

# Behavioral Economics: Problem Set 7

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**Exercise 1:** (*continuous action space*) Consider a student who has to write a term paper. The student has two periods of time to work on the term paper. In each period  $t = 1, 2$  the student chooses an effort level  $e_t \geq 0$ , which she invests in the task. If the student invests effort in the task in period  $t$ , then contemporaneous effort cost are  $c(e_t) = \frac{1}{2}e_t^2$ . The quality of the term paper depends on the total effort the student invests in writing the term paper. Formally, the grade is  $g(e_1 + e_2) = 2(e_1 + e_2) - \frac{1}{2}(e_1 + e_2)^2$  for  $e_1 + e_2 \leq 2$  and  $g(e_1 + e_2) = 2$  otherwise. The student receives her grade in period three. Consider three types of students, time consistent (TC), naifs (N) and sophisticates (S). Suppose that the time consistent discount factor  $\delta = 1$  and the present bias parameter is  $\beta < 1$ .

- Show that TCs choose the same effort level in each period.
- Show that both types of hyperbolic discounters work harder in the second period than in the first period.
- Show that a naif works less in the first period but more in the second period than a sophisticate.
- Who receives the better grade, naifs or sophisticates? Show that the long-run utility of sophisticates is higher than the long run utility of naifs.
- Explain in words the pessimism effect and the incentive effect. Which effect increases the grade of a sophisticate?

**Exercise 2:** (*Final Exam Exercise 2007/2*) Consider a person who can work on two unpleasant tasks,  $A$  and  $B$ , during the next three days ( $t = 1, 2, 3$ ). Each task needs two days of work to be completed, a starting period and a finishing period. If the person has completed a task within the first three days, he will receive a reward at day four. On each day  $t = 1, 2, 3$  the person can take *one* of the following three actions: working on task  $A$ , working on task  $B$ , or not working. Not working costs zero. The immediate costs for working on a project  $j \in \{A, B\}$  in period  $t = 1, 2, 3$ ,  $c_{jt}$ , and the delayed rewards,  $r_j$ , are given in the following table.

project	$c_{j1}$	$c_{j2}$	$c_{j3}$	$r_j$
$A$	4	22	45	40
$B$	8	4	15	25

It is assumed that people do not discount future utilities, i.e.  $\delta = 1$ . Furthermore, assume that when the person is a hyperbolic discounter his degree of present biasedness is  $\beta = 1/2$ .

- a) Calculate the behavior of a time-consistent person.
- b) Consider a sophisticated hyperbolic discounter. When does this person work and on which task?
- c) Calculate the behavior of a naive hyperbolic discounter.
- d) Compare the behavior of sophisticates and naifs. Give a brief intuitiv explanation for the different behavior of these two types of hyperbolic discounters.

**Exercise 3:** (*Final Exam Exercise 2007/1*) Consider the following simple three period addiction model. The three periods are “youth” , “middle age”, and “old age”. In each period the person decides whether or not to consume an addictive good. The person’s preferences in each of the three periods can be represented with the following instantaneous utilities:

	utility from hitting	utility from refraining
in youth when unhooked	14	0
in middle age when unhooked	10	0
in middle age when hooked	-8	-25
in old age when unhooked	-5	0
in old age when hooked	-23	-25

A person is hooked in period  $t$  when she has consumed the addictive good in period  $t-1$ . This implies that a single period of restraint gets a person completely unhooked. Furthermore, suppose the person is initially unhooked.

- a) Calculate the behavior of a time-consistent person for  $\delta = 1$ .
- b) Consider a naive hyperbolic discounter with  $\delta = 1$  and  $\beta = 1/2$ . When does this person choose hit?
- c) Consider a sophisticated hyperbolic discounter with  $\delta = 1$  and  $\beta = 1/2$ . When does this person choose hit?
- d) Compare the behavior of sophisticates and naifs and intuitively explain the different behavior of these two types of hyperbolic discounters. Are the results concerning the effects of awareness of self-control problems on the behavior of a hyperbolic discounter general results or due to the specific assumptions of this exercise?