Branch : CSE & IT Batch : Hinglish

WEEKLY TEST – 04
Subject : Computer Networks

Maximum Marks 12

Q.1 to 4 Carry ONE Mark Each

[MCQ]

1. Consider generator polynomial function G(x) is $X^3 + 1$, the data stream at sender end is **10110101110101**, then calculate CRC?

(a) 100 (b) 110
(c) 101 (d) 010

[MSQ]

2. Which of the following is/are true property of the CRC generator?

(a) CRC generator should have at least two terms.
(b) The coefficient of the term x^0 should be 1.
(c) CRC generator should not divide $x^t + 1$, for t between 2 and n–1.
(d) CRC generator should have the factor $x + 1$

[NAT]

3. Consider hamming code (Single bit error detection and correction technique), the minimum parity bits needed for 90 data bits is _____.

[NAT]

4. A bit stream 1101100010100 is transmitted from the sender side and the transmission uses CRC method for error control in data link layer. If the generator polynomial is $x^3 + x^2 + 1$. What will be the actual bit string transmitted [in decimal]?

Q.5 to 8 Carry TWO Mark Each

[MSQ]

5. Dataword = d(x)
Codeword = c(x)
Generator = g(x)
Syndrome = s(x)
Error = e(x)
Which of the following statement is/are true

(a) if (x) ≠ 0 then code word is rejected and CRC scheme is working find
(b) CRC is Not perfect scheme if e(x) is divisible by g(x) then that error can't be detected.
(c) if S(x) =0 and e(x) ≠ 0 [e(x) is divisible by g(x)] then code wore accepted and CRC scheme failed to detect error.
(d) If s(x) = 0 and e(x) =0 then code word is accepted & CRC scheme is working find

[NAT]

6. Consider a hamming codeword consisting of 12 bits . In which 8 are data bits and 4 are parity check bits. If receiver receives the 12 bits hamming codeword as 011100101110 then calculate the bit number which got corrupted to noise [Note: start counting the bit stream MSB to LSB as 1–12]

[MCQ]

7. Given are
$d(x) = x^9 + x^7 + x^3 + x^2 + 1$
$g(x) = x^5 + x^4 + x^2 + 1$
Determine message to send c(x) = ?

(a) 101000110101110
(b) 101000110101101
(c) 101000110100111
(d) 101000110111100

[NAT]

8. Consider a code with only four valid code works 0000 000000,0000011111, 1111100000, 1111111111 assume minimum hamming distance of a code is 'x' and maximum hamming distance of a code is 'y' and maximum No. of erroneous bits that can be detected by code is z and maximum No of erroneous bit that can be corrected by the code is w, then value of x +z+w –y___.

Answer Key

1. **(d)**
2. **(a,b,c,d)**
3. **(7)**
4. **(55461)**
5. **(a,b,c,d)**
6. **(5)**
7. **(a)**
8. **(1)**

Hints and Solutions

1. (d)

$G(x) = x^3 + 1$

$1.x^3 + 0.x^2 + 0.x^1 + 1x^0$

1001

Sender

$$
\begin{array}{r|l}
1001 & 10110101110101000 \\
 & \underline{1001} \\
 & 00100101110101000 \\
 & \underline{1001} \\
 & 000001110101000 \\
 & \underline{1001} \\
 & 0111101000 \\
 & \underline{1001} \\
 & 011001000 \\
 & \underline{1001} \\
 & 01011000 \\
 & \underline{1001} \\
 & 0010000 \\
 & \underline{1001} \\
 & 00010
\end{array}
$$

2. (a,b,c,d)

3. (7)

$\boxed{m + r + 1 \le 2^r}$ $m = 90$

$r = 6 \Rightarrow 90 + 6 + 1 \le 2^6$, $97 \le 64$ (no)

$r = 7 \Rightarrow 90 + 7 + 1 \le 2^7$ $98 \le 128$ (yes)

4. $(55461)_{10}$

Generator $= x^3 + x^2 + 1$

$= 1.x^3 + 1.x^2 + 0.x^1 + 1.x^0$

$= 1101$

$$
\begin{array}{r|l}
1101 & 1101100010100000 \\
 & \underline{1101} \\
 & 0000100010100000 \\
 & \quad\underline{1101} \\
 & 0101101000000 \\
 & \underline{1101} \\
 & 0110010000 0 \\
 & \underline{1101} \\
 & 0001100000 \\
 & \quad\underline{1101} \\
 & 0001000 \\
 & \quad\underline{1101} \\
 & 0\boxed{101}
\end{array}
$$

CRC Remainder

Transmitted data $= (1101100010100101)_2$

$= (55461)_{10}$

5. (a,b,c,d)

Recived code word = c(x) +e(x)

$$\frac{\text{Received codeword}}{g(x)} = \frac{c(x)}{g(x)} + \frac{e(x)}{g(x)} = 0$$

$\frac{c(x)}{g(x)} = 0$ $\boxed{\text{According to CRC defination}}$

6. (7)

Odd Parity is preferable over even parity

P_1	P_2	3	P_4	5	6	7	P_8	9	10	11	12
0	1	1	1	0	0	1	0	1	1	1	0

P_1

1, 3, 5, 7, 9, 11

0, 1, 0, 1, 1, 1→ (even) (False) (P_1 =1)

P_2

2, 3, 6, 7, 10, 11

1, 1, 0, 1, 1, 1→ (Odd) (True) (P_2 =1)

P_4

4, 5, 6, 7, 12

1, 0, 0, 1, 0 → (even) (False) (P_4 =1)

P_8

8, 9, 10, 11, 12

0, 1, 1, 1, 0 → (Odd) (True) (P_8 =1)

P_8	P_4	P_2	P_8
0	1	0	1

⇓

d.value = 5th bit gor corrupted

7. (a)

$d(x) = x^9 + x^7 + x^3 + x^2 + 1 = 1\cdot x^9 + 0\cdot x^8 + 1\cdot x^7 + 0\cdot x^6 + 0\cdot x^5 + 0\cdot x^4 + 1\cdot x^3 + 1\cdot x^2 + 0\cdot x^1 + 1\cdot x^0$

$g(x) = x^5 + x^4 + x^2 + 1 \Rightarrow 1\cdot x^5 + 1\cdot x^4 + 0\cdot x^3 + 1\cdot x^2 + 0\cdot x^1 + 1\cdot x^0 = 11010$

```
110101 ) 10100011010000 00
         110101
         ------
         01110111010000 00
           110101
           ------
           00111010100000 0
             110101
             ------
             00111110000 00
               110101
               ------
               00101100000
                 110101
                 ------
                 01100100
                   110101
                   ------
                   00 01110
```

Remainder CRC

Code word = 101000110101110

Code word = 101000110100000

+ 01110

101000110101110

8. (a)

d (a, b) = 5

d (a, c) = 5

d (a, d) = 10

d (b, c) = 10

d (b, d) = 5

d (c, d) = 5

Minimum hamming distance = 5 (x)

Maixiumum hamming distance = 10(y)

d + 1 = 5

d = 4(z)

2d + 1 = 5

2d = 4

d = 2(w)

x + z + w – y = 5 + 4 + 2 – 10 = 1