HOMOLOGICAL ALGEBRA
HOMEWORK ASSIGNMENT I

Read pages 1-5, 417-424.

PROBLEMS

1. **(Chriestenson, Gern, Harper) Exercise 1.1.6 of Weibel.**

2. **(Hower, Jones) Exercise A.1.3 of Weibel. (Change the word "isomorphic" to "equivalent".)**

3. **(Keller, Li) First part of exercise A.1.4 of Weibel. (Be sure to check naturality.)**

4. **(Lizzi, Martinez) Let $\mathcal{C}$ be the full subcategory of Ab consisting of divisible groups. Show that the natural map $\mathbb{Q} \to \mathbb{Q}/\mathbb{Z}$ is a monic that is not 1-1.**

5. **(Strider, Moore, Moorhead) Let G and H be groups considered as 1-object categories.**

(a) **Show that functors between G and H correspond to group homomorphisms.**

(b) **For which pairs of functors $E, F\colon G \to H$ do there exist natural transformations $\eta\colon E \to F$?**

6. **(Pratarelli, Sanders) Let $\mathcal{C}$ be the subcategory of Sets containing all objects but only the identity morphisms. Let $F = G$ be the inclusion functor of $\mathcal{C}$ into Sets. Show that Nat(F, G) is not a set.**

7. **(Scherer, Selker, Tuley) Let O be the ordered pair functor from Sets to itself ($O(X) = X^2$, $O(f) = f \times f$). Let U be the unordered pair functor from Sets to itself. ($U(X) = \{\{x, y\} \mid x, y \in X\}, U(f)(\{x, y\}) = \{f(x), f(y)\}$. We allow $x = y$.) Find all natural transformations from O to U.**

8. **(Wakefield, Wiscons) Show that every small category can be embedded into the category of sets. (Hint: Use a functor that maps an object A to the set of morphisms with codomain A.)**