Key to 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: $\mathbf{1001101010_2}$.

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 10-bit binary representation of the following signed number: $\mathbf{511_{10}}$.
5. Write down the 16-bit binary representation of the following signed number: $\mathbf{-511_{10}}$.

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?**

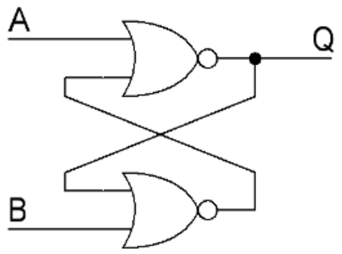
9. How many bytes does the value **8 Mib** contain? Use a power-of-two notation.
10. How many bits does the value **512 MiB** contain? Use binary prefixes (Ki, Mi or Gi) and choose the most appropriate prefix so that the integer numerical value will be as small as possible.

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.

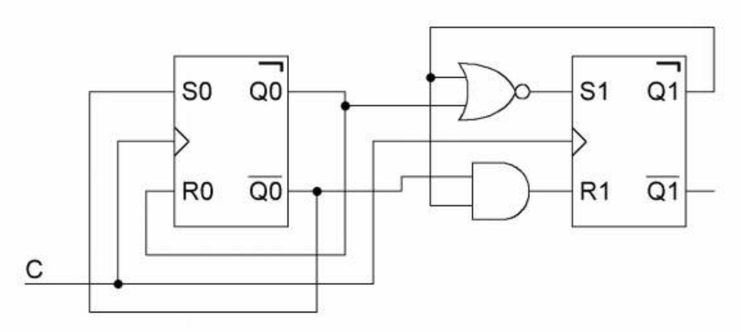


Figure 1

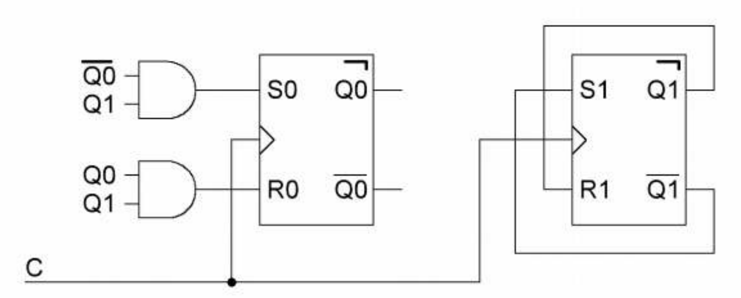


Figure 2

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

ANSWER SHEET

Exercise 1

1. $26A_{16}$	6. 17 bits
2. 618_{10}	7. 18 bits
3. -406_{10}	8. 17 bits
4. $01\ 1111\ 1111_2$	9. 2^{20} bytes
5. $1111\ 1110\ 0000\ 0001_2$	10. 4 Gib

Exercise 2

1.

Number	S	E	M
163	0	10000110	01000110000000000000000
27.625	0	10000011	10111010000000000000000
-0.921875	1	01111110	11011000000000000000000

2.

IEEE-754 Representation	Associated Representation
$413C\ 0000\ 0000\ 0000_{16}$	7×2^{18}
$8000\ 0000\ 0000\ 0000_{16}$	-0
$0001\ 1000\ 0000\ 0000_{16}$	17×2^{-1030}
$7FF0\ 0000\ 0000\ 1000_{16}$	NaN

3.

n	n1	n2
-149	-23	-126

Exercise 3

A	B	Q
0	0	q
0	1	1
1	0	0
1	1	0

Name of the circuit
RS latch

Exercise 4

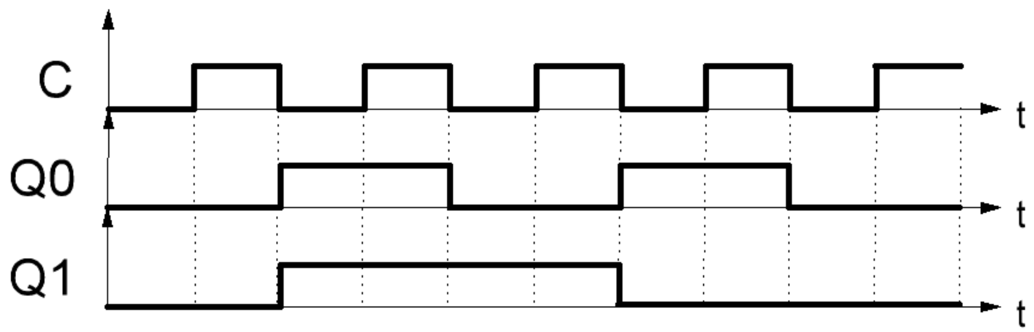


Figure 1

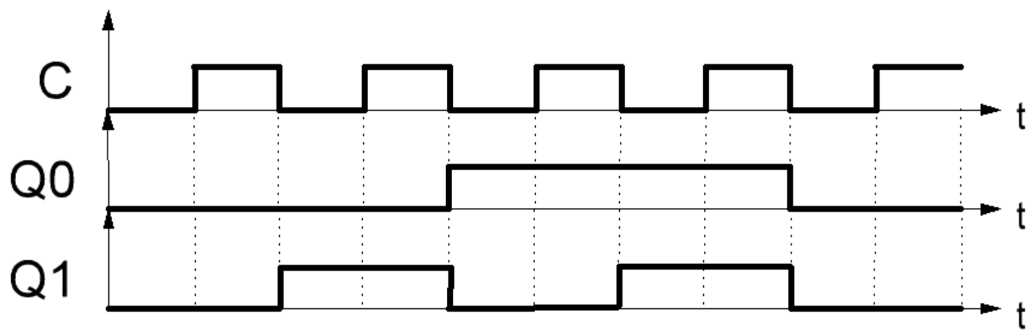


Figure 2

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