

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 **11-bit** binary number: 10111101010_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 12-bit binary representation of the following signed number: -94_{10} .
5. Write down the 12-bit binary representation of the following signed number: $-2,048_{10}$.

6. Determine the minimum number of bits required to encode the following unsigned number: 2^{17} ?
7. Determine the minimum number of bits required to encode the following signed number: 2^{17} ?
8. Determine the minimum number of bits required to encode the following signed number: -2^{17} ?

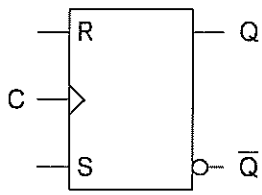
9. How many bytes does the value **2 Kib** contain? Use a power-of-two notation.
10. How many bits does the value **256 KiB** contain? Use binary prefixes (Ki, Mi or Gi) and choose the most appropriate prefix so that the integer numerical value will be as small as possible.

Exercise 2 (7 points)

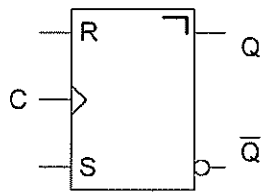
1. Convert the numbers given on the answer sheet into their **single-precision** IEEE-754 representations. Write down the final result in its **binary form** and specify the three fields.
2. Convert the **double-precision** IEEE-754 words given on the answer sheet into their associated representations. If a representation is a number, use the following form: $k \times 2^n$ where k and n are integers (either positive or negative).

Exercise 3 (4 points)

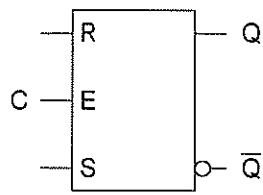
1. Give the type of each flip-flop below (answer on the answer sheet).



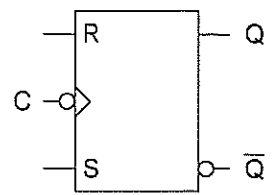
Flip-Flop 1



Flip-Flop 2



Flip-Flop 3



Flip-Flop 4

2. Complete the timing diagrams shown on the answer sheet (up to the last vertical dotted line) for a gated RS latch ($Q0$), a positive-edge-triggered RS flip-flop ($Q1$), a negative-edge-triggered RS flip-flop ($Q2$) and a master-slave RS flip-flop ($Q3$).

Exercise 4 (4 points)

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

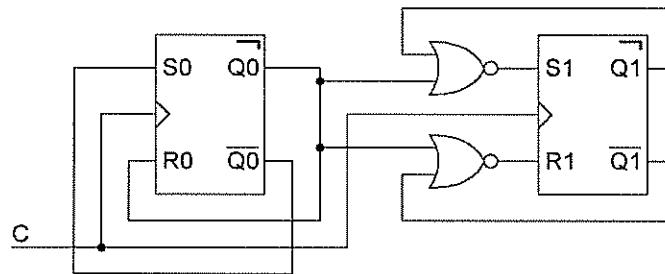


Figure 1

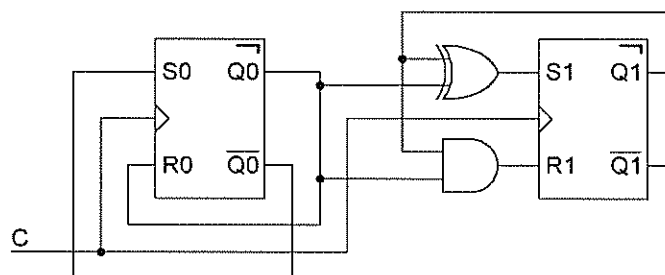


Figure 2

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
43			
-203.75			
0.171875			

2.

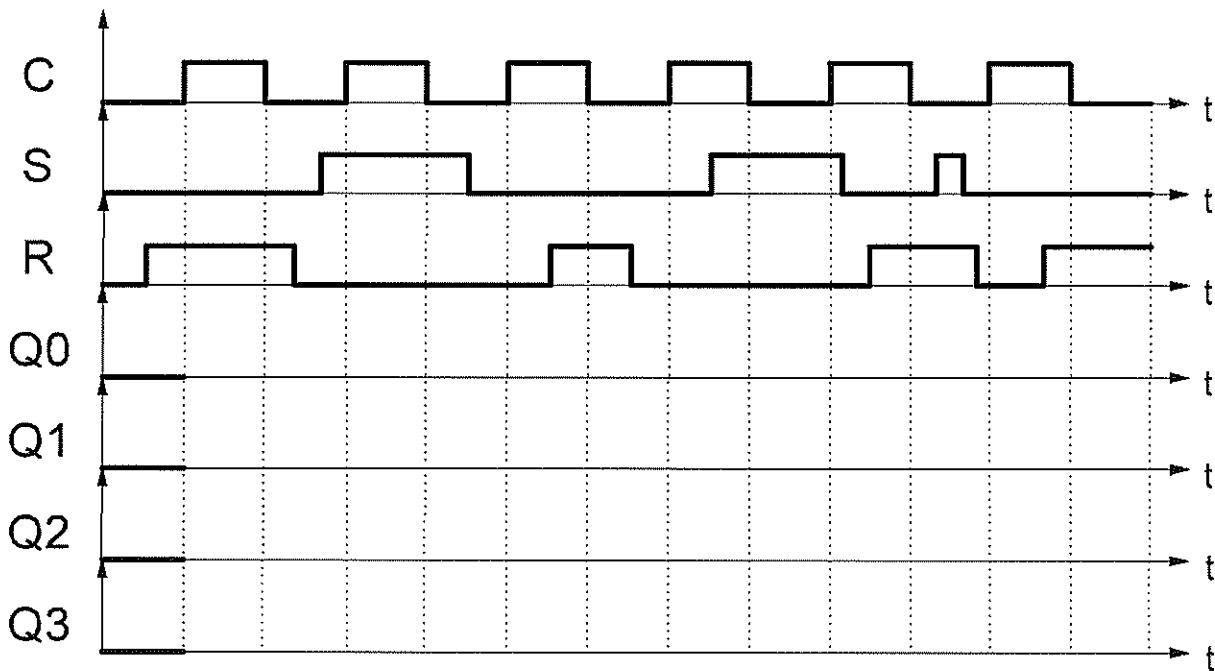
IEEE-754 Representation	Associated Representation
403D 4000 0000 0000 ₁₆	
FFF0 0000 0000 0000 ₁₆	
FFFF 0000 0000 0000 ₁₆	
0002 8000 0000 0000 ₁₆	

Exercise 3

1.

Flip-Flop	Type of Flip-Flop
1	
2	
3	
4	

2.



Exercise 4

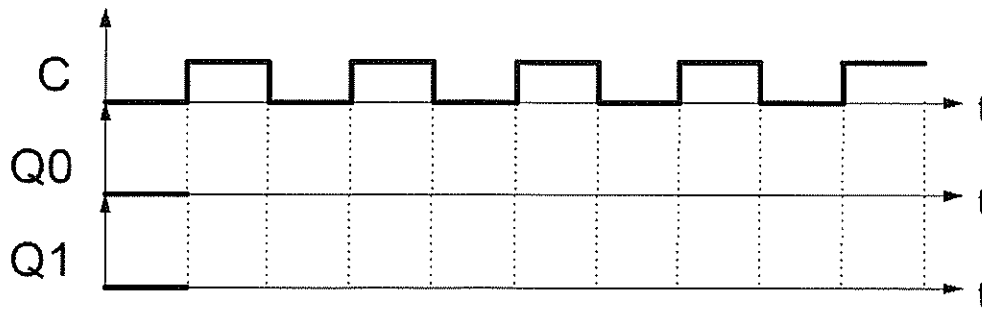


Figure 1

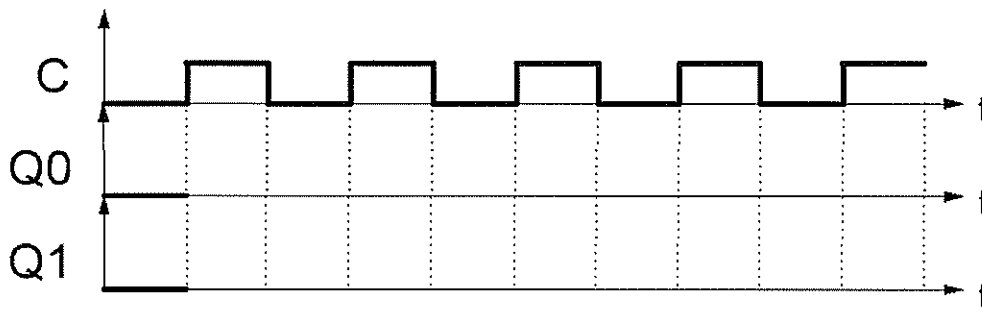


Figure 2

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