POLI 244: Bargaining & Game Theory

I. Core Scenario: War as Bargaining Failure

Bargaining over Peanut Peninsula

States A and B bargain over a peninsula with four assets:

- Mineral-rich mountains
- Touristic site
- Agricultural area
- Island with strategic value

> **Asset Valuation:** The first three assets are valued equally. The island is worth **50 utility points** for State A and **0** for State B.
>
> **Partition Rule:** If a partition line splits an asset, its value is divided equally.

Initial War Scenario (A vs. B)

- **Expected Outcome (p):** Equivalent to status quo (sq).
- **State A War Cost:** 10 utility points.
- **State B War Cost:** 20 utility points.

Both states are rational utility-maximizers with complete information.

II. Questions: Initial Scenario

1. Complete the Payoff Table:

Outcome	State A's Payoff	State B's Payoff
War	A(sq) - 10 = **70**	B(sq) - 20 = **10**
Status Quo (sq)	80	30
Deal x	50	0
Deal y	95	15
Deal z	140	80

> **Bargaining Range:** The set of deals both sides prefer to war.
> State A wants deals > 70. State B wants deals > 10.
> Peaceful deals A accepts: **sq, y, z**.
> Peaceful deals B accepts: **sq, y, z**.

2. Credible Challenge? Yes. Both states prefer sq, y, and z to war. The status quo is not the only option.

3. Is Status Quo Pareto Optimal? No. Deals y and z are Pareto superior to sq, as both states get higher payoffs.

4. Expected Outcome? Deals **y** and **z** are peaceful, in the bargaining range, and Pareto superior to the status quo.

III. Scenario 2: Alliance with State C

New War Outcome (A+C vs. B)

- **Expected Outcome (A):** 140 utility points
- **Expected Outcome (B):** 80 utility points
- **War Cost (A):** 5 utility points
- **War Cost (B):** 40 utility points

> **A's War Payoff:** 140 - 5 = **135**
> **B's War Payoff:** 80 - 40 = **40**

a. Can any state credibly challenge the status quo?

Yes. State A's war payoff (135) is now much better than the status quo (80). State A has a credible incentive to challenge the status quo.

b. Is there a Pareto superior peaceful deal?

A needs a deal > 135. B needs a deal > 40. Deal **z (140, 80)** satisfies both conditions and is preferred to war by both states. It is Pareto superior to the war outcome.

c. What is the expected outcome?

The new bargaining range is defined by the war payoffs (135, 40). State A will push for a deal better than its war payoff. The likely outcome is a peaceful settlement at or near **Deal z**.

IV. Scenario 3: Differing Beliefs

Asymmetric Information on Alliance

- **State A believes:** C will join (War payoff = 135).
- **State B believes:** C will NOT join (War payoff = 10).

a. Deals acceptable to State A?

A wants deals with payoff > 135. Only **Deal z (140)** is acceptable.

b. Deals acceptable to State B?

B wants deals with payoff > 10. Deals **sq (30), y (15), z (80)** are acceptable.

c. Expected outcome?

There is no overlap in acceptable deals that A would propose and B would accept if A makes the first move. A demands 'z', but B sees no reason to concede that much (B thinks A's war

V. Scenario 4: Future Power Shift

Dynamic Bargaining & Commitment Problems

Return to the original A vs. B scenario. Both states expect State B to grow much stronger in the future. War today can prevent this shift.

- **War Today Payoffs (from Part I):** A gets 70, B gets 10.
- **Future War Payoffs (if no war today):** A gets 70, B gets 150.

a. A's expected long-run payoff if no war today?

If no war now, B's power grows. A's bargaining position weakens. B will be able to enforce a new, less favorable status quo or win a future war. A's expected payoff will trend towards its future war payoff of **70**.

b. A's expected long-run payoff if war today?

State A gets its war payoff of **70**.

c. Long-Run Payoff Matrix & Expected Outcome:

A compares its best possible peaceful outcome today with the inevitable decline. The best peaceful deal for A today is **z (140)**. However, B has no incentive to agree to this today, knowing it will be much stronger tomorrow. A knows that any peaceful deal today is temporary. Since A's payoff is 70 whether it fights now or accepts decline and fights later, and there's no credible way for B to commit to a favorable deal for A in the long run, A may choose to fight now to lock in the outcome. This is a commitment problem. The expected outcome is likely **war** due to the anticipated power shift. State A initiates a preventive war.

Exercise 1: Payoff Matrix Analysis

Game: France vs. Greenpeace

	F1	F2	F3	F4
G1	6, 5	2, 2	5, 4	1, 3
G2	5, 5	4, 5	0, 3	3, 2
G3	**7, 7**	3, **9**	4, 6	2, **8**

1. Dominant Strategies? No dominant strategies for either player.

2. Rationalizable Strategies? Iterated elimination of strictly dominated strategies.

- For France: F3 is dominated by F2 (5>4, 5>3, 9>6). F4 is dominated by F2 (5>3, 5>2, 9>8). Eliminate F3, F4.
- Reduced Game: F1 vs F2. For Greenpeace, G1 and G2 are now dominated by G3 (7>6, 3>2; 7>5, 3>4 is false, check again). F3 is NOT dominated by F2 for France (5>4, 5>3, but 6<9). Re-eval: No strategies are strictly dominated. All are rationalizable.

3. Nash Equilibria (NE): (Best response analysis - underlined payoffs)

- If G plays G1, F plays F1 (5).
- If G plays G2, F plays F1 or F2 (5).
- If G plays G3, F plays F2 (9).
- If F plays F1, G plays G3 (7).
- If F plays F2, G plays G2 (4).
- If F plays F3, G plays G1 (5).
- If F plays F4, G plays G2 (3).
- There is one pure-strategy NE: **(G3, F1)** with payoff (7, 7).

4. Expected Outcome? The Nash Equilibrium (G3, F1).

5. Is it Pareto Optimal? Yes. There is no other outcome where at least one player is better off and no player is worse off. (7,7) is on the Pareto frontier.

Exercise 2: Sequential Game

Iran's Nuclear Program vs. Israel's Threat

Game tree A (complete info) vs. B (incomplete info). Tree **B is better** as it captures Iran's uncertainty about Israel's "type" (serious or bluffing) using a single information set.

c. Dominant Strategies?

For Iran, "Don't Build" is a weakly dominant strategy if we look at the matrix. It gives a payoff of 2 regardless of Israel's type, while "Build" gives -1 or -10. Israel has no dominant strategy.

d. Backward Induction (Game A - Complete Info):

- If Israel is "Serious": Iran sees (-1 vs 2) and chooses "Don't Build". Israel gets -2.
- If Israel is "Bluff": Iran sees (-10 vs 2) and chooses "Don't Build". Israel gets -2.
- Israel anticipates this, so the outcome is always ("Don't Build", -2).

e. Why no BI in Game B?

You cannot use backward induction because Iran is at an information set with two nodes and doesn't know which one it's at. It cannot make a clear choice without forming a belief about Israel's type.

g. Matrix Analysis (Game B):

(Iran, Israel)	Israel: Serious	Israel: Bluff
Build Weapon	(-1, -50)	(-10, 20)
Don't Build	(2, -2)	(2, -2)

NE: ("Don't Build", "Serious Threat") and ("Don't Build", "Bluff").

i. 50/50 Belief:

- Expected Utility (Build): 0.5*(-1) + 0.5*(-10) = -5.5