Lab #2

MAT 305

Spring 2016

1. Create a new worksheet. Set the title to, "Lab #2". (You can change the title using the button with an "i" in a circle.) Add other information to identify you, as necessary.

Reread the Section on "Algebra" in Lecture 2, "Introduction to Sage."

2. Create a section labeled, "Modular arithmetic: demonstration," then:

   (a) Define a ring R to be $\mathbb{Z}_{10}$, the finite ring of 10 elements.
   (*Hint:* The revised notes show a simpler way to do this than the in-class demonstration.)

   (b) Define m to be the value of 2 in R, and compute $1 \times m$, $2 \times m$, $3 \times m$, …, $10 \times m$.
   (*Hint:* If your answer to the last product is 20, you're doing it wrong. You have to convert 2 to a value of the ring R. The notes show how to do that.)

   (c) Define n to be the value of 3 in R, and compute $1 \times n$, $2 \times n$, $3 \times n$, …, $10 \times n$.

   (d) Define r to be the value of 5 in R, and compute $1 \times r$, $2 \times r$, $3 \times r$, …, $10 \times r$.

   (e) Define s to be the value of 7 in R, and compute $1 \times s$, $2 \times s$, $3 \times s$, …, $10 \times s$.

   (f) Define t to be the value of 9 in R, and compute $1 \times t$, $2 \times t$, $3 \times t$, …, $10 \times t$.

3. For the following, write your answer into a *text* box at the end of the worksheet. The top of the textbox should have the heading, "Modular arithmetic: analysis."

   (a) Notice that $10 \times 2 = 10 \times 3 = \cdots = 10 \times 9$ in this ring. Why does that make sense? (Your answer should address what I said in class about arithmetic in $\mathbb{Z}_n$, illustrated on slide 44 with $\mathbb{Z}_7$.)

   (b) Which of m, n, r, s, t lists *all* the numbers from 0 to 9?

   (c) What property do the numbers you listed in (b) share that the other numbers do not?