

Midterm Exam S1

Computer Architecture

Answer on the worksheet

Duration: 1 hr 30 min.

Last name: First name: Group:

Exercise 1 (3 points)

Simplify the following expressions. Give each result in a power-of-two form. Write down the result only (do not show any calculation).

Expression	Result
$\frac{32^8 \cdot 16^5 \cdot 64^{-4}}{(512^{-7} \cdot 16^{16})^4}$	
$\frac{(4^{-8} \cdot 128^{12}) \cdot (8000 + 192)^{-10}}{(8^{-5} \cdot (2^{15} - 2^{14}))^{-3} \cdot 64^4}$	
$\frac{((16384 \cdot 128^{-3})^3 \cdot 1024^{10})^7}{(64^{-8} \cdot 2048)^{-7} \cdot 128}$	

Exercise 2 (3 points)

1. How many bytes do the following values contain? **Use a power-of-two notation.** Write down the result only (do not show any calculation).

• 32 KiB =

• 256 Mib =

• 64 Gib =

2. How many bits do the following values contain? Use binary prefixes (Ki, Mi or Gi). **Choose the most appropriate prefix so that the integer numerical value will be as small as possible.** Write down the result only (do not show any calculation).

• 2^{28} bits =

• 1 GB =

• 2^{33} bytes =

Exercise 3 (5 points)

Convert the following numbers from the source form into the destination form. Do not write down the result in a fraction or a power form (e.g. write down 0.25 and not $\frac{1}{4}$ or 2^{-2}). Write down the result only (do not show any calculation).

Number to Convert	Source Form	Destination Form	Result
11101001.00011	Binary	Decimal	
DA.18	Hexadecimal	Decimal	
99.99	Decimal	Hexadecimal (2 digits after the point)	
103.09375	Decimal	Binary	
134.64	Base 8	Binary	
741.735	Base 8	Hexadecimal	
D9.B7	Hexadecimal	Base 8	
80.25	Decimal	Base 13 (2 digits after the point)	
42	Base 5	Base 7	
100110011.10011	Binary	Hexadecimal	

Exercise 4 (5 points)

Perform the operations below. **Show all calculations.**

<p>Base 2</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 10%;"></td><td style="width: 10%;"></td><td style="width: 10%; text-align: center;">1</td><td style="width: 10%; text-align: center;">0</td><td style="width: 10%; text-align: center;">1</td><td style="width: 10%; text-align: center;">0</td><td style="width: 10%; text-align: center;">1</td><td style="width: 10%; text-align: center;">1</td><td style="width: 10%; text-align: center;">0</td><td style="width: 10%; text-align: center;">1</td><td style="width: 10%; text-align: center;">0</td></tr> <tr><td></td><td style="text-align: center;">-</td><td></td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td colspan="11" style="border-top: 1px solid black;"></td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> <tr><td colspan="11"> </td></tr> </table>			1	0	1	0	1	1	0	1	0		-		1	0	1	0	0	1	1	1																																																																																																																										<p>Base 16</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 10%;"></td><td style="width: 10%;"></td><td style="width: 10%; text-align: center;">5</td><td style="width: 10%; text-align: center;">9</td><td style="width: 10%; text-align: center;">8</td><td style="width: 10%; text-align: center;">7</td></tr> <tr><td></td><td style="text-align: center;">+</td><td style="text-align: center;">D</td><td style="text-align: center;">F</td><td style="text-align: center;">A</td><td style="text-align: center;">7</td></tr> <tr><td colspan="6" style="border-top: 1px solid black;"></td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> <tr><td colspan="6"> </td></tr> </table>			5	9	8	7		+	D	F	A	7																																																																																																																																																																																																																																																																																																																																																			
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Exercise 5 (4 points)

1. Work out the following negative powers of two:

Power	Answer
2^{-8}	
2^{-9}	
2^{-10}	

2. In how many patterns can a byte be arranged?

3. Determine the minimum number of bits required to encode the following signed number: **8192**

4. Determine the minimum number of bits required to encode the following signed number: **-8192**

Feel free to use the blank space below if you need to: