**Queries**

1. Has anyone tried Cournot’s Equilibrium with **p(q) = a / q**, which is a rather accepted formula for cost vs price, instead of **p(q) = a – q**?
2. The following code gets struck at line 4 to compute next of a generator object, for games with decently large matrix (100 X 100). Will a GPU help? Why?

game = nash.Game(p1\_mesh, p2\_mesh)  
nash\_eq = game.support\_enumeration()  
print(f'nash\_eq ({type(nash\_eq)})\n{nash\_eq}')

# next\_nash = next(nash\_equilibrium)

**Microeconomics by Game Theory**

<https://www.youtube.com/watch?v=Ft1MqdjFdOk&list=PLKI1h_nAkaQppKwAw3BuwMwe0IvmZ5oei>

**Gametheory-101** by **William Spaniel**

<https://www.youtube.com/@Gametheory101/playlists>

Basics:

<https://www.youtube.com/watch?v=NSVmOC_5zrE&list=PLKI1h_nAkaQoDzI4xDIXzx6U2ergFmedo>

Advanced:

<https://www.youtube.com/watch?v=Ft1MqdjFdOk&list=PLKI1h_nAkaQppKwAw3BuwMwe0IvmZ5oei>

**Game Theory** by **Aditya Jagannatham**

<https://www.youtube.com/watch?v=OKHiS0xDBb4&list=PLDlJ2nw7-dHb3oowMJfwgleor6dwWsVZ1>

**Game Theory** by **Vincent Knight**

<https://www.youtube.com/watch?v=T50RbGZv-gw&list=PLnC5h3PY-znxMsG0TRYGOyrnEO-QhVwLb>

**Nashpy** by **Vincent Knight**

<https://www.youtube.com/watch?v=3bFCDg2ApP4&list=PLnC5h3PY-znw_SyhvDO3-yH_EWB5z0w_8>

<https://www.youtube.com/watch?v=aD9JX1BqM5Y&list=PLnC5h3PY-znw_SyhvDO3-yH_EWB5z0w_8&index=8>

1 player 2 players few to many players infinite number of small players

Monopoly Duopoly Oligopoly Perfect Competition

You don’t care All concepts of Oligopoly are Usual practical scenario. Infinite small competitors.

Easily visualizable here Infinite market to share.

No feedback loop of one player’s

action on others and back.

**Types of competition**

* Types of goods produced
  + Simultaneous (Cournot)
  + Sequential (Stackleberg)
* Price of the good (Bertrand)
* Effort (Contests / Tullock)
* Timing (Duels)
* Spatial (Hotelling)

**Cournot Competition: Types of goods produced SIMULTANOUSLY**

* Each firm produces quantity qi simultaneously: e.g. q1 = 50, q2 = 60, qi >= 0
* Goods produced are homogenous, identical & no brand identity. e.g. nails, apples
  + Total quantity in the market: q = q1 + q2
  + Price p is a function of q:
    - p(q) = a – q for q < a, where a > 0 is some constant
    - p(q) = 0 for q >= a
  + Firms have marginal cost of production ci >= 0
  + Profit of firm i:
    - p(q)qi – ciqi
  + Objective: maximize profit qi
* Solution Strategy
  + Derive firm 1’s best response to firm 2’s output decision (q2)
  + Derive firm 2’s best response to firm 1’s output decision (q1)
  + Find a pair of outputs that are mutual best responses

**Equilibrium in dominant strategies**

**Best response** function of a player (other players’ strategies) = strategy with max\_payoff for that player

BRJoe(ConfessBob)=ConfessJoe

**Symmetric** if one can change the identities of the players without changing the game.

**Dominant Strategy** the strategy that always gives best response for all other strategies of other players

If ConfessJoe = BRJoe(ConfessBob) = BRJoe(DenyBob)

Then ConfessJoe = DominantStrategyJoe

**Equilibrium in dominant strategies**: each player has a dominant strategy

**Iterated deletion of dominated strategies**

|  |  |
| --- | --- |
| * *Strategic situation / game: $2, $4, $5 per beer* * *20 locals => chose cheapest beer* * *40 tourists => chose at random 20 at each bar* | **Round 1 of deletion**   * **A** will never maximize payoff at **A$2** * **A** will never rationally play **A$2** * **A$2** is a dominated strategy for **A**   + **deleted** * Similarly: * **B$2** is a dominated strategy for **B**   + **deleted** |

**Round 2 of deletion**

* Delete all dominated strategies of all players
* **Rationalizable strategies**: remain after the iterated deletion of strictly dominated strategies
* **Dominance solvable** game => iterated del of dominated strategies results in one strategy profile

**Nash equilibrium**

|  |  |
| --- | --- |
|  | * *Situation/ game:* ***$3****, $4, $5 per beer* * *20 locals => chose cheapest beer* * *40 tourists => chose at random 20 at each bar* |

Strategy profile in which each player’s strategy is the best response to all other players’ strategies



**Mathematically** an action profile (a\*1, a\*2, …. a\*N) is in NE

**if** for each player i, his payoff Ui(a\*i, a\*-i) >= Ui(ai, a\*-i)

* Self-enforcing agreement

