

Question 1:

[Hatcher Ex 1 p. 155] Construct a surjective map $S^n \rightarrow S^n$ of degree zero, for each $n \geq 1$.

Question 2:

[Hatcher Ex 9 p. 156] Compute the homology of the following 2-complexes:

1. The quotient of S^2 obtained identifying north and south poles to a point.
2. The space obtained from D^2 by first deleting the interiors of two disjoint subdisks in the interior of D^2 and then identifying all three resulting boundary circles together via homeomorphisms preserving clockwise orientations of these circles.

Question 3:

[Hatcher Ex 12 p. 156] Show that the quotient map $S^1 \times S^1 \rightarrow S^2$ obtained by collapsing the subspace $S^1 \vee S^1$ to a point is not null homotopic (i.e. homotopic to a constant map) by showing that it induces an isomorphism on H_2 .

Bonus: On the other hand, show via covering spaces that any map $S^2 \rightarrow S^1 \times S^1$ is nullhomotopic.