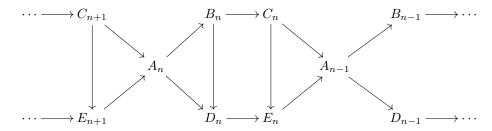
**Problem 1** (2.2.35). Use the Mayer-Vietoris sequence to show that a nonorientable closed surface, or more generally a finite simplicial complex X for which  $H_1(X)$  contains torsion, cannot be embedded as a subspace of  $\mathbb{R}^3$  in such a way as to have a neighborhood homeomorphic to the 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]

 $\square$ 

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



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.

**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  $S^k \mid \mid S^\ell$ .

Proof.