SALISBURY UNIVERSITY

COMPUTER SCIENCE DEPARTMENT

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Assignment 2

Student name: ........Jade Pearl........

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*Course: Microcomputer Organization (COSC 250) – Professor: Dr.Giulia Franchi*

1. What is the decimal equivalent of (1101011)2

1 x 26 + 1 x 25 + 0 x 24 + 1 x 23 + 0 x 22 + 1 x 21 + 1 x 20 = 64 + 32 + 8 + 2 + 1 = (107)10

1. What is the next binary number following 10111 in the counting sequence?

The next number in the sequence is 11000

1. What is the largest decimal value that can be represented using 12 bits?

The largest binary value using 12 bits is (111111111111)2. So this must be converted into decimal:

1 x 211 + 1 x 210 + 1 x 29 + 1 x 28 + 1 x 27 + 1 x 26 + 1 x 25 + 1 x 24 + 1 x 23 + 1 x 22 + 1 x 21 + 1 x 20 = 2048 + 1024 + 512 + 256 + 128 + 64 + 32 + 16 + 8 +4 + 2 + 1 = (4095)10

1. Which of the following are analog quantities and which are digital?

* number of atoms in a sample of material -- digital
* altitude of an aircraft -- analog
* pressure in a bicycle tire -- analog
* current through a speaker -- analog
* timer setting on a microwave oven -- digital
* width of a piece of lumber -- analog
* the amount of time before the over buzzer goes off -- analog
* the time of day displayed on a quartz watch -- digital
* altitude above sea level measured on a staircase -- digital
* altitude above sea level measured on a ramp -- analog

1. Convert the following binary numbers to their equivalent decimal values

* 11001

1 x 24 + 1 x 23 + 0 x 22 + 0x21 + 1 x 20 = 16 + 8 + 1 = (25)10

* 10011001

1 x 27 + 1 x 24 + 1 x 23 + 1 x 20 = 128 + 16 + 8 + 1 = (153)10

* 1001110101

1 x 29 + 1 x 26 + 1 x 25 + 1 x 24 + 1 x 22 + 1 x 20 = 512 + 64 + 32 + 16 + 4 + 1 = (629)10

* 10011

1 x 24 + 1 x 21 + 1 x 20 = 16 + 2 + 1 = (19)10

* 1111111

1 x 26 + 1 x 25 + 1 x 24 + 1 x 23 + 1 x 22 + 1 x 21 + 1 x 20 = 64 + 32 + 16 + 8 + 4 + 2 + 1 = (157)10

1. How many bits are needed to count up to a maximum of 511

To find the number of bits, you need to first convert to binary then count the number of binary digits present.

511/ 2 = 255 remainder 1

255/2 = 127 remainder 1

127/2 = 63 remainder 1

63/2 = 31 remainder 1

31/2 = 15 remainder 1

15/2 = 7 remainder 1

7/2 = 3 remainder 1

3/2 = 1 remainder 1

½ = 0 remainder 1

511 in binary is 111111111. There are 9 binary digits shown, so the number of bits needed is 9.

1. Convert the following decimal numbers to binary

* 566

566/2 = 283 remainder 0; 283/2 = 141 remainder 1; 141/2 = 70 remainder 1; 70/2 = 35 remainder 0; 35/2 = 17 remainder 1; 17/2 = 8 remainder 1; 8/2 = 4 remainder 0; 4/2 = 2 remainder 0; 2/2 = 1 remainder 0; ½ = 0 remainder 1

= 1000110110

* 114

114/2 = 57 remainder 0; 57/2 = 28 remainder 1; 28/2 = 14 remainder 0; 14/2 = 7 remainder 0; 7/2 = 3 remainder 1; 3/2 = 1 remainder 1; ½ = 0 remainder 1

= 1110010

* 19288

19288/2 = 9644 remainder 0; 9644/2 = 4822 remainder 0; 4822/2 = 2411 remainder 0; 2411/2 = 1205 remainder 1; 1205 = 602 remainder 1; 602/2 = 301 remainder 0; 301/2 = 150 remainder 1; 150/2 = 75 remainder 0; 75/2 = 37 remainder 1; 37/2 = 18 remainder 1; 18/2 = 9 remainder 0; 9/2 = 4 remainder 1; 4/2 = 2 remainder 0; 2/2 = 1 remainder 0; ½ = 0 remainder 1;

= 100101101011000

* 29373

29373/2 = 14686 remainder 1; 14686/2 = 7343 remainder 0; 7343/2 = 3671 remainder 1; 3671/2 = 1835 remainder 1; 1835/2 = 917 remainder 1; 917/2 = 458 remainder 1; 458/2 = 229 remainder 0; 229/2 = 114 remainder 1; 114/2 = 57 remainder 0; 57/2 = 28 remainder 1; 28/2 = 14 remainder 0; 14/2 = 7 remainder 0; 7/2 = 3 remainder 1; 3/2 = 1 remainder 1; ½ = 0 remainder 1

= 111001010111101

* 3333

3333/2 = 1666 remainder 1; 1666/2 = 833 remainder 0; 833/2 = 416 remainder 1; 416/2 = 208 remainder 0; 208/2 = 104 remainder 0; 104/2 = 52 remainder 0; 52/2 = 26 remainder 0; 26/2 = 13 remainder 0; 13/2 = 6 remainder 1; 6/2 = 3 remainder 0; 3/2 = 1 remainder 1; ½ = 0 remainder 1

= 110100000101

1. Convert the following decimal numbers to binary, octal and Hexadecimal numbers:

* 35

Binary: 35/2 = 17 remainder 1; 17/2 = 8 remainder 1; 8/2 = 4 remainder 0; 4/2 = 2 remainder 0; 2/2 = 1 remainder 0; ½ = 0 remainder 1

= 100011

Octal: 35/8 = 4 remainder 3; 4/8 = 0 remainder 4

= 43

Hexadecimal: 35/16 = 2 remainder 3; 2/16 = 0 remainder 2

= 23

* 67

Binary: 67/2 = 33 remainder 1; 33/2 = 16 remainder 1; 16/2 = 8 remainder 0; 8/2 = 4 remainder 0; 4/2 = 2 remainder 0; 2/2 = 1 remainder 0; ½ = 0 remainder 1;

= 1000011

Octal: 67/8 = 8 remainder 3; 8/8 = 1 remainder 0; 1/8 = 0 remainder 1;

= 103

Hexadecimal: 67/16 = 4 remainder 3; 4/16 = 0 remainder 4;

= 43

* 83

Binary: 83/2 = 41 remainder 1; 41/2 = 20 remainder 1; 20/2 = 10 remainder 0; 10/2 = 5 remainder 0; 5/2 = 2 remainder 1; 2/2 = 1 remainder 0; ½ = 0 remainder 1

= 1010011

Octal: 83/8 = 10 remainder 3; 10/8 = 1 remainder 2; 1/8 = 0 remainder 1;

= 123

Hexadecimal: 83/16 = 5 remainder 3; 5/16 = 0 remainder 5;

= 53

* 90

Binary: 90/2 = 45 remainder 0; 45/2 = 22 remainder 1; 22/2 = 11 remainder 0; 11/2 = 5 remainder 1; 5/2 = 2 remainder 1; 2/2 = 1 remainder 0; ½ = 0 remainder 1

= 1011010

Octal: 90/8 = 11 remainder 2; 11/8 = 1 remainder 3; 1/8 = 0 remainder 1;

= 132

Hexadecimal: 90/16 = 5 remainder 10 (A); 5/16 = 0 remainder 5

= 5A

* 45

Binary: 45/2 = 22 remainder 1; 22/2 = 11 remainder 0; 11/2 = 5 remainder 1; 5/2 = 2 remainder 1; 2/2 = 1 remainder 0; 1/2 = 0 remainder 1

= 101101

Octal: 45/8 = 5 remainder 5; 5/8 = 0 remainder 5

= 55

Hexadecimal: 45/16 = 2 remainder 13; 2/16 = 0 remainder 2;

= 2D

* 113

Binary: 113/2 = 56 remainder 1; 56/2 = 28 remainder 0; 28/2 = 14 remainder 0; 14/2 = 7 remainder 0; 7/2 = 3 remainder 1; 3/2 = 1 remainder 1; ½ = 0 remainder 1

= 1110001

Octal: 113/8 = 14 remainder 1; 14/8 = 1 remainder 6; 1/8 = 0 remainder 1;

=161

Hexadecimal: 113/16 = 7 remainder 1; 7/16 = 0 remainder 7

= 71

1. Convert the following binary numbers to decimal, octal and Hexadecimal numbers:

* 101101

Decimal = 45

Octal = 55

Hexadecimal = 2D

* 11111111

Decimal = 255

Octal = 377

Hexadecimal = FF

* 101010110

Decimal = 342

Octal = 526

Hexadecimal = 156

* 101

Decimal = 5

Octal = 5

Hexadecimal = 5

* 1111100

Decimal = 124

Octal = 174

Hexadecimal = 7C

* 1000011

Decimal = 67

Octal = 103

Hexadecimal = 43

* 10110011

Decimal = 179

Octal = 263

Hexadecimal = B3

1. Convert the following octal numbers to binary numbers:

* 73222254 = 111011010010010010101100
* 6444 = 110100100100
* 7222 = 111010010010

1. Convert the following hexadecimal numbers to binary numbers:

* ABC10 = 10101011110000010000
* FFAA10 = 111111111010101000010000
* 3882927382 = 11100010000010100100100111001110000010
* B10 = 101100010000

1. Please find the correct representation for the following decimal numbers into Sign and Magnitude, One’Complement and Two’s Complement Format (in a 8 bit memory location)

* +45 – 101101 in binary

Sign and magnitude: 00101101

One’s Complement: 00101101

Two’s complement: 00101101

* -223 – 11011111 in binary

Not enough bits to convert

* +99 – 1100011 in binary

Sign and magnitude: 01100011

One’s complement: 01100011

Two’s complement: 01100011

* -200

Not enough bits to convert

* -34 -- 100010 binary  
  Sign and magnitude: 10100010

One’s complement: 11011101

Two’s complement: 11011110

* -17 – 10001 in binary

Sign and magnitude: 10010001

One’s complement: 11101110

Two’s complement: 11101111

* -456

Not enough bits to convert

* -78 – 1001110

Sign and magnitude: 11001110

One’s complement: 10110001

Two’s complement: 10110010

1. Decode the following number (Two’s Complement Format) into Decimal

* 10010101 = -107
* 11111111 = -1
* 00000101 = 5
* 11100000 = -32

1. Decode the following number (Sign and Magnitude Format) into Decimal

* 10010101 = -21
* 11111111 = -127
* 00000101 = 5
* 11100000 = -96

1. Decode the following number (One’s Complement Format) into Decimal

* 10010101 = -106
* 11111111 = 0
* 00000101 = 5
* 11100000 = -31

1. Do the following operation as a computer with 16 bit memory space would, using the two’s complement format.

* -46 +13

1111111111011111

* +57-2

0000000000110111

* -102-87

1111111101000011

* +8-3

0000000000000101

* -11-24

0000000000100011

* +567-134

0000000110110001

* -900-1200

1111011111001100

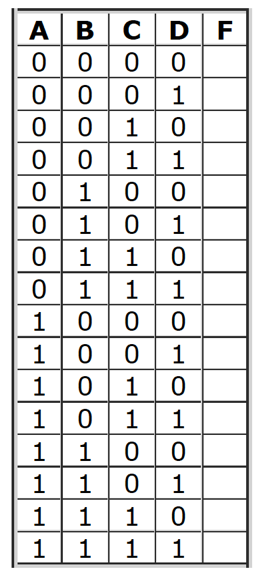
* +333-45

0000000100100000

For each of the exercises below please do not write only the result but even the process, I want to see your work!!

For the following exercises you are required to work with Logisim and upload a .circ file.

1. The 2-Input AND gate can be extended to a 4 input AND gate. How will you do it using only AND gates? After you design the circuit in Logisim, generates the output and fill the following Truth Table.



1. Design a 3-Input AND gate that is composed of different 2-input AND gates

Measure the output and generate the Truth Table.

1. How would you create a 5-Input AND gate?
2. The 2-Input OR gate can be extended to a 4 input OR gate. How will you do it using only OR gates? After you design the circuit in Logisim, generates the output and fill the following Truth Table.

