

# MATH 340 Assignment 7, Fall 2007

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This assignment is due Wednesday November 21st at the beginning of class. For problems requiring Maple please submit a printout of a Maple worksheet. Late penalty:  $-20\%$  for up to 24 hours late. Zero after that.

## Section 2.8: Multiplicative Structure of Finite Fields

Exercises 1(ii), 5.

State and prove Fermat's Theorem for  $GF(q)$ .

## Section 2.9: Primitive Elements

Exercises 4, 6.

Use Maple for exercise 6. Check that your answer agrees with exercise 4.

Also, find the smallest primitive element in  $\mathbb{Z}_{31}$ . Using 4(i), determine the other primitive elements in  $\mathbb{Z}_{31}$ . Use Maple on this question as needed.

## Section 2.10: Subfield Structure of Finite Fields

Exercises 2, 4.

Also, exercise 12 from section 2.7.

## Section 2.11: Minimal Polynomials

Exercises 3, 4, 6.

Do 4 by hand and 6 using Maple. Also, find the minimal polynomial  $m_\alpha(x) \in \mathbb{Q}[x]$  for  $\alpha = \sqrt{2} + \sqrt{3}$  using linear algebra, i.e. setting up a linear system over  $\mathbb{Q}$  to solve. You are given that  $\deg(m) = 4$ . Use Maple to solve the linear system if you wish.