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 a pencil or red ink.

Exercise 1 (5 points)

Answer on the answer sheet. Let us consider the following **10-bit** binary number: $\mathbf{1011101010_2}$.

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 unsigned number: $\mathbf{2^{10}}$.
5. Write down the 10-bit binary representation of the following signed number: $\mathbf{-2^{10}}$.

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 **2 Gib** 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 (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 (2 points)

1. Draw the circuit diagram of a divide-by-two circuit by using only one master-slave D flip-flop. Answer on the answer sheet.
1. Draw the circuit diagram of a divide-by-two circuit by using only one master-slave JK flip-flop. Answer on the answer sheet.

Exercise 4 (6 points)

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

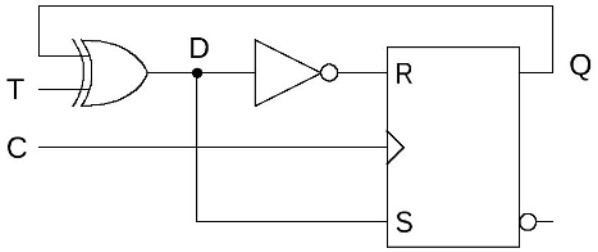


Figure 1

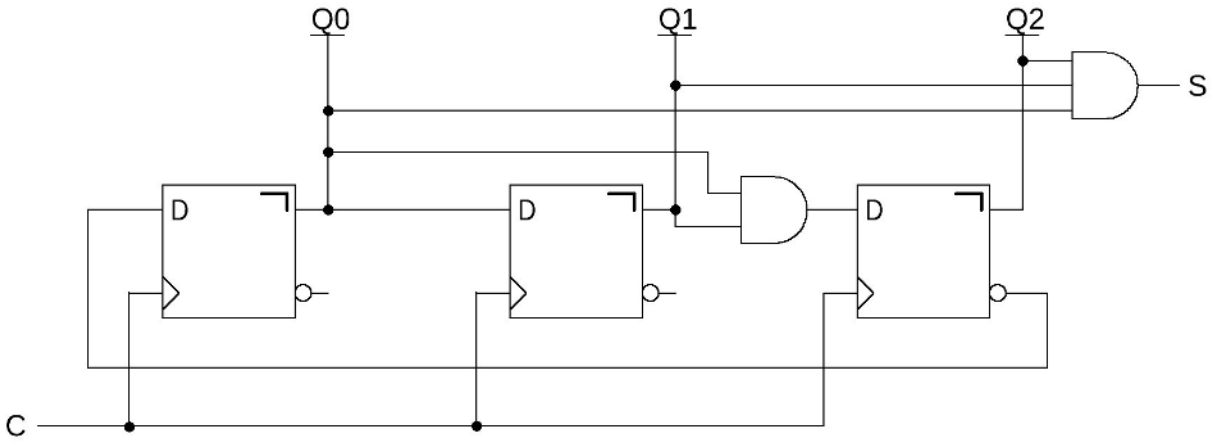


Figure 2

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

ANSWER SHEET

Exercise 1

1. $2EA_{16}$	6. 17 bits
2. 746_{10}	7. 17 bits
3. -278_{10}	8. 18 bits
4. $100\ 0000\ 0000_2$	9. 2^{28} bytes
5. $100\ 0000\ 0000_2$	10. 4 Gib

Exercise 2

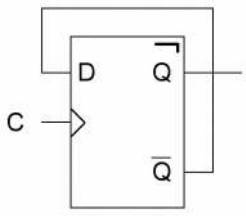
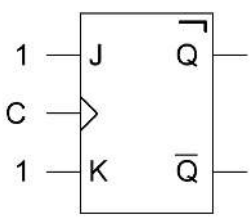
1.

Number	S	E	M
-532	1	10001000	00001010000000000000000
1.03125	0	01111111	00000100000000000000000
0.03125	0	01111010	00000000000000000000000

2.

IEEE-754 Representation	Associated Representation
4432000000000000_{16}	9×2^{65}
$FFF0000000000000_{16}$	$-\infty$
$7FF1000000000000_{16}$	NaN
$000FF00000000000_{16}$	255×2^{-1030}

Exercise 3

D Flip-Flop	JK Flip-Flop
	

Exercise 4

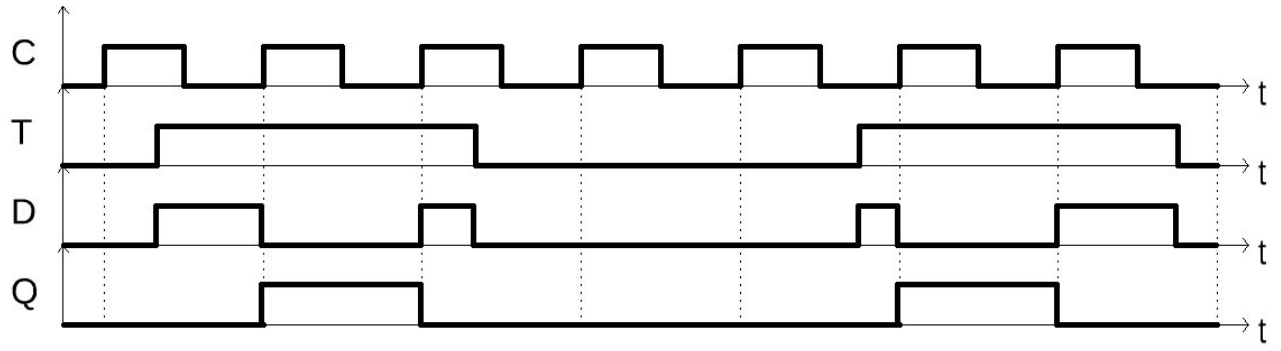


Figure 1

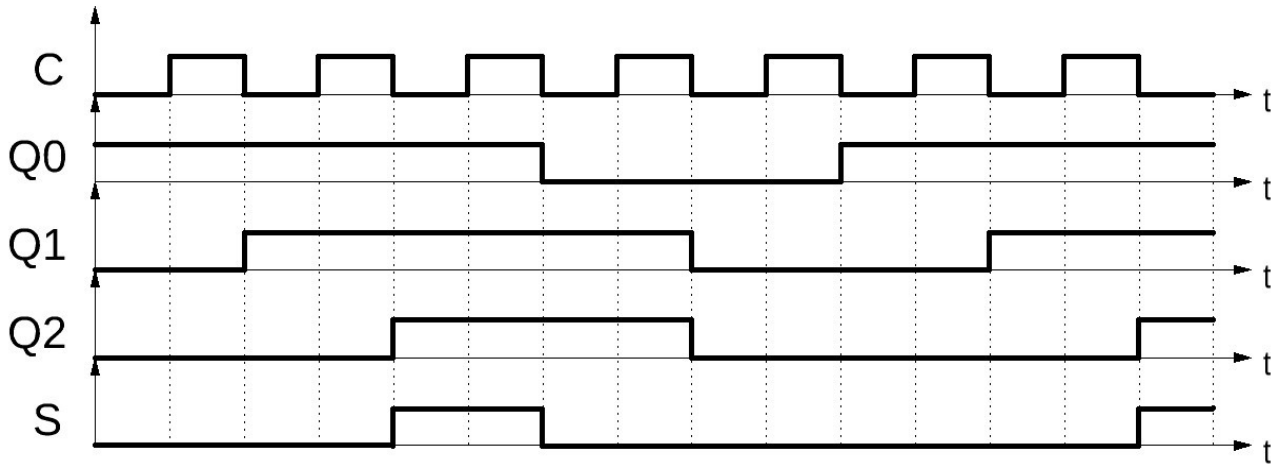


Figure 2

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