

# 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: **1011101010<sub>2</sub>**.

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: **2<sup>10</sup>**.
5. Write down the 10-bit binary representation of the following signed number: **-2<sup>10</sup>**.
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.

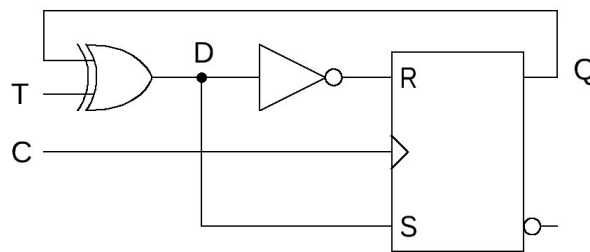


Figure 1

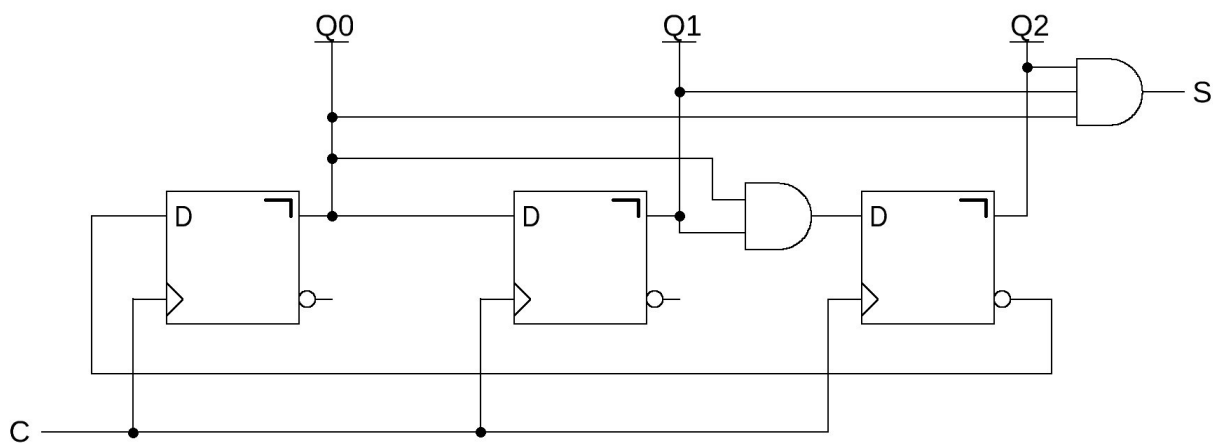


Figure 2

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**

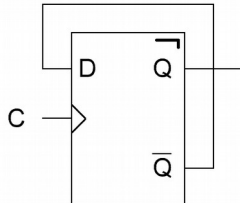
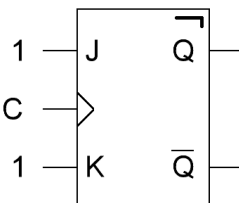
1.

Number	S	E	M
-532	1	10001000	000010100000000000000000
1.03125	0	01111111	000010000000000000000000
0.03125	0	01111010	000000000000000000000000

2.

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

**Exercise 3**

D Flip-Flop	JK Flip-Flop
	

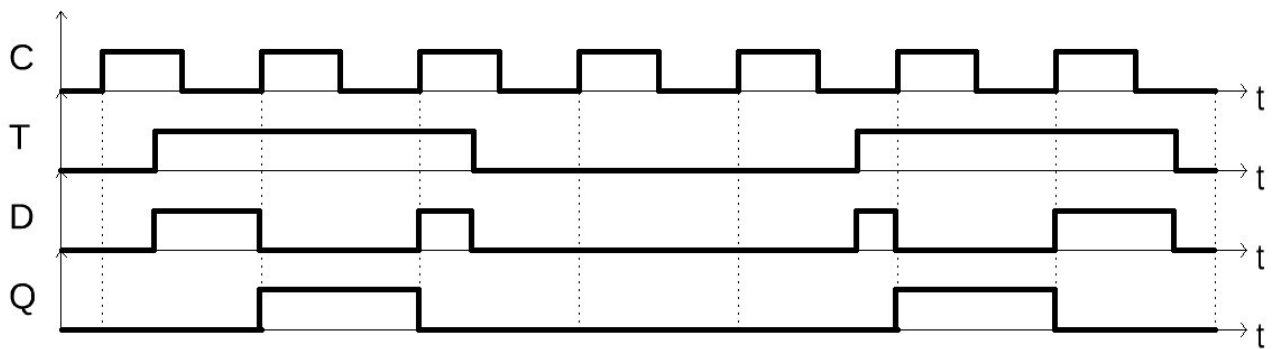
**Exercise 4**

Figure 1

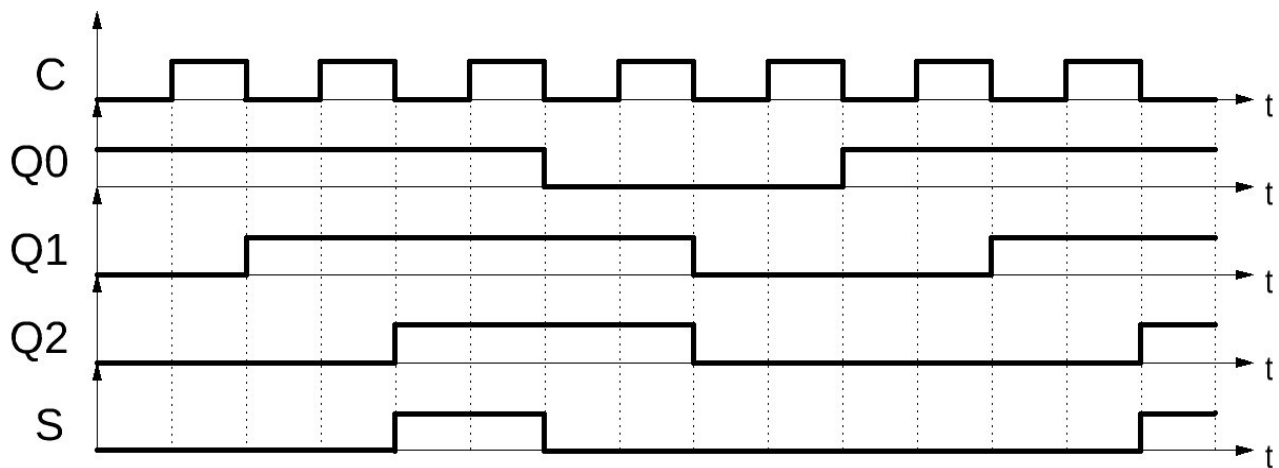


Figure 2

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