Exercise 1: Let’s look in more detail at division. We will use the octal numbers in the following table.

	A	B
A	40	21
B	25	44

1. Calculate A divided by B using the hardware described in Figure 1 and the algorithm shown in Figure 2. You should show the contents of each register on each step. Assume A and B are unsigned 6-bit integers.

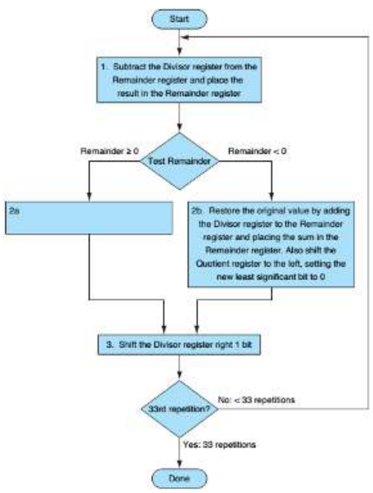

Figure 2.

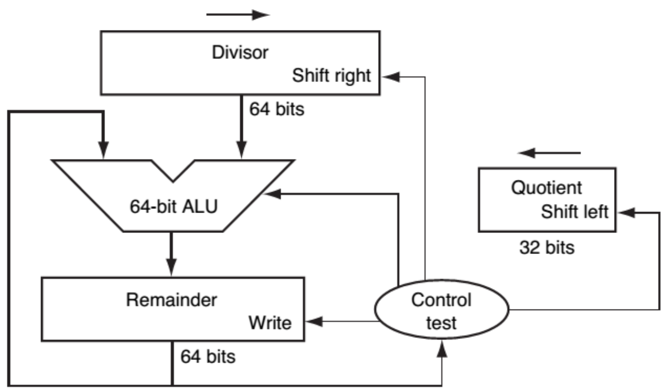

Figure 1.

2. Calculate A divided by B using the hardware described in Figure 3. You should show the contents of each register on each step. Assume A and B are unsigned 6-bit integers.

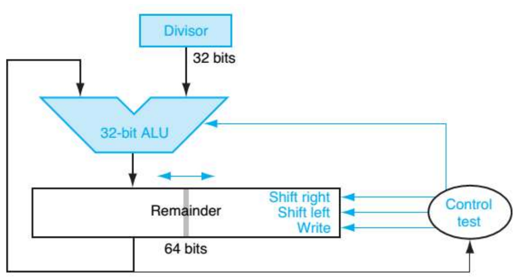

Figure 3.

Exercise 2: The following table shows decimal numbers

a	-1609.5
b	-938.8125

1. Write down the binary representation of the decimal number, assuming the IEEE 754 **single** precision format.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
s	exponent								fraction																						

1 bit 8 bits 23 bits

2. Write down the binary representation of the decimal number, assuming the IEEE 754 **double** precision format.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
s	exponent											fraction																			

1 bit 11 bits 20 bits

fraction (continued)

32 bits

<u>Exercise 3:</u> Let's look in more detail at division. We will use the decimal numbers in the following table.

	A	B
A	13	20
B	30	9

1. Calculate A divided by B using the hardware described in Figure 1 and the algorithm shown in Figure 2. You should show the contents of each register on each step. Assume A and B are unsigned 6-bit integers.
2. Calculate A divided by B using the hardware described in Figure 3. You should show the contents of each register on each step. Assume A and B are unsigned 6-bit integers.

<u>Exercise 4:</u> The following table shows decimal numbers

a	5.00736125×10^{5}
b	$-2.691650390625 \times 10^{-2}$

3. Write down the binary representation of the decimal number, assuming the IEEE 754 **single** precision format.

4. Write down the binary representation of the decimal number, assuming the IEEE 754 **double** precision format.

<u>Exercise 5</u>: The following table shows bit patterns expressed in hexademical notation.

a	0x24A60004
b	0xAFBF0000

1. What decimal number does the bit pattern represent if it is a two's complement integer? An unsigned integer?
2. If this bit pattern is placed into the Instruction Register, what MIPS instruction will be executed?
3. What decimal number does the bit pattern represent if it is a floating point number? Use the IEEE 754 standard.

Exercise 6:
The following table shows pairs of decimal numbers

	A	B
a.	-1278×10^{3}	-3.90625×10^{-1}
b.	2.3109375×10^{1}	$6.391601562 \times 10^{-1}$

1. Calculate the sum of A and B by hand, assuming that we keep 11 bits of significand and 5 bits of the exponent. (Rounding rule: add 1 if the bits to the right of the desired point is larger or equal to $100_{(2)}$). Show all the steps.
2. Calculate the sum of A and B by hand, assuming A and B are stored in the IEEE-754 single precision format. Show all the steps.
3. Write MIPS assembly language program to calculate the sum of A and B, assuming that the memory address of A is 0x04 and of B is 0x08

Exercise 7:
The following table shows pairs of decimal numbers

	A	B
a.	5.66015625×10^{0}	8.59375×10^{0}
b.	6.18×10^{2}	5.796875×10^{1}

1. Calculate the A x B by hand, assuming that we keep 11 bits of significand and 5 bits of the exponent. (Rounding rule: add 1 if the bits to the right of the desired point is larger or equal to $100_{(2)}$). Show all the steps.
2. Calculate the sum of A and B by hand, assuming A and B are stored in the IEEE-754 single precision format. Show all the steps.
3. Write MIPS assembly language program to calculate the product of A x B, assuming that the memory address of A is 0x04 and of B is 0x08

Exercise 8:
Explain and give an example for each of the following MIPS instructions to distinguish the difference between them

- mult, multu, mul.s, mul.d
- div, divu, div.s, div.d