

GAMES COURSE

HOMEWORK 1

1. Create an addition table mod 7.
2. For each $x \in \{0, 1, 2, 3, 4, 5, 6\}$ say if there is a y such that $x + y \equiv 0 \pmod{7}$. If so, what is that y . (such a y is called the “additive identity of x ”)
3. Create a multiplication table mod 7.
4. For each $x \in \{0, 1, 2, 3, 4, 5, 6\}$ say if there is a y such that $xy \equiv 1 \pmod{7}$. If so, what is that y . (such a y is called the “multiplicative identity of x ”)
5. Do questions 1, 2,3,4 for mod 8.
6. For each of the following equations either solve it or show it can't be solved. If it can be solved then give **all** solutions. Note that x must be an integer.
 - (a) $3x+1 \equiv 0 \pmod{5}$
 - (b) $2x+5 \equiv 6 \pmod{8}$
 - (c) $4x-1 \equiv 2 \pmod{7}$
 - (d) $xy \equiv 0 \pmod{10}$
7. For each of the following NIM games do the following: Fill in the following sentence: Player I wins iff n has property XXX, and
 - (a) (1, 3, 4)-NIM
 - (b) (1, 3, 5)-NIM
 - (c) (1, 3, 6)-NIM
 - (d) (1, 3, 7)-NIM
 - (e) (1, 3, k)-NIM
8. I have forgotten the combination to my suitcase lock. It has 3 digits, and each is 0-9. How many numbers might I have to try before I find the right one? What if I know that no number is reused?
9. EXTRA CREDIT: Find a quadratic equation of the form ax^2+bx+c which has MORE THAN 2 roots if interpreted mod 12. Make sure that $a, b, c \in \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$.