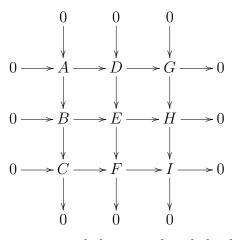# Math 8062 Homework 7

Due Wednesday, 4/11/18

1. Page 53, problem 9 (easier using homology!).

2. Page 133, problem 27.

3. Page 133, problem 29.

4. Consider the following commutative diagram of Abelian groups:

$$
\begin{array}{ccccccccc}
 & & 0 & & 0 & & 0 & & \\
 & & \downarrow & & \downarrow & & \downarrow & & \\
0 & \longrightarrow & A & \longrightarrow & D & \longrightarrow & G & \longrightarrow & 0 \\
 & & \downarrow & & \downarrow & & \downarrow & & \\
0 & \longrightarrow & B & \longrightarrow & E & \longrightarrow & H & \longrightarrow & 0 \\
 & & \downarrow & & \downarrow & & \downarrow & & \\
0 & \longrightarrow & C & \longrightarrow & F & \longrightarrow & I & \longrightarrow & 0 \\
 & & \downarrow & & \downarrow & & \downarrow & & \\
 & & 0 & & 0 & & 0 & &
\end{array}
$$

Prove that if all the rows are exact, and the second and third columns are exact, then the first column is also exact. *Note:* When describing a diagram chase, it is helpful to give "walking directions." For instance: given an element $e \in E$, chase down, then to the right, then up...