NOTES

Chapter 1. *The Problem of Cooperation*

1. For useful illustrations of these applications to international politics, see the following sources: the security dilemma (Jervis 1978), arms competition and disarmament (Rapoport 1960), alliance competition (Snyder 1971), tariff negotiations (Evans 1971), taxation of multinational firms (Laver 1977), and communal conflict in Cyprus (Lumsden 1973).

2. The Prisoner's Dilemma game was invented in about 1950 by Merrill Flood and Melvin Dresher, and formalized by A. W. Tucker shortly thereafter.

3. The situations that involve more than pairwise interaction can be modeled with the more complex n-person Prisoner's Dilemma (Olson 1965; G. Hardin 1968; Schelling 1973; Dawes 1980; R. Hardin 1982). The principal application is to the provision of collective goods. It is possible that the results from pairwise interactions will help suggest how to undertake a deeper analysis of the n-person case as well, but that must wait. For a parallel treatment of the two-person and n-person cases, see Taylor (1976, pp. 29–62).

4. The value received from always defecting when the other is playing TIT FOR TAT is:

$$\begin{aligned} V(\text{ALL D|TFT}) &= T + wP + w^2P + w^3P \ldots \\ &= T + wP(1+w+w^2 \ldots) \\ &= T + wP/(1-w). \end{aligned}$$

5. If the other player is using a strategy of permanent retaliation, you are better off always cooperating than ever defecting when $R/(1-w) > T + wP/(1-w)$ or $w > (T-R)/(T-P)$.

6. This means that the utilities need only be measured as an interval scale. Using an interval scale means that the representation of the payoffs may be altered with any positive linear transformation and still be the same, just as temperature is equivalent whether measured in Fahrenheit or Centigrade.

7. For the implications of not assuming deliberate choice in an evolutionary model of economic change, see Nelson and Winter (1982).

Chapter 2. *The Success of TIT FOR T*

1. The second round of the tournament u
scribed in the text.

2. This is a broader definition of forgiveness
Chammah (1965, pp. 72–73), which is the
move after receiving the sucker's payoff, *S*.

3. In the five games between them, the ave
TAT and 230 for JOSS.

4. In the environment of the 15 rules of th
ING averages 542 points. This compares to
504 points. TIT FOR TWO TATS averages
LOOK AHEAD averages 520 points.

5. This probability of ending the game at
expected median length of a game would be
players was matched five times, and the lengt
mined once and for all by drawing a randc
sample from the implied distribution specified
players would be of lengths 63, 77, 151, 156,
length of a game turned out to be somewhat s

6. This reproduction process creates a simul
nament in which the average score achieved b
score with each of the rules, where the weigh
the other rules in the initial generation.

7. This simulation of future rounds of the
the weighted average of the scores of a given
weights are the numbers of the other rules wh
The numbers of a given rule in the next gene
tional to the product of its numbers in the cur
current generation. This procedure assumes c
matrix. It is the only instance in this book wh
cardinal, rather than merely interval, interpret

Chapter 3. *The Chronolo*

1. Those familiar with the concepts of gam
tion of a collectively stable strategy as a strateg
itself. My definitions of invasion and collect
from Maynard Smith's (1974) definitions of i
His definition of invasion allows a newcomer
same score as a native meeting a native, provi
comer does better than a newcomer meeting a
new definitions to simplify the proofs and to
the effect of a single mutant and the effect of
rule which is evolutionarily stable is also colle
which will never be the first to defect), the de
sitions in the text remain true if "evolutionary
tive stability" with the exception of the Chara
B, where the characterization is necessary but