Math 8302 **Homework 1** **PJW**

Date due: Monday February 4, 2002

1. 5.14 on page 100 of Rotman.
2. 5.15 on page 100 of Rotman.
3. Show that $H_1(D^2, S^1) = 0$, and calculate $H_2(D^2, S^1)$. (This is an augmented version of 5.20 on page 104.)
4. 5.21 on page 104 of Rotman.
5. Suppose that X is a simplicial complex which is a union of simplicial complexes $X = A \cup D$ where $D \cong D^2$ and $D \cap A \cong S^1$. (Thus A is X with a hole removed.)
   (i) Show that $H_n(X) \cong H_n(A)$ when $n \geq 3$.
   (ii) Suppose that the inclusion map $A \cap D \hookrightarrow A$ is homotopic to a constant map. Show that $H_2(X) \cong H_2(A) \oplus \mathbb{Z}$ and that $H_1(X) \cong H_1(A)$.
   (iii) Suppose that $\pi_1(A)$ is abelian and that the inclusion map $A \cap D \hookrightarrow A$ is not homotopic to a constant map. Show that $H_2(X) \cong H_2(A)$.