Reading List Are 261, last two lectures

I will discuss two types of dynamic games. In the first type ("Nash"), strategic agents make decisions simultaneously in each period (each instant of time). For example, agents extract a common property resource. In the second type ("asymmetric"), one group of nonstrategic agents solve dynamic optimization problems and have rational expectations. A strategic agent, such as the government or a monopolist, makes decisions which affect the behavior of nonstrategic agents.

My objective is to leave you with an idea of the types of problems that can be analyzed and the methods that are used. I will not have time for detailed derivations. I'll describe the type of problem, try to sketch how the solution is obtained, and tell you something about the solution. I will try to give you "the big picture".

You can read the final set of notes on the web for an overview of the lectures. Here is an annotated reading list.

I. "Nash" games:

I suggest you begin with

Kamien M and N Schwartz Dynamic Optimization 1991 North Holland part II, Section 23;

This chapter outlines the basic methods for continuous time problems and discusses a number of examples. If you liked the other chapters in this book, you will probably find this one useful.

The classic paper in this field using a discrete time model is

Levhari D and L Mirman "The Great Fish War" Bell Journal of Economics (1980) 11: 322 - 334.

They use dynamic programming to obtain an explicit solution for a common property (fish wars) problem.

Fudenberg, D. and Tirole Game Theory 1992 MIT Press, Chapter 13

contains an excellent treatment of this kind of game. Their example 2, beginning on page 510 provides a different (much more concise) derivation of the fish wars equilibrium.

One of the best known models of continuous time dynamic games is

Fershtman, C and M Kamien "Dynamic Duopolistic Competition with Sticky Prices" (1987) Econometrica 55 1151 - 1164.

The chapter in K&S discusses the important aspects of this model. By reading the original you will see more clearly how the model works. This paper also emphasizes the difference between

open loop and Markov equilibria.

All of the above models assume a unique equilibrium. The following paper

Tsutsui S and K Mino "Nonlinear Strategies in Dynamic Duopolistic Competition" (1990) Journal of Economic Theory 52: 136 - 161

shows why there typically exists a family of differentiable Markov equilibria, each of which converges to a different steady state. They illustrate this fact by studying the "sticky price" model. This paper contains an important idea, but it is not an easy read. The following paper

Karp, L., and J Livernois. "Using Automatic Tax Changes to Control Pollution Emissions" JEEM, vol 27 (1994) pp 38 - 48

uses the same ideas to show the multiplicity of equilibria in an environmental setting. This paper also emphasizes the difference between open loop and Markov equilibria.

In nonrenewable resource (game) models, the problem of non-uniqueness does not arise because of the existence of a "natural boundary condition" (exhaustion of the resource). The paper by

Reinganum J and N Stokey "Oligopoly Extraction of a Common Property Resource" (1985) IER 26: 161 - 173

uses a variation of the "fish wars" model (with no growth of the resource) to illustrate the possibility that competition drives rents instantly to zero. This paper relies on a specific functional form and obtains an explicit solution using dynamic programming. The paper by

Karp, L, "Social Welfare in a Common Property Oligopoly" (1992) IER 33: 353 - 372

studies the same problem in a more general setting and shows that in general rents are positive in equilibrium.

II. “Asymmetric games”

The place to begin is the policy paper

F Kydland and E Prescott (1977) “Rules Rather than Discretion” JPE vol 85 pp 473 - 471.

This paper “uncovers” the problem that a government has in influencing the decisions of agents with rational expectations who solve dynamic problems. The optimal government policy is “time inconsistent”.

The same kind of issue shows up in industrial organization settings, for example in the

problem of the durable goods monopolist.

Tirole, J. The Theory of Industrial Organization MIT Press 1989 pp 79 - 87

describes the basic problem.

Kahn, C. (1987): "The Durable Goods Monopolist and Consistency with Increasing Costs," Econometrica, 54, 274-294

shows how to construct a (Markov perfect) equilibrium when the monopolist has increasing costs, for specific functional forms.

Karp, L. S. (1996) "Depreciation Erodes the Coase Conjecture". European Economic Review 40 pp 473-490

shows that if the durable good depreciates, the Markov perfect equilibrium is not unique. Non-uniqueness is caused by essentially the same problem here as in the "Nash" game.

Xie, D (1997) “On Time Inconsistency” Journal of Economic Theory, 76: 412 - 430 shows that in optimal policies may not be time consistent in some surprising circumstances.