

## 2 Dynamic games and refinements of Nash equilibrium

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- (2001) “The definition of a strategy in an extensive form game does not correspond to a plan of action since it peculiarly requires a player to specify his actions after histories that are impossible if he carries out his plan.”  
Give an example of an extensive form game along with a strategy that illustrates the statement. Explain why the “peculiarity” in the definition is necessary for equilibrium analysis. Is there a good way to interpret the notion of a strategy in an extensive form? Explain your answer.
- (2000) Why have refinements of Nash equilibrium been thought necessary? How successful have the refinements been?
- (1998) “Game theory cannot tell us how an opposing player would interpret a non-equilibrium choice; so it cannot tell us either why a player should prefer her equilibrium choice to others.” Discuss.
- (1997)
  - Explain carefully what is meant by a *subgame perfect equilibrium* of an extensive form game.
  - Are there any examples in which subgame perfection is not a compelling equilibrium concept?

4. (1993) “The theory of infinitely repeated games of complete information shows that repetition generates cooperation without an enforcement mechanism”. Discuss.
5. Are there fewer difficulties in identifying an equilibrium with infinitely than with finitely repeated games?
6. (1992) Should we really believe the backward induction argument?
7. (2001) Consider the following simultaneous-move game:

	L	C	R
T	3, 1	0, 0	5, 0
M	2, 1	1, 2	3, 1
B	1, 2	0, 1	4, 4

This stage game is played twice, with the outcome from the first stage observed before the second stage begins. There is no discounting. Can the payoff (4, 4) be achieved in the first stage in a pure-strategy subgame perfect Nash equilibrium? If so, describe a strategy profile that does so and prove that it is a subgame perfect Nash equilibrium. If not, prove why not.

8. (2001) Five ferocious pirates are dividing their plunder (100 gold coins). They are numbered from 1 to 5, and suggest ways of sharing the coins as follows. Pirate 1 suggests a way of sharing the coins (where no single coin can be subdivided). For example, he might suggest {80, 5, 5, 5, 5} meaning that he gets 80 coins and the others get 5 each. All five pirates then vote on the proposal. If a majority accept, the division is carried out. If a majority decline, then pirate 1 is thrown overboard. Ties are broken in favour of the proposer. If there is agreement, the game ends. If pirate 1 has been thrown overboard, we return to the first step, with pirate 2 suggests a division, and so on. The process continues until an agreement is reached.

Explain carefully what happens on the path of the (unique) subgame perfect Nash equilibrium (assuming any voter who is indifferent (at equilibrium) between accepting or rejecting votes to reject).

9. Three oligopolists operate in a market with demand given by  $p(Q) = a - Q$  where  $Q = q_1 + q_2 + q_3$  and  $q_i$  is the quantity produced by firm  $i$ . Each firm has a constant marginal cost of production of  $c$  and no fixed costs. The firms chose their quantities as follows:

- (a) Firm 1 chooses  $q_1 \geq 0$ ;
- (b) Firms 2 and 3 observe  $q_1$  and simultaneously chose  $q_2$  and  $q_3$ .

What is the subgame perfect equilibrium outcome?