

Computer Science

1. (10 pts.) The following 8 bits 10101011, are to be sent over a channel along with the cyclic redundancy checks (CRC). If the codeword has $n = 11$ bits and the divisor is 1011, how many CRC bits will need to be added to the 8 bit message? Show the computing of the CRC.

2. (10 pts.) Given a 7-bit Hamming codeword 1110111 with odd parity, extract the data bits, determine bit error if any, and if so, correct it. Show your calculation.

3. (4 pts.) Convert the following hexadecimal numbers to decimal. a. $F00_{16}$ b. 1010_{16} c. 10_{16} d. 123.45_{16}

a. $F00_{16} = 111100000000_2 = 3840$

c. $10_{16} = 00010000_2 = 16$

b. $1010_{16} = 0001000000010000_2 = 4096$

d. $123.45_{16} = 000100100011.00100101 = 241.134375$

4. (4 pts.) Change the following decimal numbers to 8-bit two's complement integers. a. -128 b. -127 c. -1 d. 128

a. $-128 = 10000000$

b. $-127 = 01111111$

c. $-1 = 11111111$

d. $128 = 10000000$

5. (10 pts.) The bit pattern 01000011_11100000.00000000.00000000₂ is stored in memory in 32-bit IEEE format. What is the value of the number in decimal notation. Show your calculation. Hint: 32-bit IEEE format

exponent size is 8 bits

mantissa size is 23 bits

bias is 127

6. (20 pts.) Convert the following numbers in 32-bit IEEE format. Show your calculation.

a. -0.71875 b. 0.1

7. (4 pts.) We need to set (force to 1) the four leftmost bits of an 8-bit pattern. Show the mask and the operation.

mask 11110000
or 11110000
11110000

8. (4 pts.) What is the range of a 32-bit integer using the two's complement representation?

$+2^{31} \sim -2^{31}$

9. (4 pts.) Which of the following operation creates an overflow if numbers and the result are represented in 8-bit two's complement representation? a. $01111111_2 + 11111111_2$ b. $11111010_2 - 01111111_2$

a. $01111111 + 11111111 = 10111110$
b. $11111010 - 01111111 = 10111111$

10. (4 pts.) Write an UNIX command to execute a program named "dec2hex" and redirect the numbers in file named "data.csv" to be the input of the program "dec2hex".

`chmod`

11. (4 pts.) Write an UNIX command to move all files in the directory "/stu/opengl/" to your home directory.

`mv /stu/opengl/ /`

12. (4 pts.) Write an UNIX command to make all files in the directory "all" executable by owner.

`chmod u+x all`

13. (4 pts.) Write an UNIX command to rename a file named "tmp.cpp" in directory "/home/stu/" to "a.cpp".

`mv /home/stu/tmp.cpp a.cpp`

14. (4 pts.) Explain the function of the UNIX command `ls -al | grep 2022 > list.csv`

顯示 grep 2022 的結果 list.csv

15. (10 pts.) Prove the following two theorems: (1) $\overline{(x+y)} = \bar{x} \cdot \bar{y}$ (2) $\overline{(x \cdot y)} = \bar{x} + \bar{y}$.

(1)

x	y	$\overline{x+y}$	$\bar{x} \cdot \bar{y}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

(2)

x	y	$\overline{x \cdot y}$	$\bar{x} + \bar{y}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

16. (10 pts.) The full-adder has three inputs: an X bit, a Y bit, and C_1 bit. The result of the addition of these three bits produces two bits: a sum bit S, and a carry bit C_0 . Design a logic circuit that will perform the full-adder. Construct the truth table, the sum-of-products expression for the S and C_0 , and the circuit.