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 (9 points)

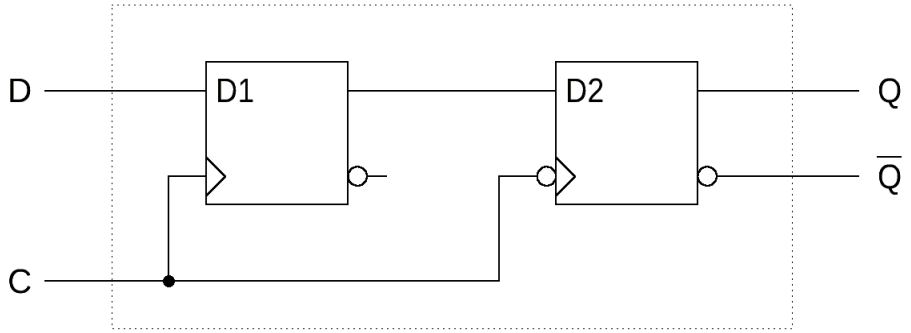
1. Convert the numbers given on the answer sheet into their **single-precision** IEEE-754 representations. Write down the final result in its **binary form** and specify the three fields.
2. Convert the **double-precision** IEEE-754 words given on the answer sheet into their associated representations. 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).

Answer the following questions for normalized numbers only and give the result in a power-of-two form.

3. For the single precision, what is the smallest number (greater than 0) which, when added to 16, gives a different result from 16?
4. For the double precision, what is the smallest number (greater than 0) which, when added to 2^{83}, gives a different result from 2^{83}?

Exercise 2 (3 points)

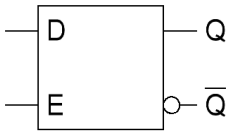
Let us consider the following circuit:



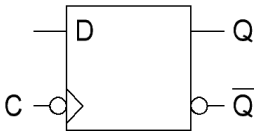
1. Complete the timing diagrams shown on the answer sheet (up to the last vertical dotted line).
2. If we consider the whole circuit as only one D flip-flop, what type of flip-flop is it?

Exercise 3 (2 points)

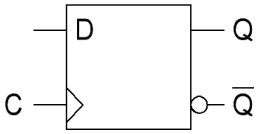
Give the type of each flip-flop below (answer on the answer sheet).



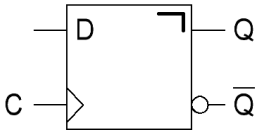
Flip-Flop 1



Flip-Flop 2



Flip-Flop 3



Flip-Flop 4

Exercise 4 (6 points)

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

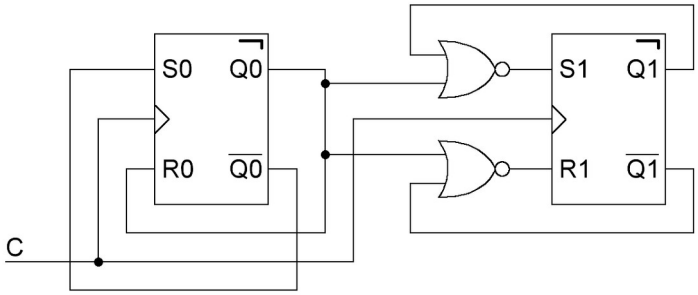


Figure 1

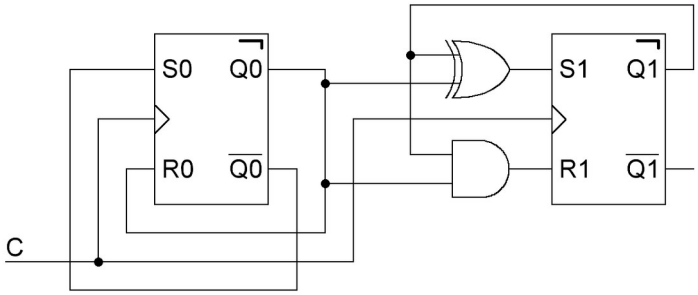


Figure 2

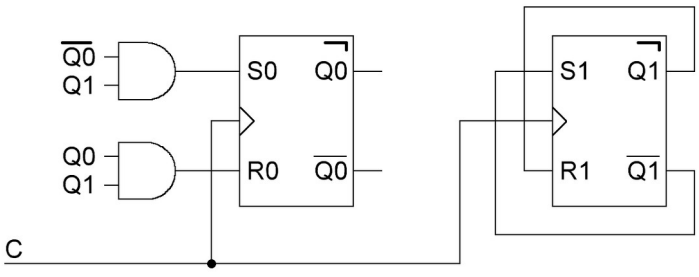


Figure 3

Family name: ..... First name: ..... Group: .....

ANSWER SHEET

Exercise 1

1.

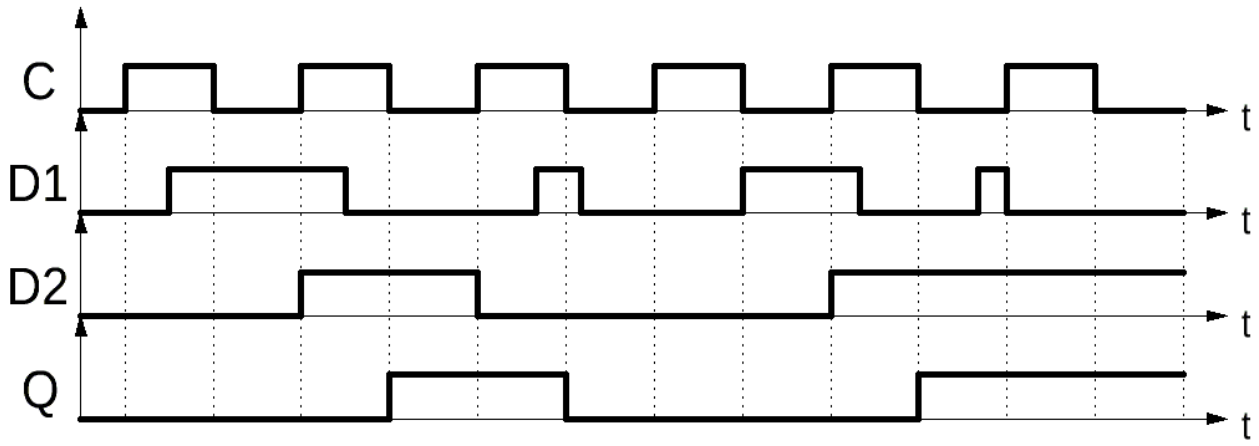
Number	S	E	M
483	0	10000111	11100011000000000000000
84.4375	0	10000101	01010001110000000000000
0.171875	0	01111100	01100000000000000000000

2.

IEEE-754 Representation (base 16)	Associated Representation
3A44 0000 0000 0000	5×2^{-93}
7FF0 0000 0000 0000	$+\infty$
000A D000 0000 0000	173×2^{-1030}
7FF1 0000 0000 0000	NaN

3. $\mathbf{2^{-19}}$	**4.** $\mathbf{2^{31}}$

Exercise 2



Type of flip-flop:

Master-slave D flip-flop

Exercise 3

Flip-Flop	Type of flip-flop
1	Gated D latch
2	Negative-edge-triggered D flip-flop
3	Positive-edge-triggered D flip-flop
4	Master-slave D flip-flop

Exercise 4

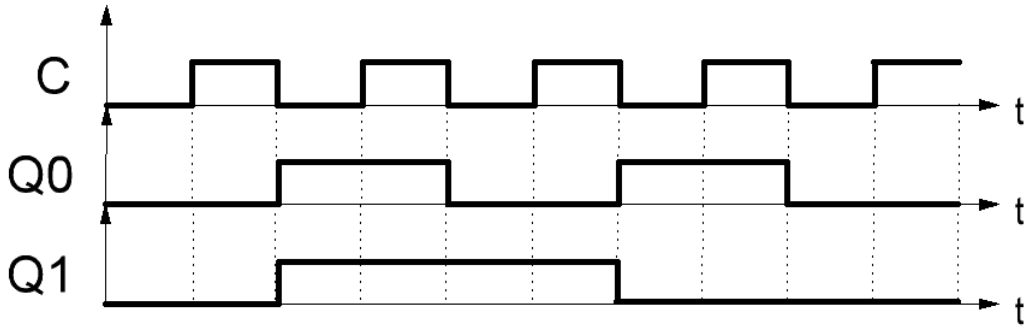


Figure 1

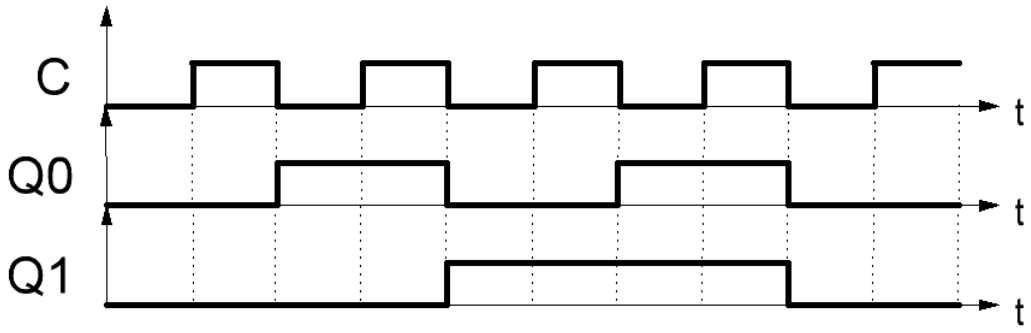


Figure 2

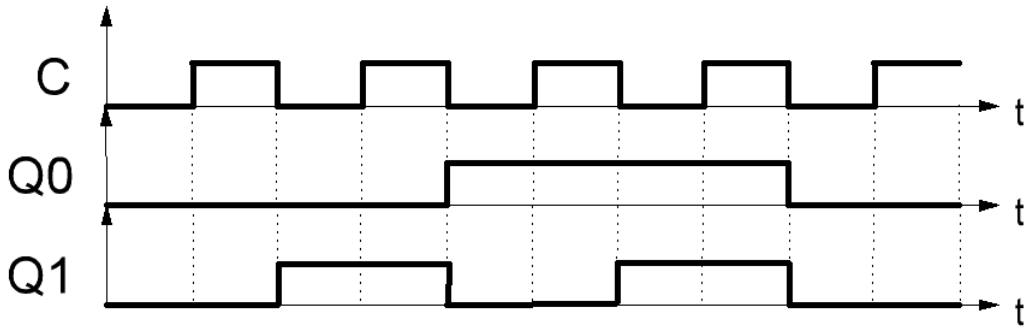


Figure 3