: 0	C: 0 P: 0
B4	C: 1000 P: -1000	C: -500 P: 800
B5	C: 300 P: -200	C: 100 P: -100

B1

B2

B3

B4

B5

Congress ⇒ B5
President ⇒ V

8

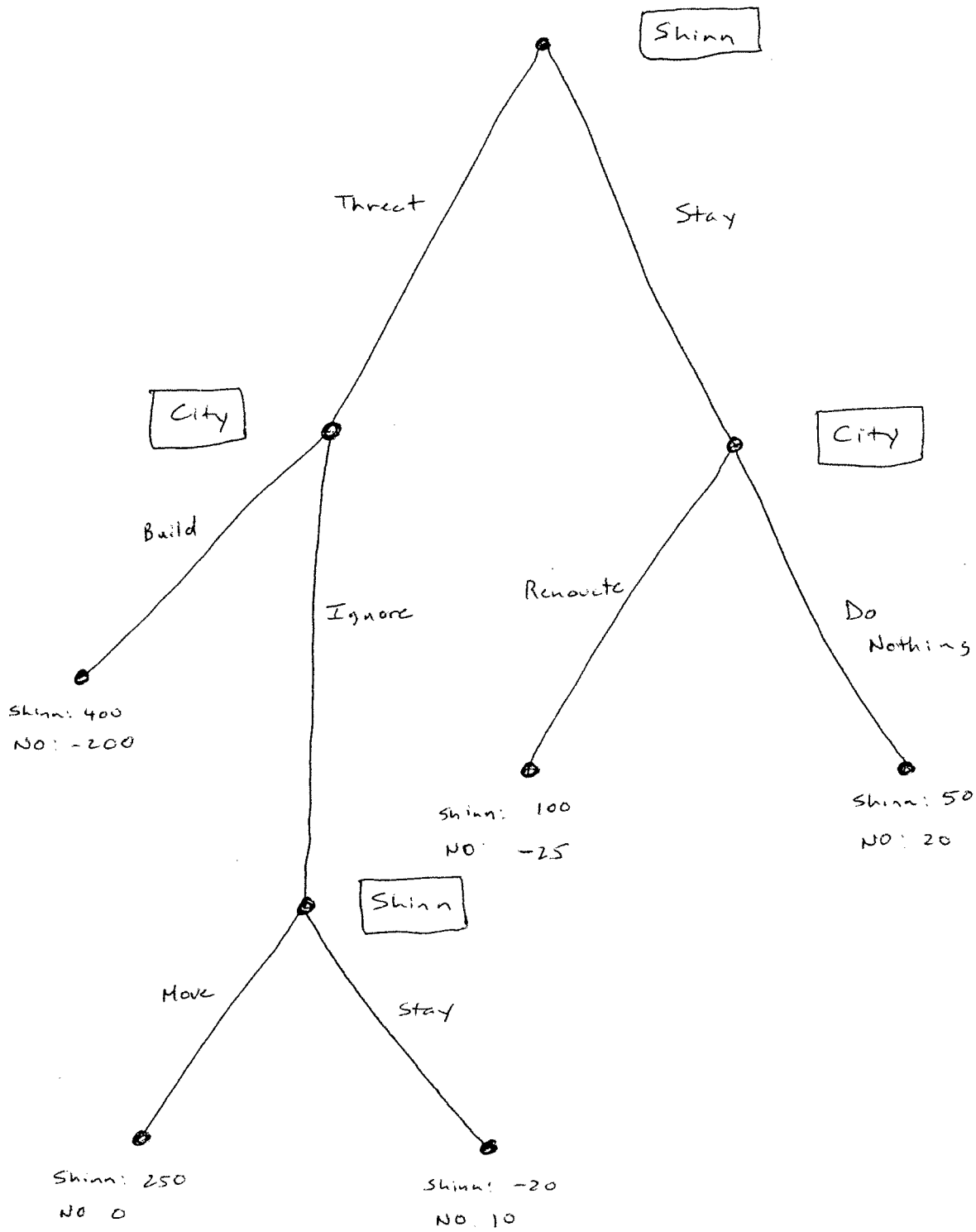
Ted

	L	R
L	B: -1000 T: -1000	B: 0 T: 0
R	B: 0 T: 0	B: -1000 T: -1000

B:11

- ⇒ 2 NE.
1. Bill ⇒ L
Ted ⇒ R
 2. Bill ⇒ R
Ted ⇒ L

9 a)



b)

Shinn

- $S_1 = \{ \text{Threat}, \text{Move} \}$
- $S_2 = \{ \text{Threat}, \text{Stay} \}$
- $S_3 = \{ \text{Stay}, \text{Move} \}$
- $S_4 = \{ \text{Stay}, \text{Stay} \}$

New Orleans

- $S_1 = \{ \text{Build}, \text{Renovate} \}$
- $S_2 = \{ \text{Build}, \text{D.N.} \}$
- $S_3 = \{ \text{Ignore}, \text{Renovate} \}$
- $S_4 = \{ \text{Ignore}, \text{D.N.} \}$

City - New Orleans

b)

	S_1	S_2	S_3	S_4
S_1	S: 400 No: -200	S: 400 No: -200	S: 250 No: 0	S: 250 No: 0
S_2	S: 400 No: -200	S: 400 No: -200	S: -20 No: 10	S: -20 No: 10
S_3	S: 100 No: -25	S: 50 No: 20	S: 100 No: -25	S: 50 No: 20
S_4	S: 100 No: -25	S: 50 No: 20	S: 100 No: -25	S: 50 No: 20

Shinn

c) There are two N.E.

1

Shinn $S_1 \Rightarrow \{ \text{Threat, Move} \}$
 City $S_3 \Rightarrow \{ \text{Ignore, Renovate} \}$

2

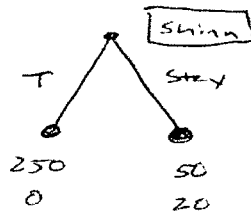
Shinn $S_1 \Rightarrow \{ \text{Threat, Move} \}$
 City $S_4 \Rightarrow \{ \text{Ignore, D.N.} \}$ \rightarrow Subgame Perfect NE

To find the subgame perfect N.E. use backwards induction.

At the last stage Shinn would choose "Move". Knowing this the city would choose "Ignore". If the city faced Shinn's "other path" \rightarrow if Shinn chooses stay \rightarrow then the city would "Do nothing". Thus, Shinn faces the following

choice:

"Threat".



So, Shinn would choose

The Subgame P. N.E. \Rightarrow

Shinn $\Rightarrow S_1$

City $\Rightarrow S_4$

#10

Employer $\Rightarrow s_1 = \{ \text{Fire, G.B.} \}$

$s_2 = \{ \text{Fire, N.B.} \}$

$s_3 = \{ \text{Re-sign, G.B.} \}$

$s_4 = \{ \text{Resign, N.B.} \}$

Worker \Rightarrow

$s_1 = \{ \text{Work Hard} \}$

$s_2 = \{ \text{Slack off} \}$

W

s_1 s_2

s_1	E: 0	E: 0
	W: -10	W: -10
s_2	E: 0	E: 0
	W: -10	W: -10
s_3	E: 5	E: -10
	W: 10	W: 20
s_4	E: 15	E: -5
	W: -5	W: 10

E

Two N.E.

1 $E \Rightarrow s_1$
 $W \Rightarrow s_2$

2 $E \Rightarrow s_2$
 $W \Rightarrow s_2$

#11

ACME $\Rightarrow s_1 \Rightarrow \{ \text{Large R+D, Large Ad, Large Ad} \}$

$s_2 \Rightarrow \{ \text{Large R+D, Large Ad, Small Ad} \}$

$s_3 \Rightarrow \{ \text{Large R+D, Small Ad, Large Ad} \}$

$s_4 \Rightarrow \{ \text{Large R+D, Small Ad, Small Ad} \}$

$s_5 \Rightarrow \{ \text{Small R+D, Large Ad, Large Ad} \}$

$s_6 \Rightarrow \{ \text{Small R+D, Large Ad, Small Ad} \}$

$s_7 \Rightarrow \{ \text{Small R+D, Small Ad, Large Ad} \}$

$s_8 \Rightarrow \{ \text{Small R+D, Small Ad, Small Ad} \}$

Zed

$s_1 \Rightarrow \{ \text{Large Ad} \}$

$s_2 \Rightarrow \{ \text{Small Ad} \}$

	S_1	S_2
S_1	A: 300 Z: 200	A: 400 Z: 100
S_2	A: 300 Z: 200	A: 400 Z: 100
S_3	A: 200 Z: 200	A: 150 Z: 150
S_4	A: 200 Z: 200	A: 150 Z: 150
S_5	A: 350 Z: 150	A: 400 Z: 50
S_6	A: 100 Z: 150	A: 125 Z: 125
S_7	A: 350 Z: 150	A: 400 Z: 50
S_8	A: 100 Z: 150	A: 125 Z: 125

A

Large Ad. is a dominant strategy for Zed!

Two N.E.

① ACME $\Rightarrow S_5$
Zed $\Rightarrow S_1$

② ACME $\Rightarrow S_7$
Zed $\Rightarrow S_1$

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The Centipede Game

The N.E. is

Player 1 \Rightarrow { Quit, Quit, Quit, Quit }

Player 2 \Rightarrow { Quit, Quit, Quit, Quit }

The N.E. is subgame perfect.