

Math 601 Spring 2008  
Homework 9

Due: Friday April 11 in Martin Kerin's mailbox.

A portion of the homework will be graded and returned to you.

- (1) Let  $F: S^n \rightarrow T^n$  be a continuous map. Show that  $f_*$  and  $f^*$  are 0 in positive degrees. How about  $F: T^n \rightarrow S^n$ ?
- (2) Consider the connected sum  $M \natural N$  of two compact orientable manifolds. Describe the cohomology groups and ring structure in terms of those of  $M$  and  $N$ .
- (3) Show that if a topological manifold is  $\mathbb{Z}$  orientable it is also  $\mathbb{Z}_p$  orientable. Show that the converse is true if  $p$  is a prime  $p \neq 2$ .
- (4) Show that  $H_c^i(X \times \mathbb{R}, G) = H_c^{i-1}(X, G)$  for all spaces  $X$ .
- (5) Let A be two unlinked circles in  $\mathbb{R}^3$  and B two simply linked circles (like circle in x-y plane containing the origin and z-axis closed up at infinity). Show that the complements have isomorphic cohomology groups but different ring structure.