Problem 1 (2.2.35)**.** *Use the Mayer-Vietoris sequence to show that a nonorientable closed surface, or more generally a finite simplicial complex X for which $H_1(X)$ contains torsion, cannot be embedded as a subspace of $\mathbb{R}^3$ in such a way as to have a neighborhood homeomorphic to the mapping cylinder of some map from a closed orientable surface to X. [This assumption on a neighborhood is in fact not needed if one deduces the result from Alexander duality in 3.3]*

Proof. $\square$

Problem 2 (2.2.38)**.** *Show that the commutative diagram*

$$\begin{tikzcd}
\cdots \arrow[r] & C_{n+1} \arrow[dd] \arrow[dr] & & B_n \arrow[r] \arrow[dd] & C_n \arrow[dd] \arrow[dr] & & B_{n-1} \arrow[r] & \cdots \\
& & A_n \arrow[ur] \arrow[dr] & & & A_{n-1} \arrow[ur] \arrow[dr] & & \\
\cdots \arrow[r] & E_{n+1} \arrow[ur] & & D_n \arrow[r] & E_n \arrow[ur] & & D_{n-1} \arrow[r] & \cdots
\end{tikzcd}$$

with the two sequences across the top and bottom exact, gives rise to an exact sequence

$$\cdots \to E_{n+1} \to B_n \to C_n \oplus D_n \to E_n \to B_{n-1} \to \cdots$$

where the maps are obtained from those in the previous diagram in the obvious way, except that $B_n \to C_n \oplus D_n$ has a minus sign in one coordinate.

Proof. $\square$

Problem 3 (2.B.1)**.** *Compute $H_i(S^n \setminus X)$ when X is he subspace of S^n homeomorphic to $S^k \vee S^\ell$ or to $S^k \coprod S^\ell$.*

Proof. $\square$