

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: **1001101010₂**.

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 10-bit binary representation of the following signed number: **511₁₀**.
5. Write down the 16-bit binary representation of the following signed number: **-511₁₀**.

6. Determine the minimum number of bits required to encode the following unsigned number: **65,536?**
7. Determine the minimum number of bits required to encode the following signed number: **65,536?**
8. Determine the minimum number of bits required to encode the following signed number: **-65,536?**

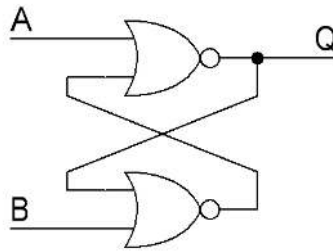
9. How many bytes does the value **8 Mib** contain? Use a power-of-two notation.
10. How many bits does the value **512 MiB** contain? Use binary prefixes (Ki, Mi or Gi) and choose the most appropriate prefix so that the integer numerical value will be as small as possible.

Exercise 2 (9 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).
3. Determine the smallest and largest absolute values of a single-precision IEEE-754 **denormalized** number. Use the following form: 2^n for the smallest number and $(1 - 2^{n1}) \times 2^{n2}$ for the largest number where n , $n1$ and $n2$ are integers (either positive or negative). Write down the base-10 numerical values of n , $n1$ and $n2$ on the [answer sheet](#).

Exercise 3 (2 points)

Let us consider the following circuit:



1. Complete the truth table shown on the [answer sheet](#).
2. What is the name of this circuit?

Exercise 4 (4 points)

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

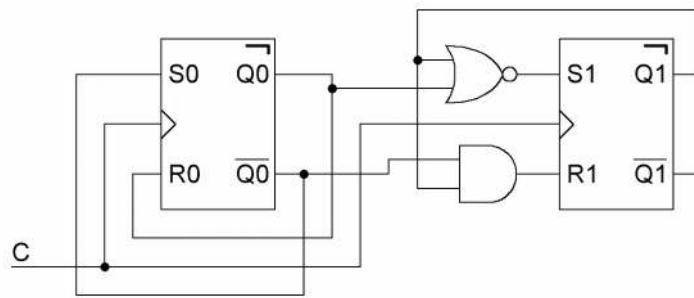


Figure 1

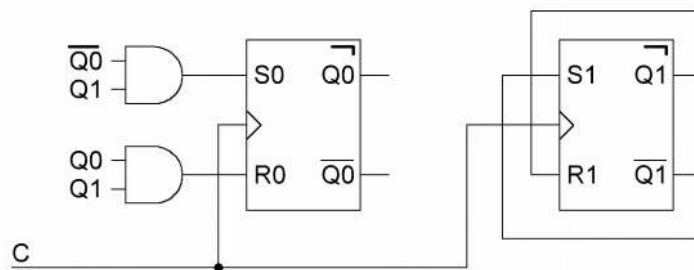


Figure 2

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 |
|-----------|---|---|---|
| 163 | | | |
| 27.625 | | | |
| -0.921875 | | | |

2.

| IEEE-754 Representation | Associated Representation |
|-----------------------------------|---------------------------|
| 413C 0000 0000 0000 ₁₆ | |
| 8000 0000 0000 0000 ₁₆ | |
| 0001 1000 0000 0000 ₁₆ | |
| 7FF0 0000 0000 1000 ₁₆ | |

3.

| n | n1 | n2 |
|---|----|----|
| | | |

Exercise 3

| A | B | Q |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

| |
|----------------------------|
| Name of the circuit |
| |

Exercise 4

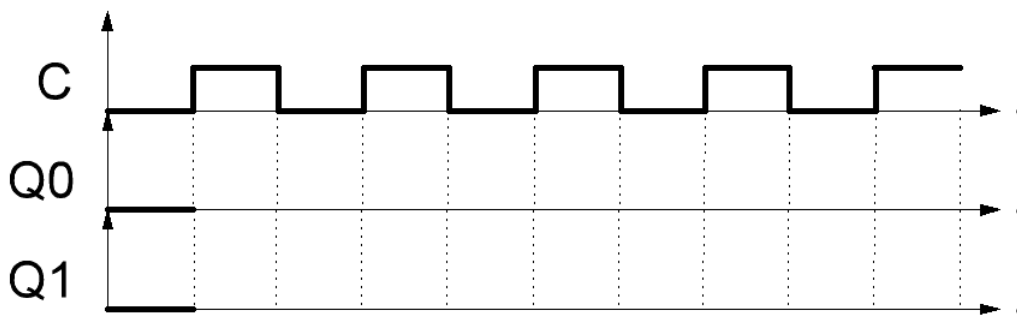


Figure 1

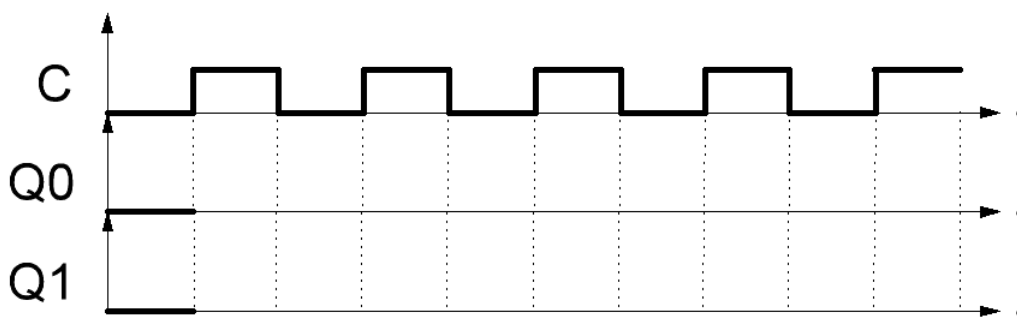


Figure 2

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