

CO450 Computer Architectures Week 2 Exercise Handout

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Re-Cap on Base 10 Decimal Numbers

1. What is the correct way to write out the following base 10 number:

45_{10}

				(4×10^1)	+	(5×10^0)	=	45_{10}
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2. What is the correct way to write out the following base 10 number:

68_{10}

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3. What is the correct way to write out the following base 10 number:

183_{10}

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4. What is the correct way to write out the following base 10 number:

3549_{10}

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5. What is the correct way to write out the following base 10 number:

27318_{10}

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Positional Notation: Binary to Decimal Conversion

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

00001110₂

We have worked this first question through for you.

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	0	0	1	1	1	0
$8 + 4 + 2 = 14$							

The correct answer is:

14₁₀

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

00101010₂

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

10001101₂

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:

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

11011111₂

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:

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

01110001₂

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:

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

11101010₂

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:

Doubling: Binary to Decimal Conversion

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

10110100₂

We have worked this first question through for you.

0	x	2	+	1	=	1
1	x	2	+	0	=	2
2	x	2	+	1	=	5
5	x	2	+	1	=	11
11	x	2	+	0	=	22
22	x	2	+	1	=	45
45	x	2	+	0	=	90
90	x	2	+	0	=	180

The answer is:

180₁₀

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

11100111₂

0	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	

The answer is:

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

00110101₂

0	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	

The answer is:

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

00111000₂

0	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	
	x	2	+		=	

The answer is:

Short Division by Two with Remainder: Decimal to Binary Conversion

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

86₁₀

We have worked this first question through for you.

86	/	2	=	43	Remainder	0
43	/	2	=	21	Remainder	1
21	/	2	=	10	Remainder	1
10	/	2	=	5	Remainder	0
5	/	2	=	2	Remainder	1
2	/	2	=	1	Remainder	0
1	/	2	=	0	Remainder	1
	/	2	=		Remainder	

The answer is:

1010110₂

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

109₁₀

	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	

The answer is:

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

72₁₀

	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	

The answer is:

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

124₁₀

	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	
	/	2	=		Remainder	

The answer is:

Comparison with Descending Powers of Two and Subtraction: Decimal to Binary Conversion

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

57₁₀

We have worked this first question through for you.

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	0	0	1
		57 - 32 = 25	25 - 16 = 9	9 - 8 = 1			1 - 1 = 0

The answer is:

0	0	1	1	1	0	0	1
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2. Convert the following decimal number to binary using the Comparison with Descending Powers of Two and Subtraction method:

113₁₀

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 answer is:

--	--	--	--	--	--	--	--

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

93₁₀

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 answer is:

--	--	--	--	--	--	--	--

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

29₁₀

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 answer is:

--	--	--	--	--	--	--	--

Binary Addition

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

$$00000110_2 + 00001010_2 =$$

We have worked this first question through for you.

+	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	0	0	0	1	1	0
	0	0	0	0	1	0	1	0
	0	0	0	1	0	0	0	0
				1	1	1		

The answer is:

0	0	0	1	0	0	0	0
---	---	---	---	---	---	---	---

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

$$00000110_2 + 00011100_2 =$$

+	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 answer is:

--	--	--	--	--	--	--	--

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

$$00101100_2 + 00111001_2 =$$

+	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 answer is:

--	--	--	--	--	--	--	--

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

$$00111100_2 + 00010101_2 =$$

+	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 answer is:

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The Answers

Re-Cap on Base 10 Decimal Numbers

1. $(4 \times 10^1) + (5 \times 10^0) = 45_{10}$
2. $(6 \times 10^1) + (8 \times 10^0) = 68_{10}$
3. $(1 \times 10^2) + (8 \times 10^1) + (3 \times 10^0) = 183_{10}$
4. $(3 \times 10^3) + (5 \times 10^2) + (4 \times 10^1) + (9 \times 10^0) = 3549_{10}$
5. $(2 \times 10^4) + (7 \times 10^3) + (3 \times 10^2) + (1 \times 10^1) + (8 \times 10^0) = 27318_{10}$

Positional Notation: Binary to Decimal Conversion

1. 14_{10}
2. 42_{10}
3. 141_{10}
4. 223_{10}
5. 113_{10}
6. 234_{10}

Doubling: Binary to Decimal Conversion

1. 180_{10}
2. 231_{10}
3. 53_{10}
4. 56_{10}

Short Division by Two with Remainder: Decimal to Binary Conversion

1. 01010110_2
2. 01101101_2
3. 01001000_2
4. 01111100_2

Comparison with Descending Powers of Two and Subtraction

1. 00111001_2
2. 01110001_2
3. 01011101_2
4. 00011101_2

Binary Addition

1. 00010000_2

2. 00100010_2

3. 01100101_2

4. 01010001_2