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| **KING SAUD UNIVERSITY**  **COLLEGE OF COMPUTER AND INFORMATION SCIENCES**  **COMPUTER SCIENCE DEPARTMENT** | | | |
| **CSC 329: Computer Network** | **Tutorial 4** | | **1st Semester 1437-1438** |
| **Name:** | | **Student ID:** | |
| **Serial Number:** | | **Section Number:** | |

**Part1: Multiple-Choice Questions**

**1) Which error detection method consists of just one redundant bit per data unit?**

a. Simple parity check

b. Two-dimensional parity check

c. CRC

d. Checksum

**2) Which error detection method consists of a parity bit for each data unit as well as an entire data unit of parity bits?**

a. Simple parity check

b. Two-dimensional parity check

c. CRC

d. Checksum

**3) The Hamming code is a method of \_\_\_\_\_\_\_**

a. Error detection

b. Error correction

c. Error encapsulation

d. (a)and(b)

**4) Which error detection method involves the use of parity bits?**

a. Simple parity check

b. Two-dimensional parity check

c.CRC

d. (a) and (b)

**5) If the ASCII character c is sent and the character g is received, what type of error is this? The ASCII code for c= 110 0011, g= 1100111**

a. Single-bit

b. Multiple-bit

c. Burst error

d. Recoverable

**6) Which error detection method can detect a burst error?**

a. simple parity check

b. Two-dimensional parity check

c. (b) and (c)

d. None of the above

**7) In \_\_\_\_\_ coding, we divide our message into blocks, each of k bits, called \_\_\_.**

1. block; blockwords
2. linear; datawords
3. block; datawords
4. none of the above

**8) A receiver receives the code 11001100111. When it uses the Hamming encoding algorithm, the result is 0101. Which bit is in error?**

a. 1

b. 3

c. 5

d. none of the above

**Part2: Exercises**

1) assuming odd parity, find the parity bits for the following data units.

**a.0101110**

**b.1000100**

**c.1100111**

2) A receiver receives the bit pattern **01001001** if the system is using even parity, is the pattern in error?

3) Find the parity bits for the following bit pattern, using two-dimensional parity. Assume even parity.

**1010101 1110101 0110101 1010100**

4) The following block is received by a system using two-dimensional even parity. Is there any error in the block?

**10110101 01001101 11010010 11001111**

5) For each data unit of the following sizes, find the minimum number of redundancy bits needed to correct one single-bit error

1. **8**
2. **30**

6) Hamming code is a technique that is used to achieve forward error control. This allows a receiver to correct any single error, if any, in the received message. If the transmitted character is **01001010**, generate the Hamming codeword.

1. **Calculate the number of redundant bits**
2. **Implementing the Hamming codeword**

7) Assume that the **received** Hamming codeword is:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |

Deduce the original data word from the above codeword after correction if any error.

8) implement the Haming codeword for 1011.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| d7 | d6 | d5 | p4 | d3 | p2 | p1 |
| 1 | 0 | 1 |  | 1 |  |  |

Determine p1, p2 and p3.

P1 = p1 d3 p5 d7

= 1 => 1 1 1

P2 = p2 d3 d6 d7

= 0 = >1 0 1

P4 = p4 d5 d6 d7

1. =>1 0 1 p4 is 0 cause number of 1’s are even.. ( even parity bit )

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| d7 | d6 | d5 | p4 | d3 | p2 | p1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 |

So receiver will send 1010101 in channel to the transmitter.

**9)**

**If the 7 bit haming code word received is 1011011 assuming the even parity state whether the received code word is correct or wrong. If worng locate the bit having error.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| d7 | d6 | d5 | p4 | d3 | p2 | p1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 |

Solution :

P4 = p4 d5 d6 d7

= 1 => 1 0 1 p4 is 1

P2 = p2 d3 d6 d7

= 0 = >0 0 1 p2 = 0

P1 = p1 d3 p5 d7

= 1=> 011

P1 = 1.

P4 p2 p1 = 101 = 5..

Error at 5th bit.

Corrected answer after changing the 5th bit will be : 1001011