

Discrete Mathematics, 2016 Fall - Worksheet 19

November 28, 2016

Instructor: Zsolt Pajor-Gyulai, CIMS

In all of the above problems explain your answer in full English sentences.

1. In the context of \mathbb{Z}_{10} , calculate

(a) $3 \oplus 3$

(b) $7 \otimes 3$

2. In the context of \mathbb{Z}_{12} , calculate

(a) $9 \oplus 8$

(b) $11 \otimes 5$

3. In the context of \mathbb{Z}_9 , calculate

(a) $5 \ominus 8$

(b) $8 \ominus 5$

4. In the context of \mathbb{Z}_{10} , calculate

(a) $8 \oslash 7$

(b) $5 \oslash 9$

5. In \mathbb{Z}_{431} , find 29^{-1} .

6. Solve

(a) $4 \otimes (x \ominus 8) = 9$ in \mathbb{Z}_{11} .

(b) $2 \otimes x = 3$ in \mathbb{Z}_{10} .

7. Find all solutions of

(a) $3x \equiv 17 \pmod{20}$

(b) $2x \equiv 12 \pmod{15}$

Optional programming exercise:

Write a modular arithmetic calculator, i.e. functions `oplus(a,b,n)`, `ominus(a,b,n)`, `otimes(a,b,n)`, `odivide(a,b,n)` that implement the operations in \mathbb{Z}_n we learned about today.