

CO450 Computer Architectures Week 4 Exercise Handout

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Recap on Binary to Decimal Conversion

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

10001110₂

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

The correct answer is:

142

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

11001100₂

0	x	2	+		=	1
1	x	2	+		=	3
3	x	2	+	.	=	6
6	x	2	+	.	=	12
12	x	2	+		=	25
25	x	2	+		=	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 · 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 · · | · · ·

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
+

	.				.			.

The correct answer is:

•		/		•		/	•
---	--	---	--	---	--	---	---

Recap on Binary Multiplication

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

$$00010110_2 \times 00000110_2 =$$

			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			.	.	.	1	.	1	1	.
			1	1	.
+					1	.	1	1	.	.
				1	.	1	1	.	.	.
			1	1	.	.
			1	1	1	1				

The correct answer is:

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	.	1	1	1
Flipped bits	1	.	.	.	1	1	1	1
One to add to the flipped bits above								1
Result of addition of flipped bits and one	1	.	.	1
Carry Bits				1	1	1	1	

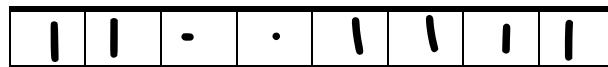
The correct answer is:



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	.	.	1	1	.	.	.	1
Flipped bits	1	1	.	.	1	1	1	.
One to add to the flipped bits above	1
Result of addition of flipped bits and one	1	1	.	.	1	1	1	1
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		.				.	/	
Positional notation used to convert Second Term decimal to binary	.		.				.	
Flipped bits of Second Term		.	/	.	.	-		.
One to add to the flipped bits of Second Term								
Two's Complement of Second Term	/	/	
<i>Carry Bits</i>								
Addition of First Term and Two's Complement of Second Term	+		
Result	
<i>Carry Bits</i>	/							

The correct answer is:

.	/	.	/	/	/	/	.
---	---	---	---	---	---	---	---

Recap on Converting Hexadecimal to Decimal

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

 $1EA_{16}$

	1×256			2	5	6
+	14×16			2	2	4
	10×1			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
1	1	.	.	1
0	1	.	1	1
4	-	1	.	.
7	1	.	1	.

The correct answer is:

1 . 1 . 0 1 1 . 1 0 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	.	.		.
4	.		.	.
E				.
F				

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

	3×64			1	9	2
+	7×8				5	6
	2×1					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):

245g

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

The correct answer is:

· / · | · . · | · . |

Recap on Converting Binary to Octal

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

0101011101110111₂

	4	2	1
	2^2	2^1	2^0
>	1	1	1
≤	1	1	.
≤	1	.	1
≥	.	1	1
≤	1	.	1

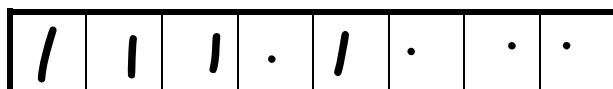
The correct answer is:

53567

Signed Magnitude Notation**1.** Represent the following decimal number in binary using Signed Magnitude Notation:**-104₁₀**

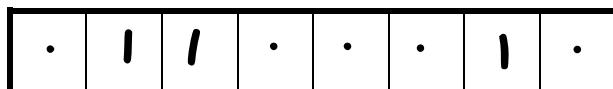
128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
		

The correct answer is:

**2.** Represent the following decimal number in binary using Signed Magnitude Notation:**98₁₀**

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

The correct answer is:

**3.** Represent the following decimal number in binary using Signed Magnitude Notation:**-76₁₀**

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

The correct answer is:



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:

32₁₀

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	1 0 8							
Unsigned decimal value minus Excess ($2^{(n-1)}$) Note: n = number of bits	- 2 0							

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	2 3 1							
Unsigned decimal value minus Excess ($2^{(n-1)}$) Note: n = number of bits	1 0 3							

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