

# Mathematics for Computer Science

## Home Work3

week: Aug 12, 2011

Tutorial Discussion Week: Aug 19, 2011

Tutorial Submission Deadline: Aug 23, 2011

1.
  - (a) Convert the decimal number 136 into the following number systems.
    - i. *Binary*
    - ii. *Octal*
    - iii. *Hexadecimal*
  - (b) Convert the binary number 10010101 into the following number system and find  $n'$ 's complement in each number system including binary number system ( $n=2$ ). Where  $n$  is base of the number system.
    - i. *Decimal* ( $n = 10$ )
    - ii. *Octal* ( $n = 8$ )
    - iii. *Hexadecimal* ( $n = 16$ )

2. Consider the following matrices.

$$A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & 0 & 5 \end{bmatrix}, B = \begin{bmatrix} 7 & 0 \\ 0 & 5 \\ 1 & 0 \end{bmatrix}$$

Find

- (a)  $A + B^T$
  - (b)  $A^T - B$
  - (c)  $AB$
  - (d)  $A \odot B$
  - (e)  $(AB)^{-1}$
3. Construct a  $GF(8)$  field with a function  $1 + x + x^3 = 0$ .
4.
  - (a) Encrypt *howareyou* using affine function  $5x + 7 \pmod{26}$ . What is the decryption function? Check that it works with example.
  - (b) Solve the following congruence for  $x$ .
    - i.  $4x \equiv 5 \pmod{9}$
    - ii.  $2x \equiv 7 \pmod{17}$

5. Books are identified by an **International Standard Book Number (ISBN)**, a 10 digit code  $x_1x_2 \dots x_{10}$ . The last digit ( $x_{10}$ ) is check digit and is selected so that

$$\sum_{i=1}^{10} ix_i \equiv 0 \pmod{11}$$

- (a) The first nine digits of the **ISBN** of the third edition of this book are 0 – 07 – 053965. What is the check digit for this book?
- (b) The **ISBN** of *Elementary Number Theory and Its Applications*, 3rd ed., is 0 – 201 – 57Q89 – 1, where  $Q$  is a digit. Find the value of  $Q$
- (c) Determine whether the check digit of the **ISBN** for *Discrete Mathematics and Its Applications* by *Kenneth H. Rosen* was computed correctly by the publisher.