# MATH 195: CRYPTOGRAPHY
# HOMEWORK #3

**Problem 7.8**. *Recall* $\phi(n) = \#(\mathbb{Z}/n\mathbb{Z})^*$. *Give a concise reason why* $\phi(n)$ *is even for* $n > 2$.

**Problem 7.9(a)**. *Determine* $\gcd(24140, 16762)$.

**Problem 7.9(b)**. *Determine* $\gcd(4655, 12075)$.

**Problem 7.9(c)**. *Compute* $367^{-1}$ *in* $(\mathbb{Z}/1001\mathbb{Z})^*$ *and* $1001^{-1}$ *in* $(\mathbb{Z}/367\mathbb{Z})^*$.

**Problem 2.11**. *For which* $n$ *is the matrix*

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{pmatrix}$$

*invertible over* $\mathbb{Z}/n\mathbb{Z}$? *Find its inverse if* $n = 100$.

**Problem 2.12**. *Exhibit an algorithm that given a prime number* $n$ *and a* $k \times k$ *matrix* $M$ *over* $\mathbb{Z}/n\mathbb{Z}$, *computes* $\det M$ *using no more than* $k^3$ *arithmetic operations* $(+, -, \cdot, ^{-1})$ *in* $\mathbb{Z}/n\mathbb{Z}$, *of which no more than* $k$ *are inversions* $(^{-1})$.

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7.8, 7.9(a)(b)(c), 2.11, 2.12.