NTNU
Kunnskap for en bedre verden

Institutt for samfunnsøkonomi

Eksamensoppgave i SØK3524 - Miljø- og ressursøkonomi

Faglig kontakt under eksamen: Anders Skonhoft

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Eksamensdato:	15. desember 2017
Eksamenstid (fra-til):	6 timer (09.00-15.00)
Sensurdato:	15. januar 2018

Hjelpemiddelkode/Tillatte hjelpemidler: C /Flg formelsamling: Knut Sydsæter, Arne Strøm og Peter Berck (2006): Matematisk formelsamling for økonomer, 4utg. Gyldendal akademiske. Knut Sydsæter, Arne Strøm, og Peter Berck (2005): Economists' mathematical manual, Berlin. Calculator Casio fx-82ES PLUS, Casio fx-82EX Citizen SR-270x, SR-270X College eller HP 30S.

Målform/språk:	Engelsk
Antall sider (uten forside):	2
Antall sider vedlegg:	0

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Question 1 (40%)

Consider a so-called cake eating problem where the size of the given resource ('the cake') reduces according to:

(1) $dX_t / dt = -C_t$.

The planning problem is $\max_{C_t} \int_0^T U(C_t)e^{-\delta t} dt$ s.t. Eq.(1) and where X_0 is given. The planning horizon T is assumed fixed.

a) Write down the Hamiltonian function and find the control and portfolio conditions. Interpret these conditions. Next, eliminate the shadow price and find an expression for the consumption path.

b) Assume that the utility function is given as $U(C_t) = \ln C_t$. Calculate the consumption path, and find how the size of the resource ('the cake') evolves over time. What happens when discount rent equalizes zero, $\delta = 0$?

c) Formulate an optimal oil, or mine, depletion problem. Which cost and benefit components should be included in this type of problem? Write down the Hamiltonian, and find the optimality conditions. Discuss these conditions.

Question 2 (40%)

a) Discuss briefly the concept of 'sustainable development'.

b) What is the difference between a flow and stock pollution problem? Formulate and discuss (not solve) the main elements of an optimal stock pollution problem.

c) Discuss the basic driving forces behind overexploitation of (wild) fish.

d) What are the most important differences between a biomass fishery model and an age structured fishery model? Explain the main elements of the following age structured model:

1) $X_{0,t} = R(X_{2,t})$,

2) $X_{1,t+1} = s_0 X_{0,t}$

and

3) $X_{2,t+1} = s_1(1 - f_{1,t})X_{1,t} + s_2(1 - f_{2,t})X_{2,t}$.

Question 3 (20%)

The biomass of a stand of trees grows according to $V(t)$. The timber price also changes through time, $p(t)$.

a) How may the growth function $V(t)$ look like? Suggest an explicit formulation.

b) Find the optimal cutting time when the land has no opportunity value. Interpret the optimality condition. Find also the second order condition of the problem, and find how the discount rent influences the optimal cutting time.

c) Formulate and solve the optimal cutting problem when the land has a fixed opportunity value W both before and after cutting.