1. Log in to your Sage/Cocalc account.
   
   (a) Start Chrome browser.
   (b) Go to http://cocalc.com
   (c) Click “Sign In”.
   (d) Click project Math 401.
   (e) Click “New”, call it s05, then click “Sage Worksheet”.

Write Sage’s responses.

2. First construct the group $\mathbb{Z}_5$. Evaluate: $\mathbb{Z}_5 = \text{Integers}(5)$.

3. Now list the elements of $\mathbb{Z}_5$. Evaluate: $\mathbb{Z}_5 \text{.list()}$.

4. Evaluate: $a = \mathbb{Z}_5(3)$ to define an element $a$ which is the “3” in $\mathbb{Z}_5$.

5. To check what algebraic structure Sage thinks $a$ belongs to, evaluate: $a \text{.parent()}$.

6. To test $a$ for membership in $\mathbb{Z}_5$, evaluate: $a \text{ in } \mathbb{Z}_5$.

7. To get the Cayley table for addition in $\mathbb{Z}_5$, evaluate: $\mathbb{Z}_5 \text{.addition_table(names="elements")}$

8. We know that $\mathbb{Z}_5$ is actually a partition of the integers. So every integer is in one of these partitions. Which partition is $-1$ in? Evaluate: $\mathbb{Z}_5(-1)$ to get the canonical equivalence class representative (the remainder from the Division Algorithm).
9. Find the canonical equivalence class representative for 123 in $\mathbb{Z}_5$. What command will you use?

10. You can also get the multiplication table for $\mathbb{Z}_5$.
    Evaluate: $\mathbb{Z}_5$.multiplication_table(names="elements"). Can you tell from the table whether every element of $\mathbb{Z}_5$ has a multiplicative inverse?

11. Is $\mathbb{Z}_5$ a field? Evaluate: $\mathbb{Z}_5$.is_field()

12. Define the additive group $\mathbb{Z}_4$ of integers mod 4 in Sage. What command will you use?

13. Find the canonical representative for 123 in $\mathbb{Z}_4$.

14. Find the multiplication table for $\mathbb{Z}_4$.

15. Is $\mathbb{Z}_4$ a field? What command will you evaluate to check?