

# S2 – Examination 3

## 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 (7 points)**

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

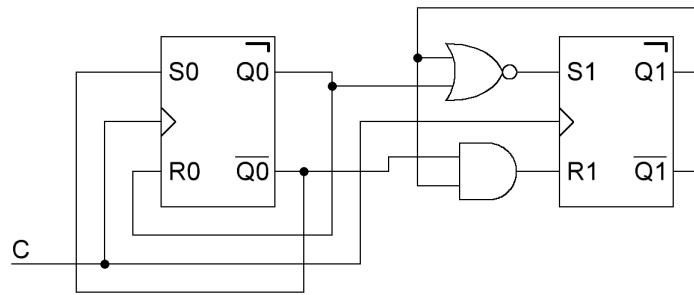


Figure 1

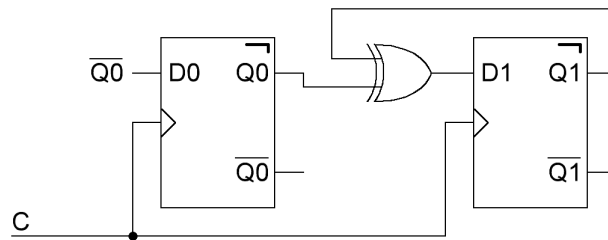


Figure 2

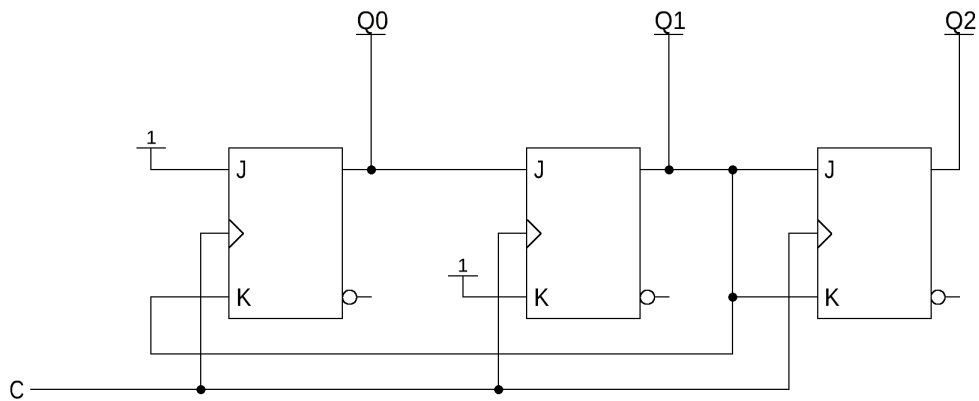


Figure 3

**Exercise 2 (6 points)**

The table shown on the answer sheet gives the sequence of a counter we want to design. This counter should be made up of JK flip-flops.

1. Complete the table shown on the answer sheet.
2. Write down the most simplified expressions of  $J$  and  $K$  for each flip-flop on the answer sheet. **Complete the Karnaugh maps (circles included) for the solutions that are not obvious.** An obvious solution does not have any logical operations apart from the complement (for instance:  $J_0 = 1$ ,  $K_1 = \overline{Q_2}$ ). **Do not use the EXCLUSIVE OR operator. No points will be given to an expression if its Karnaugh map is wrong.**

**Exercise 3 (4 points)**

The table shown on the answer sheet gives the sequence of a counter we want to design. This counter should be made up of D flip-flops.

1. Complete the table shown on the answer sheet.
2. Write down the most simplified expressions of  $D$  for each flip-flop. **Complete the Karnaugh maps for the solutions that are not obvious (circles included).** An obvious solution does not have any logical operations apart from the complement (for instance:  $D_0 = 1$ ,  $D_1 = \overline{Q_0}$ ). **Do not use the EXCLUSIVE OR operator. No points will be given to an expression if its Karnaugh map is wrong.**

**Exercise 4 (3 points)**

1. What is the circuit below (figure 4) ? Give the three following features:
  - Up or down counter.
  - Synchronous or asynchronous.
  - Value of the modulo.

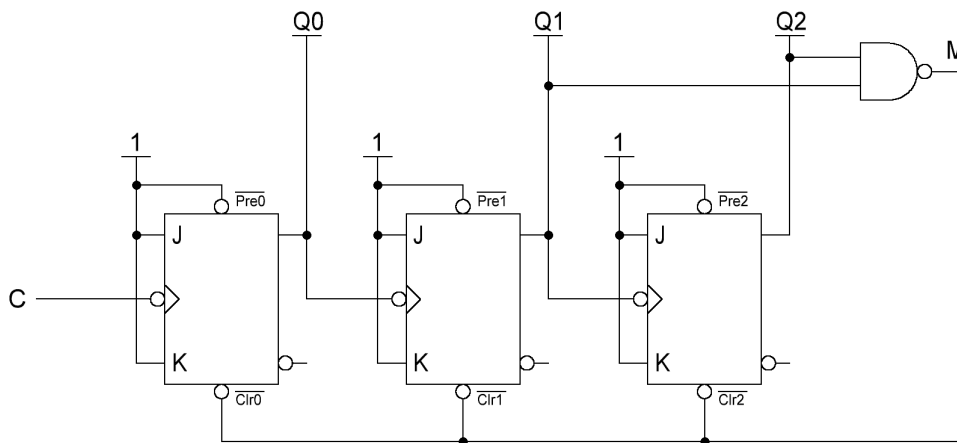


Figure 4

2. Wire the flip-flops (figure 5) in order to design a **modulo-14 asynchronous down counter**.

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

**ANSWER SHEET**

**Exercise 1**

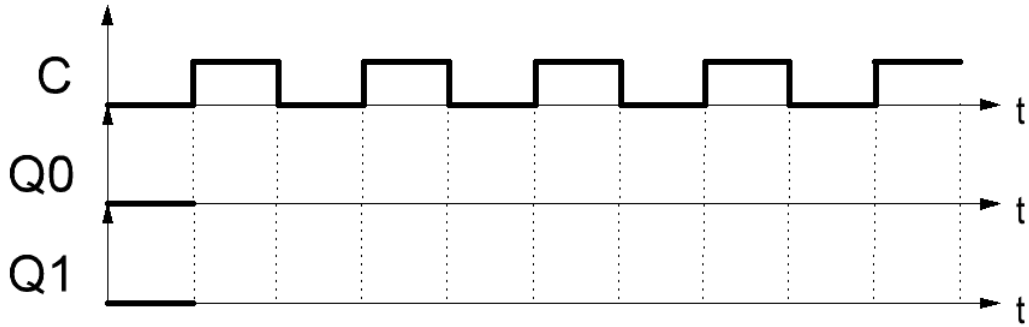


Figure 1

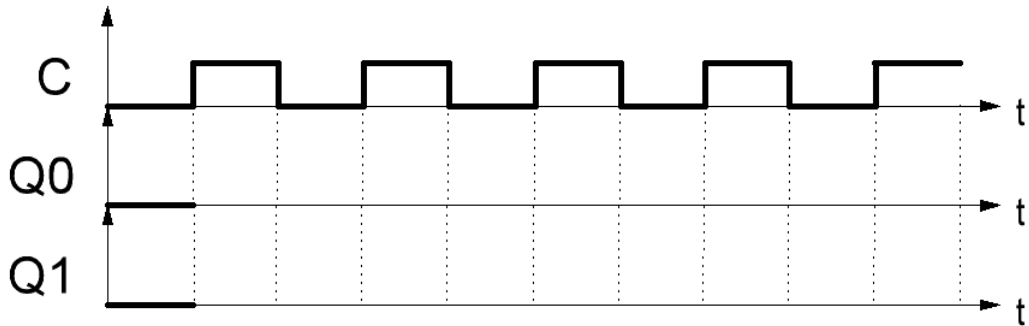


Figure 2

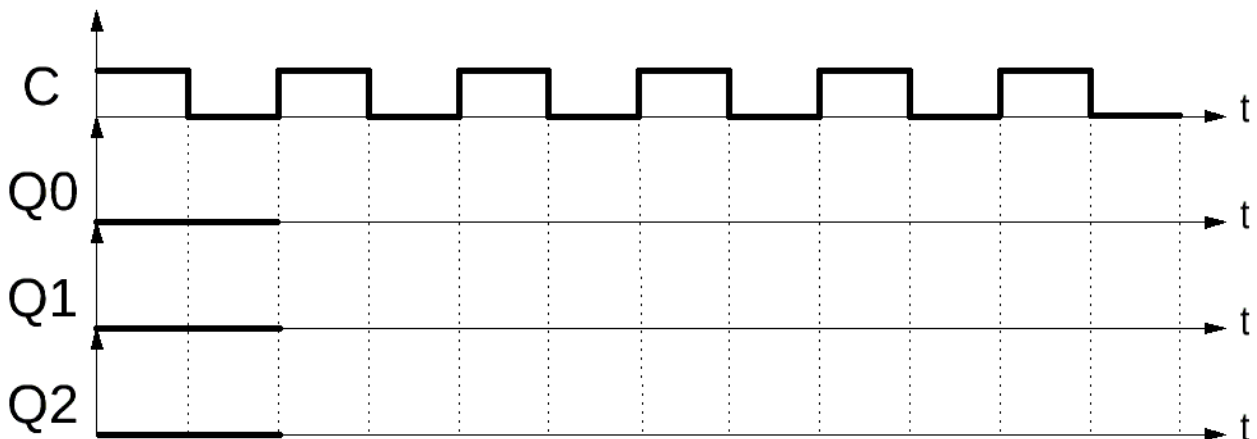


Figure 3

**Exercise 2**

Q2	Q1	Q0	J2	K2	J1	K1	J0	K0
1	1	1						
1	0	0						
1	0	1						
1	1	0						
0	1	0						
0	0	1						
0	1	1						

**Do not use Karnaugh maps for obvious solutions.**

		Q1 Q0				
		J0	00	01	11	10
Q2	0					
	1					

J0 =

		Q1 Q0				
		K0	00	01	11	10
Q2	0					
	1					

K0 =

		Q1 Q0				
		J1	00	01	11	10
Q2	0					
	1					

J1 =

		Q1 Q0				
		K1	00	01	11	10
Q2	0					
	1					

K1 =

		Q1 Q0				
		J2	00	01	11	10
Q2	0					
	1					

J2 =

		Q1 Q0				
		K2	00	01	11	10
Q2	0					
	1					

K2 =

**Exercise 3**

1.

Q2	Q1	Q0	D2	D1	D0
1	1	1			
1	1	0			
1	0	1			
1	0	0			
0	1	0			
0	0	1			
0	0	0			

2.

		Q1 Q0				
		D0	00	01	11	10
Q2	0					
	1					

D0 =

		Q1 Q0				
		D1	00	01	11	10
Q2	0					
	1					

D1 =

		Q1 Q0				
		D2	00	01	11	10
Q2	0					
	1					

D2 =

**Exercise 4**

1. Figure 4 :



2.

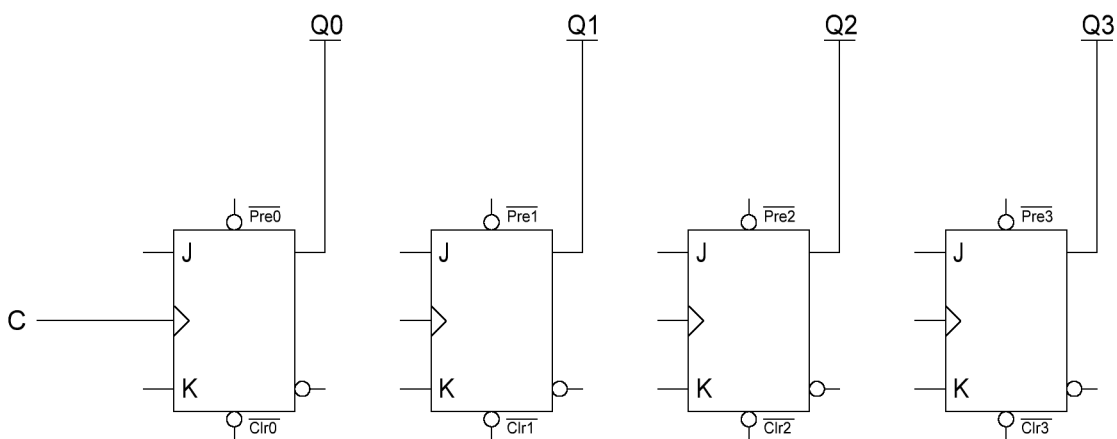
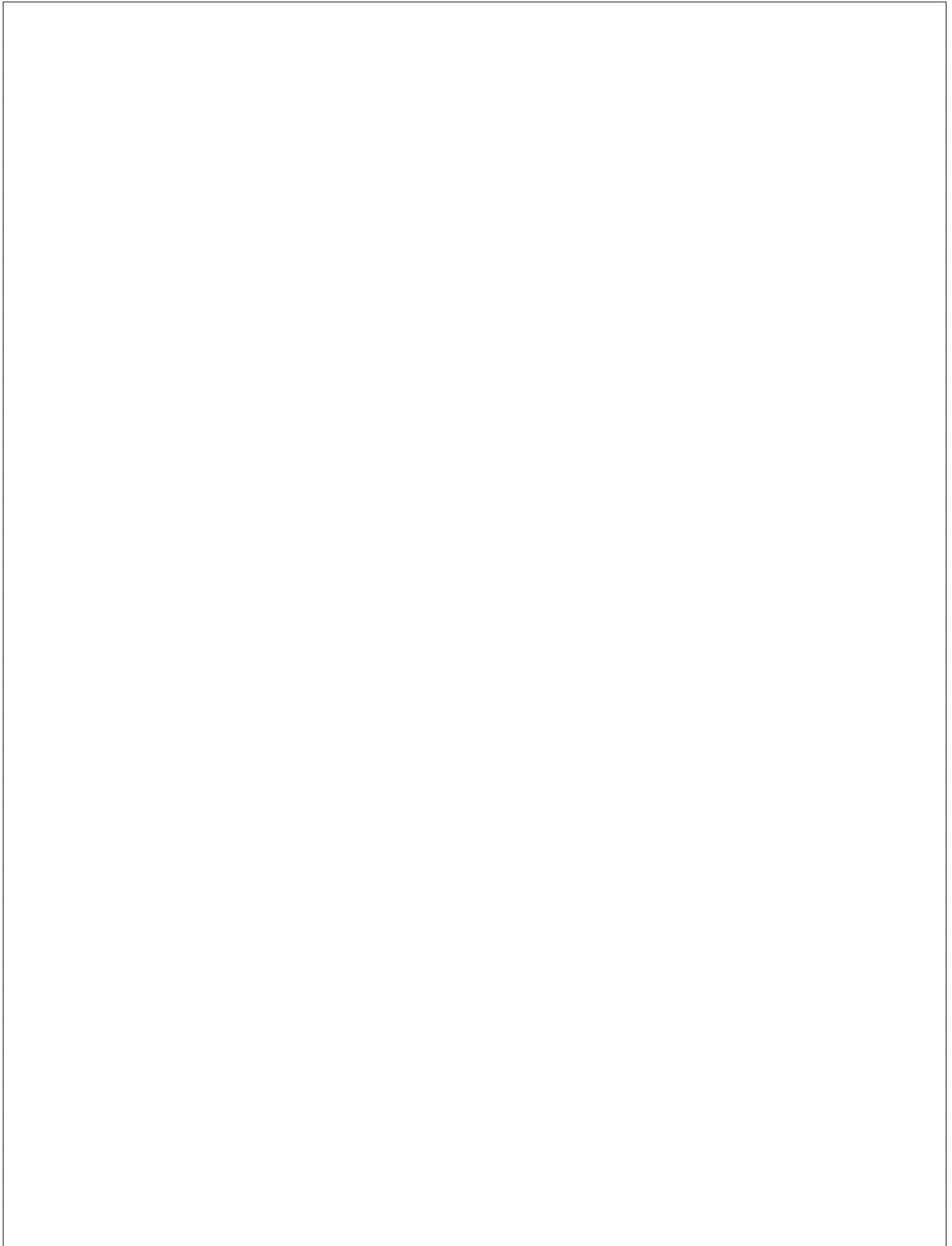


Figure 5

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

A large, empty rectangular box with a thin black border, occupying most of the page. It is intended for the student to write their answers to the exam questions.