(3) Compute the homology of the following complex.

$$\cdots \to 0 \to \mathbb{Z} \oplus \mathbb{Z} \to \mathbb{Z} \oplus \mathbb{Z} \oplus \mathbb{Z} \to \mathbb{Z} \to 0$$

The left most nontrivial group is C_2. That group is is generated by U and L, C_1 is generated by a, b, c. Define $\partial_1(a) = \partial_1(b) = \partial_1(c) = 0$ and $\partial_2(U) = \partial_2(L) = a + b - c$.

(4) Compute the homology of the following complex.

$$\cdots \to 0 \to \mathbb{Z} \oplus \mathbb{Z} \to \mathbb{Z} \oplus \mathbb{Z} \oplus \mathbb{Z} \to \mathbb{Z} \oplus \mathbb{Z} \to 0$$

The left most nontrivial group is C_2. That group is generated by U and L, C_1 is generated by a, b, c, C_0 is generated by v and w. Define $\partial_1(a) = \partial_1(b) = w - v$, $\partial_1(c) = 0$ $\partial_2(U) = -a + b + c$, and $\partial_2(L) = a - b + c$.

(5) In an arbitrary exact sequence

$$A \xrightarrow{f} B \xrightarrow{g} C \xrightarrow{h} D$$

of homomorphisms of Abelian groups, show the following are equivalent

(a) f is an epimorphism.
(b) g is the trivial homomorphism.
(c) h is a monomorphism.

(6) In an arbitrary exact sequence

$$A \xrightarrow{f} B \xrightarrow{g} C \xrightarrow{h} D \xrightarrow{k} E$$

of homomorphisms of Abelian groups show $C = 0$ if and only if f is an epimorphism and k is a monomorphism.