

**MTH G375: TOPICS IN TOPOLOGY: OPERADS**  
**PROBLEM SET 3, DUE APRIL 15, 2004**

SASHA VORONOV

I encourage you to cooperate with each other on the homeworks. This time you may not turn in your homework late, as I will leave the morning April 16 for Minnesota for good!

**Problem 1.** Identify the cohomological complex for an algebra over the associative operad as the Hochschild complex, see your notes, Markl-Shnider-Stasheff, or Ginzburg-Kapranov (dualize 4.2). You may download GK's paper for free from <http://projecteuclid.org:80/Dienst/UI/1.0/Summarize/euclid.dmj/1077286744?abstract=> till March 31 only!

**Problem 2.** Identify the dg dual  $D(Ass)$  (see your notes or MSS or GK) with the planar tree complex.

**Problem 3.** Prove that the homology of the (nonframed) little (two-dim) disks operad is the operad describing G-algebras. A G-algebra is the same as a BV-algebra, but without the BV operator.

**Problem 4** (Essay). In which sense does the free loop space  $LM$  of a manifold constitute a TCFT in genus zero?

**Problem 5** (After Givental. Perhaps, related to mirror symmetry). Why do we see ourselves in the mirror with left changed to right, but not upside down?