Midterm Exam S2
Computer Architecture

Duration: 1 hr 30 min

Answer on the answer sheet only.
Do not show any calculation unless you are explicitly asked.
Do not use red ink.

Exercise 1 (5 points)

Answer on the answer sheet. Let us consider the following **10-bit** binary number: $\mathbf{1001011010_2}$.

1. Write down its hexadecimal representation.
2. Assuming that it is an unsigned integer, write down its decimal representation.
3. Assuming that it is a signed integer, write down its decimal representation.

4. Write down the 8-bit binary representation of the following unsigned number: $\mathbf{128_{10}}$.
5. Write down the 8-bit binary representation of the following signed number: $\mathbf{-128_{10}}$.

6. Determine the minimum number of bits required to encode the following unsigned number: $\mathbf{2^{42}}$ **?**
7. Determine the minimum number of bits required to encode the following signed number: $\mathbf{-2^{42}}$**?**
8. Determine the minimum number of bits required to encode the following signed number: $\mathbf{2^{42}}$ **?**

9. How many bytes does the value **1 Mib** contain? Use a power-of-two notation.
10. How many bits does the value **256 KiB** contain? Use binary prefixes (Ki, Mi or Gi) and choose the most appropriate prefix so that the integer numerical value will be as small as possible.

Exercise 2 (7 points)

1. Convert the numbers given on the answer sheet into their **single-precision** IEEE-754 representations. Write down the final result in its **binary form** and specify the three fields.
2. Convert the **double-precision** IEEE-754 words given on the answer sheet 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).

Exercise 3 (3 points)

For each question in this exercise, choose only one correct answer from these five:

- The output is always 0.
- The output is always 1.
- The output never changes.
- The output toggles on each negative edge of the clock signal.
- We do not know.

Let us consider a master-slave JK flip-flop:

1. How does the output behave if J = K = 1?
2. How does the output behave if J = 1 et K = Q?
3. How does the output behave if J = $\overline{Q}$ et K = Q?

Exercise 4 (5 points)

Complete the timing diagrams shown on the answer sheet (up to the last vertical dotted line) for the following circuits.

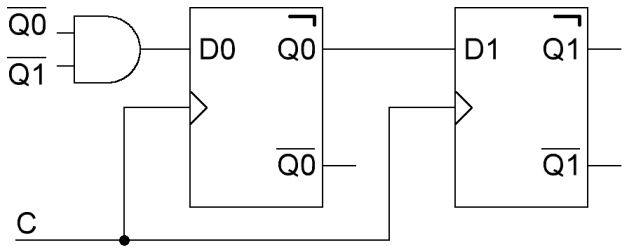

Figure 1

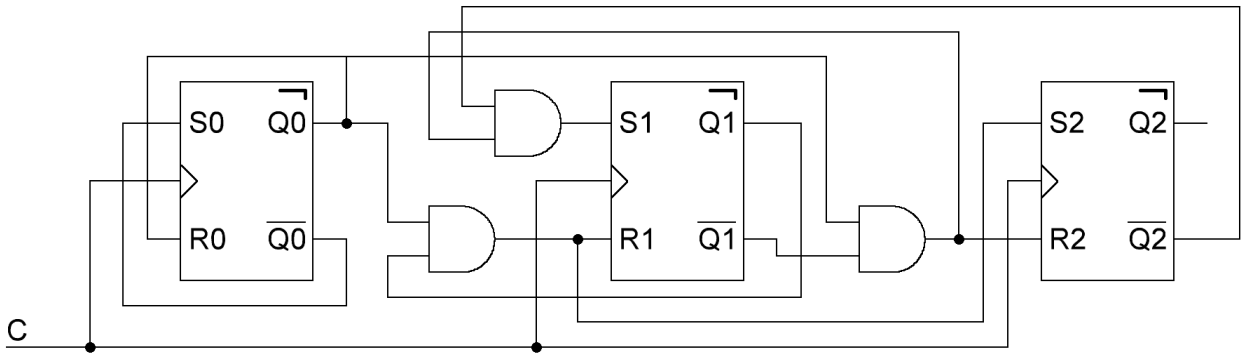

Figure 2

Last name: ..... First name: ..... Group: .....

ANSWER SHEET

Exercise 1

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

Exercise 2

1.

Number	S	E	M
-88			
45.375			
0.375			

2.

IEEE-754 Representation	Associated Representation
4321000000000000_{16}	
$FFFFFFFFFFFFFFFF_{16}$	
$7FF0000000000000_{16}$	
8002400000000000_{16}	

Exercise 3

1.
2.
3.

Exercise 4

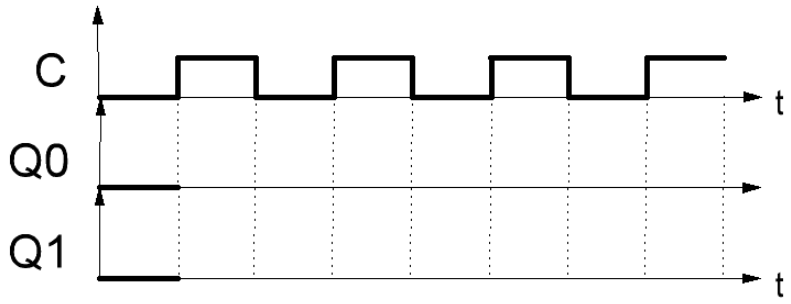

Figure 1

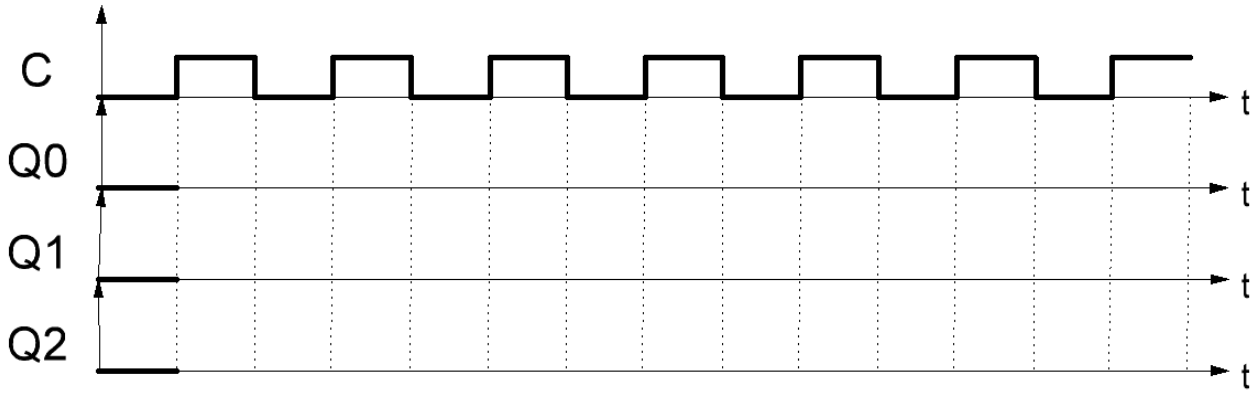

Figure 2

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