CO450 Computer Architectures Week 4 Exercise Handout

Recap on Binary to Decimal Conversion

1. Convert the following binary number to decimal using the Positional Notation method:

10001110_2

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	•	•	•	1	1	1	•

The correct answer is:

142

2. Convert the following binary number to decimal using the Doubling method:

11001100_2

0	x	2	+	1	=	1
1	x	2	+	1	=	3
3	x	2	+	•	=	6
6	x	2	+	•	=	12
12	x	2	+	1	=	25
25	x	2	+	1	=	51
51	x	2	+	•	=	102
102	x	2	+	•	=	204

The correct answer is:

204

Recap on Decimal to Binary Conversion

1. Convert the following decimal number to binary using the Short Division by Two with Remainder method:

185_{10}

185	/	2	=	92	Remainder	1
	/	2	=	46	Remainder	•
	/	2	=	23	Remainder	•
	/	2	=	11	Remainder	1
	/	2	=	5	Remainder	1
	/	2	=	2	Remainder	1
	/	2	=	1	Remainder	•
	/	2	=	0	Remainder	1

The correct answer is:

1·111··1

2. Convert the following decimal number to binary using the Comparison with Descending Powers of Two and Subtraction method:

72_{10}

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
•	1	•	•	1	•	•	•

The correct answer is:

•	1	•	•	1	•	•	•

Recap on Binary Addition

1. Add the following binary numbers together, what is the correct answer:

$00111100_2 + 00111010_2 =$

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	0	0	1	1	1	1	0	0
+	0	0	1	1	1	0	1	0
	0	1	1	1	0	1	1	0
		1	1	1				

The correct answer is:

0	1	1	1	0	1	1	0

Recap on Binary Multiplication

1. Multiply the following binary numbers, what is the correct answer:

00010110_2 X 00000110_2 =

				128	64	32	16	8	4	2	1
				2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
X				0	0	0	1	0	1	1	0
				0	0	0	0	0	1	1	0
+						1	0	1	1	0	0
					1	0	1	1	0	0	0
				1	0	0	0	0	1	0	0
				1	1	1	1				

The correct answer is:

1	0	0	0	0	1	0	0

Recap on Two's Complement

1. Convert 112_{10} to binary then use Two's Complement to convert the binary representation of 112_{10} in to the Two's Complemented binary representation for -112_{10}, what is the correct answer:

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Positional notation used to convert decimal to binary								
Flipped bits								
One to add to the flipped bits above								
Result of addition of flipped bits and one								
Carry Bits								

The correct answer is:

2. Convert 49_{10} to binary then use Two's Complement to convert the binary representation of 49_{10} in to the Two's Complemented binary representation for -49_{10}, what is the correct answer:

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Positional notation used to convert decimal to binary								
Flipped bits								
One to add to the flipped bits above								
Result of addition of flipped bits and one								
Carry Bits								

The correct answer is:

Recap on Binary Subtraction

1. Subtract 93_{10} from 187_{10} in binary, what is the correct answer:

$187_{10} - 93_{10} =$

		128	64	32	16	8	4	2	1
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Positional notation used to convert **First Term** decimal to binary		1	0	1	1	1	0	1	1
Positional notation used to convert **Second Term** decimal to binary		0	1	0	1	1	1	0	1
Flipped bits of **Second Term**		1	0	1	0	0	0	1	0
One to add to the flipped bits of **Second Term**									1
Two's Complement of **Second Term**		1	0	1	0	0	0	1	1
Carry Bits									
Addition of **First Term** and Two's Complement of **Second Term**	+	1	0	1	1	1	0	1	1
		1	0	1	0	0	0	1	1
Result	1	0	1	0	1	1	1	1	0
Carry Bits	1		1				1	1	

The correct answer is:

0	1	0	1	1	1	1	0

Recap on Converting Hexadecimal to Decimal

1. Convert the following Hexadecimal (base 16) number to Decimal (base 10):

$1EA_{16}$

+	1x256			2	5	6
	14x16			2	2	4
	10x1				1	0
	=			4	9	0

The correct answer is:

490

Recap on Converting Hexadecimal to Binary

1. Convert the following Hexadecimal (base 16) number to Binary (base 2):

$A4B9_{16}$

	8	4	2	1
	2^3	2^2	2^1	2^0
9	1	·	·	1
B	1	·	1	1
4	-	1	·	·
A	1	·	1	·

The correct answer is:

1	·	1	·	·	1	·	·	1	·	1	1	1	·	·	1	

Recap on Converting Binary to Hexadecimal

1. Convert the following Binary (base 2) number to Hexadecimal (base 16):

0010010011101111_2

	8	4	2	1
	2^3	2^2	2^1	2^0
2	·	·	1	·
4	·	1	·	·
E	1	1	1	·
F	1	1	1	1

The correct answer is:

24EF

Recap on Converting Octal to Decimal

1. Convert the following Octal (base 8) number to Decimal (base 10):

372_8

+	3 x 64			1	9	2
	7 x 8				5	6
	2 x 1					2
	=			2	5	0

The correct answer is:

250

Recap on Converting Octal to Binary

1. Convert the following Octal (base 8) number to Binary (base 2):

245_8

	4	2	1
	2^2	2^1	2^0
2	0	1	0
4	1	0	0
5	1	0	1

The correct answer is:

							0	1	0	1	0	0	1	0	1

Recap on Converting Binary to Octal

1. Convert the following Binary (base 2) number to Octal (base 8):

$0.101.011.101.110.111_2$

	4	2	1
	2^2	2^1	2^0
7	1	1	1
6	1	1	0
5	1	0	1
3	0	1	1
5	1	0	1

The correct answer is:

53567

Signed Magnitude Notation

1. Represent the following decimal number in binary using Signed Magnitude Notation:

-104_{10}

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	1	1	.	1	.	.	.

The correct answer is:

1	1	1	.	1	.	.	.

2. Represent the following decimal number in binary using Signed Magnitude Notation:

98_{10}

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
.	1	1	.	.	.	1	.

The correct answer is:

.	1	1	.	.	.	1	.

3. Represent the following decimal number in binary using Signed Magnitude Notation:

-76_{10}

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	1	.	.	1	1	.	.

The correct answer is:

1	1	.	.	1	1	.	.

Binary Excess Notation to Decimal

1. What is the decimal number that is represented by 10100000_2 in Excess Notation?

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	1	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Unsigned binary to decimal conversion using positional notation	**128 + 32 = 160_{10}**							
Unsigned decimal value minus Excess ($2^{(n-1)}$) Note: *n* = number of bits	**160 $- 2^7 = 32_{10}$**							

The correct answer is:

32_{10}

2. What is the decimal number that is represented by 01101100_2 in Excess Notation?

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	·	1	1	·	1	1	·	·
Unsigned binary to decimal conversion using positional notation	108							
Unsigned decimal value minus Excess ($2^{(n-1)}$) Note: *n* = number of bits	−20							

The correct answer is:

−20

3. What is the decimal number that is represented by 11100111_2 in Excess Notation?

	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	1	1	1	·	·	1	1	1
Unsigned binary to decimal conversion using positional notation	231							
Unsigned decimal value minus Excess ($2^{(n-1)}$) Note: *n* = number of bits	103							

The correct answer is:

103

Decimal to Binary Excess Notation

1. What is the binary Excess Notation representation of the following decimal number:

-20_{10}

Decimal plus Excess ($2^{(n-1)}$) Note: *n* = number of bits	**$-20 + 128 = 108_{10}$**							
	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Convert Decimal with Excess to binary using positional notation	**0**	**1**	**1**	**0**	**1**	**1**	**0**	**0**

The correct answer is:

0	**1**	**1**	**0**	**1**	**1**	**0**	**0**

2. What is the binary Excess Notation representation of the following decimal number:

-93_{10}

Decimal plus Excess ($2^{(n-1)}$) Note: *n* = number of bits	35							
	128	64	32	16	8	4	2	1
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Convert Decimal with Excess to binary using positional notation	.	.	1	.	.	.	1	1

The correct answer is:

.	.	1	.	.	.	1	1

The Answers

Recap on Binary to Decimal Conversion

1. 142_{10}

2. 204_{10}

Recap on Decimal to Binary Conversion

1. 10111001_2

2. 01001000_2

Recap on Binary Addition

1. 01110110_2

Recap on Binary Multiplication

1. 10000100_2

Recap on Two's Complement

1. 10010000_2

2. 11001111_2

Recap on Binary Subtraction

1. 01011110_2

Recap on Converting Hexadecimal to Decimal

1. 490_{10}

Recap on Converting Hexadecimal to Binary

1. 1010010010111001_2

Recap on Converting Binary to Hexadecimal

1. $24EF_{16}$

Recap on Converting Octal to Decimal

1. 250_{10}

Recap on Converting Octal to Binary

1. 0000000010100101_2

Recap on Converting Binary to Octal

1. 53567_8

Signed Magnitude Notation

1. 11101000_2

2. 01100010_2

3. 11001100_2

Binary Excess Notation to Decimal

1. 32_{10}

2. -20_{10}

3. 103_{10}

Decimal to Binary Excess Notation

1. 01101100_2

2. 00100011_2