1. Let $X$ be the CW complex obtained by attaching a 2-cell to $S^1$ along a map of degree 2. Let $Y = X$. Prove that the map (called the cross product in Hatcher, page 214)

$$H^*(X; \mathbb{Z}) \otimes H^*(Y; \mathbb{Z}) \to H^*(X \times Y; \mathbb{Z})$$

is not an isomorphism. (This shows that the freeness hypothesis in Theorem 3.15 is essential.)