Final Exam   **Number Theory**   **27–05–2018**

1. Solve the linear congruence.

$$40x \equiv 56 \pmod{96}$$

2. Solve the power congruence.

$$x^9 \equiv 3 \pmod{23}$$

3. Solve the discrete logarithm congruence.

$$3^x \equiv -2 \pmod{11}$$

4. Prove that if g is a primitive root mod a prime $p > 2$, then

$$g^{\frac{p-1}{2}} \equiv -1 \pmod{p}$$

5. Evaluate the Legendre symbol.
$$\left(\frac{-56}{97}\right)$$

6. Determine there is solution or no solution using Legendre symbol.

$$6x^2 + x + 1 \equiv 0 \pmod{17}$$

7. Solve the quadratic congruence using the Chinese remainder theorem.

$$x^2 \equiv 23 \pmod{77}$$

8. Prove that if a prime $p \ \% \ 8 = 3$, then

$$\left(\frac{-2}{p}\right) = +1$$

–Amin Witno