

Q1) Show that Ring  $Z_{29}$  of integers modulo 29 is an Integral Domain Where Ring  $Z_{105}$  of integers modulo 105 is not an Integral Domain.

Q2) Which of these rings are commutative? Which are rings with unity? For the rings with unity, determine the unity (multiplicative identity) and all units (units means multiplicative inverse).

(a)  $[Z, +, \cdot]$

(b)  $[C, +, \cdot]$

(c)  $[M_{N \times N}(R), +, \cdot]$

(d)  $[Q, +, \cdot]$

Q3) If the error-detecting code is being used, how would you act on the following received blocks? The error code is given by  $(a, b, c, s)$  where  $s$  should be such that the sum of all four modulo 2 is zero.

(a)  $(1, 0, 1, 1)$

(b)  $(1, 1, 1, 1)$

(c)  $(0, 0, 0, 0)$

Q4) Find the Hamming distance between the codes.

(a)  $x = 010000, y = 000101$  (b)  $x = 001100, y = 010110$

Q5) Let  $d: B^6 \rightarrow B^2$  be a decoding function defined by for

$y = y_1 y_2 \dots y_6$ . Then  $d(y) = z_1 z_2$ .

where

$z_i = 1$  if  $y_1 y_{i+2} y_{i+4}$  has at least two 1's.

$= 0$  if  $y_1 y_{i+2} y_{i+4}$  has less than two 1's.

Determine  $d(y)$  for the word  $y$  in  $B^6$ .

i)  $y = 111011$

ii)  $y = 010100$