S1 – Key to Examination 1
Computer Architecture

Duration: 1 hr 30 min.

Family name: ..... First name: ..... Class: .....

Answer on the worksheet
Do not show any calculation unless you are explicitly asked.
Do not use a pencil or red ink.

Exercise 1 (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 ¼ or 2^{-2}). Write down the result only (do not show any calculation).

Number to Convert	Source Form	Destination Form	Result
110111011	Binary	Decimal	**443**
1BA	Hexadecimal	Decimal	**442**
171	Decimal	Binary	**1010 1011**
632	Decimal	Hexadecimal	**278**
10101.11011	Binary	Decimal	**21.84375**
18.5	Hexadecimal	Decimal	**24.3125**
38.42	Decimal	Binary (5 digits after the point)	**10 0110.0110 1**
28.35	Decimal	Hexadecimal (4 digits after the point)	**1C.5999**
B7.53	Hexadecimal	Binary	**1011 0111.0101 0011**
10101101.111111	Binary	Hexadecimal	**AD.FC**

Exercise 2 (4 points)

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

Base 2

		1	1	0	1	0	1	1	0	1
	–		1	1	0	1	1	0	1	1
			1	**1**	**0**	**1**	**0**	**0**	**1**	**0**

Base 16

			8	5	4	
+			E	B	9	
			6	A	7	
		1	**D**	**B**	**4**	

Base 2

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

Base 2

									1	0	0	1	1	0	0	1	1	0	0
								×						1	0	1	1	0	0
							1	0	0	1	1	0	0	1	1	0	0		
		+				1	0	0	1	1	0	0	1	1	0	0			
		+		1	0	0	1	1	0	0	1	1	0	0					
				1	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0

Exercise 3 (5 points)

Perform the following 8-bit binary operations (the two operands and the result are 8 bits wide). Then, convert the result into unsigned and signed decimal values. If an overflow occurs, write down 'ERROR' instead of the decimal value.

Operation	Binary Result	Decimal Value	
		Unsigned	Signed
01010011 – 10010111	1011 1100	**ERROR**	**ERROR**
00100101 + 00101010	0100 1111	**79**	**79**
11010110 – 00101110	1010 1000	**168**	**-88**
01111111 + 00000001	1000 0000	**128**	**ERROR**
11111111 + 00000001	0000 0000	**ERROR**	**0**

Exercise 4 (6 points)

1. Convert the numbers below into their **single-precision** IEEE-754 representations. Write down the final result in its **binary form** and specify the three fields.

Number	S	E	M
298	0	10000111	00101010000000000000000
59.75	0	10000100	11011110000000000000000
0.15625	0	01111100	01000000000000000000000

2. Convert the **double-precision** IEEE-754 words below into their associated representations. If a representation is a number, use the base-10 following form: $k \times 2^n$ where k and n are integers (either positive or negative).

IEEE-754 Representation (base 16)	Associated Representation
3688 0000 0000 0000	3×2^{-152}
0015 8000 0000 0000	43×2^{-1027}
7FF0 0000 0000 0000	$+\infty$

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