



SF2735/MM8020 Homological algebra and algebraic topology

Homework assignment 3

- (1) (3pt) Let \mathcal{C} be the category of finite \mathbb{Z} -modules. Show that there are no projective modules in \mathcal{C} .
- (2) (4pt) Let $A = \mathbb{Q}[t]$ and let $M = \mathbb{Q}[x]$ be the module defined in problem 2 of the first homework assignment, i.e., $t^n f(x) = \frac{\partial^n}{\partial x^n} f(x)$, $n \geq 0$.
 - (a) Show that M is an injective A -module.
 - (b) Show that M contains no finitely generated submodule that is injective.
- (3) (3pt) Let $A = \mathbb{C}[x]/(x^n - 1)$ where $n > 1$ is an integer. Describe all principal A -modules, $M = A/J$, that are projective.

Discussing the homework problem with each other is admissible and even encouraged, but you have to formulate your solutions separately. Such collaboration should be clearly declared in the homework of all the participants. Identical or nearly identical solutions or solutions copied from sources on the internet are not acceptable.

The solutions should be submitted by email to Matthias Grey (mgrey@math.su.se) as pdf no later than **Tuesday September 19 at 3pm**.