

## Unit 10, Videos 3 and 4

Let's Play a game under various conditions, cont'd

1. The game described in general
2. The various conditions
  - a. Cooperative (collusive) game
  - b. Non-cooperative game, maximin players
  - c. Non-cooperative game, maximax players
  - d. Nash equilibrium
3. The dominant strategy: does it sometimes exist?

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The game, generally described:

At a carnival Jack will operate the only hamburger stand, "Jack's Burger Shack" and Jill will operate the only hot dog stand, "Jill's Hot Dog Stand".

Both Jack and Jill must simultaneously decide what price to charge for their hamburgers and hot dogs prior to the beginning of the carnival. Neither person is allowed to change the price that they charge during the carnival. (This is a non-repeating, non-sequential game.)

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# Payoff Matrix (Daily Profits)

Jack's Burger  
Shack

Jill's  
Hot Dog  
Stand

Low  
Hot Dog  
Price

High  
Hot Dog  
Price

	Low Burger Price	High Burger Price
Low Hot Dog Price	\$15 \$10	\$5 \$75
High Hot Dog Price	\$70 \$1	\$80 \$50

## Game 1:

Let us assume that Jack and Jill are allowed to collude, so they meet prior to the carnival to decide what price to charge for hot dogs and hamburgers.

The "cooperative equilibrium" ("collusive equilibrium") will be the outcome with the highest combined profits ("joint profits")

# Payoff Matrix (Daily Profits)

Cooperative  
equilibrium

Jack's Burger  
Shack

Jill's  
Hot Dog  
Stand

Low  
Hot Dog  
Price

High  
Hot Dog  
Price

	Low Burger Price	High Burger Price
Low Hot Dog Price	\$15 \$10	\$5 \$75
High Hot Dog Price	\$70 \$1	\$80 \$50

## Game 2:

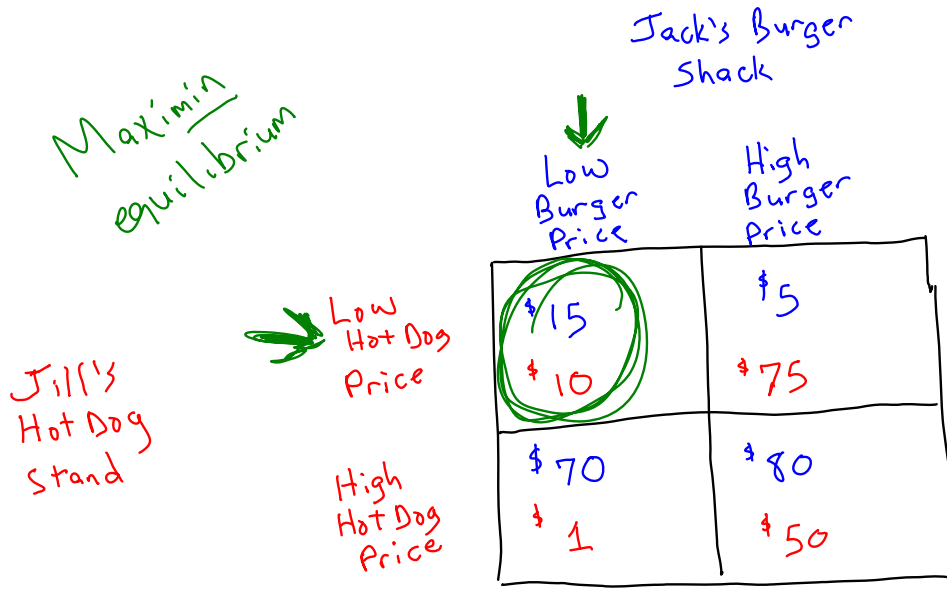
(Pretend that we never played game 1. Instead...)

Let us assume that Jack and Jill are not allowed to cooperate. Each must simultaneously, separately decide their prices.

Let us also assume that Jack and Jill are both extremely risk averse--each is a **maximin** player.

What will the "**maximin** equilibrium" be?

# Payoff Matrix (Daily Profits)



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## Game 3:

(Pretend that we never played games 1 or 2.  
Instead...)

Let us assume that Jack and Jill are not allowed to cooperate. Each must simultaneously, separately decide their prices.

Let us also assume that Jack and Jill are both extremely risk loving--each is a **maximax** player.

What will the "**maximax** equilibrium" be?

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# Payoff Matrix (Daily Profits)

Maximax  
equilibrium

Jill's  
Hot Dog  
Stand

Low  
Hot Dog  
Price

High  
Hot Dog  
Price

Jack's Burger  
Shack

Low  
Burger  
Price

High  
Burger  
Price

	Low Burger Price	High Burger Price
Low Hot Dog Price	\$15 \$10	\$5 \$75
High Hot Dog Price	\$70 \$1	\$80 \$50

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## Game 4:

(Pretend that we never played games 1 or 2 or 3. Instead...)

Let us assume that Jack and Jill are not allowed to cooperate. Each must simultaneously, separately decide their prices.

Let us also assume that Jack and Jill are both risk neutral.

What will the equilibrium be? This is a hard question to answer.

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## John Forbes Nash, Jr.

From Wikipedia, the free encyclopedia

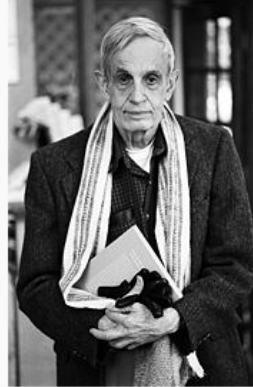
**John Forbes Nash, Jr.** (born June 13, 1928) is an American economist and mathematician whose works in **game theory**, differential geometry, and partial differential equations have provided insight into the forces that govern chance and events inside complex systems in daily life. His theories are used in market economics, computing, evolutionary biology, artificial intelligence, accounting and military theory. Serving as a Senior Research Mathematician at Princeton University during the later part of his life, he shared the 1994 Nobel Memorial Prize in Economic Sciences with game theorists Reinhard Selten and John Harsanyi.

Nash is the subject of the Hollywood movie *A Beautiful Mind*. The film, based very loosely on the biography of the same name, focuses on Nash's mathematical genius and his struggle with paranoid schizophrenia.<sup>[1][2]</sup>

Contents [hide]

1 Early life

John Forbes Nash Jr.



Born

June 13, 1928 (age 81)  
Bluefield, West Virginia, USA

**Nash equilibrium**: An outcome in which **no player** can become better off by switching his/her own strategy.

Usually the players in a Nash game are considered risk neutral.

In any game, there can be zero, one, or more than one Nash equilibria.

# Payoff Matrix (Daily Profits)

Jack's Burger Shack

Low Burger Price      High Burger Price

Jill's Hot Dog Stand

Low Hot Dog Price      High Hot Dog Price

↑  
Nash Equilibrium

\$15 \$10	\$5 \$75
\$70 \$1	\$80 \$50

Dominant strategy:

A player in a non cooperative game has a dominant strategy if one of the player's choices is always superior to all of the player's other choices, regardless of the strategy that other players choose.

# Payoff Matrix (Daily Profits)

Jack's Burger Shack

Low Burger Price      High Burger Price

Low Hot Dog Price	\$15 \$10	\$5 \$75
High Hot Dog Price	\$70 \$1	\$80 \$50

Jill's Hot Dog Stand

Jill's dominant strategy

# Payoff Matrix (Daily Profits)

No dominant strategy for Jack

Low Burger Price      High Burger Price

Low Hot Dog Price	\$15 \$10	\$5 \$75
High Hot Dog Price	\$70 \$1	\$80 \$50

Jill's Hot Dog Stand