

## Faculty of Computers and Artificial Intelligence Cairo University



## Midterm Exam

Program:

Computer Science / Software Engineering

Course Name: Course Code:

Computer Organization and Architecture CS331

Instructor(s):

Dr. Amin Allam

Date:

27/11/2021

Duration: Total Marks: 1 hour

20 marks

## تعليمات هامة

• حيازة التليفون المحمول مفتوحا داخل لجلة الامتحان يعتبر حالة غش تستوجب العقاب وإذا كان ضرورى الدخول بالمحمول فيوضع مغلقا في الحقائب · لا يسمح بنخول سماعة الأذن أو البلوتوث.

• لايسمع بدخول أي كتب أو ملازم أو أوراق داخل اللجنة والمخالفة تعتب حالة عث.

Exam consists of 20 multiple-choice questions in 3 pages. Each question weights 1 mark.

Record in the bubble sheet exactly ONE answer for each question.

Qa

⇒ Given the characteristic table of the JK flip-flop:

A1 :0

J	K	Q(t+1)
0	0	Q(t)
0	1	0
1	0	1
1	1	$\overline{Q(t)}$

For questions 1 to 4, consider an electronic circuit which consists of the following items:

A positive edge-triggered JK flip-flop with inputs: clock, J<sub>0</sub>, K<sub>0</sub>, and output: A<sub>0</sub>.

• Another positive edge-triggered JK flip-flop with inputs: clock,  $J_1$ ,  $K_1$ , and output:  $A_1$ .

Logic 1 is connected to both J<sub>0</sub> and K<sub>0</sub>.

A<sub>0</sub> is connected to both J<sub>1</sub> and K<sub>1</sub>.

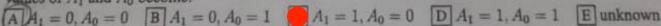
1 Assuming  $A_1 = 0$  and  $A_0 = 0$  while clock input is logic 0. After the clock input becomes logic 1, the values of A1 and A0 become:  $A_1 = 0, A_0 = 0$   $A_1 = 0, A_0 = 1$   $A_1 = 1, A_0 = 0$   $A_1 = 1, A_0 = 1$   $A_1 = 1, A_0 = 1$ 

$$A_1 = 0, A_0 = 1$$

$$C A_1 = 1, A_0 = 0$$

$$\boxed{\mathbf{D}}_1 = 1, A_0 = 1$$

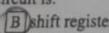
2 Assuming  $A_1 = 0$  and  $A_0 = 1$  while clock input is logic 0. After the clock input becomes logic 1, the values of  $A_1$  and  $A_0$  become:



$$D A_1 = 1, A_0 = 1$$

3 Assuming  $A_1 = 1$  and  $A_0 = 1$  while clock input is logic 0. After the clock input becomes logic 1, the values of A1 and A0 become:  $A_1 = 0, A_0 = 0$   $BA_1 = 0, A_0 = 1$   $CA_1 = 1, A_0 = 0$   $A_1 = 1, A_0 = 1$   $CA_1 = 1, A_0 = 1$   $CA_1 = 1, A_0 = 1$ 

4 The above circuit is:









Qb  $\Rightarrow$  A 4 × 1 multiplexer with selection inputs  $S_1$  and  $S_0$  selects input 0 when  $S_1S_0 = 00$ , selects input 1 when  $S_1S_0 = 01$ , selects input 2 when  $S_1S_0 = 10$ , and selects input 3 when  $S_1S_0 = 11$ . For questions 5 to 10, consider an electronic circuit which has: • Inputs:  $S_1$ ,  $S_0$ ,  $C_0$ , the binary number  $F = F_1F_0$ , and the binary number  $G = G_1G_0$ • output: the binary number  $V = V_1 V_0$ . The circuit consists of the following items: A 4 × 1 multiplexer with selection inputs S<sub>1</sub>, S<sub>0</sub>, and 4 inputs: Q<sub>0</sub>, Q<sub>1</sub>, Q<sub>2</sub>, Q<sub>3</sub>, and output: M<sub>0</sub>. Another 4 × 1 multiplexer with selection inputs S<sub>1</sub>, S<sub>0</sub>, and 4 inputs: R<sub>0</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and output: M<sub>1</sub>. A full-adder with inputs: F<sub>0</sub>, M<sub>0</sub>, C<sub>0</sub> and outputs: C<sub>1</sub> (carry), V<sub>0</sub> (sum). Another full-adder with inputs: F<sub>1</sub>, M<sub>1</sub>, C<sub>1</sub> and outputs: C<sub>2</sub> (carry), V<sub>1</sub> (sum). •  $G_0$  is connected to  $Q_0$ . •  $G_1$  is connected to  $R_0$ . •  $G_0$  is connected to  $Q_1$ . •  $G_1$  is connected to  $R_1$ . Logic 1 is connected to both Q2 and R2.
Logic 0 is connected to both Q3 and R3. 5 After  $S_1 = 0$ ,  $S_0 = 0$ ,  $C_0 = 0$ , the output V will equal to: AF+G BF-G CF+G+1 F-G-1 EF-G+16 After  $S_1 = 0$ ,  $S_0 = 0$ ,  $C_0 = 1$ , the output V will equal to: A F + G 7 After  $S_1 = 0$ ,  $S_0 = 1$ ,  $C_0 = 1$ , the output V will equal to:  $A F + G \quad B F - G$   $F + G + 1 \quad D F - G - 1 \quad E F - G + 1$ 8 After  $S_1 = 1$ ,  $S_0 = 0$ ,  $C_0 = 0$ , the output V will equal to: AF+G BF-G CF+1 F-1 EF

9 After  $S_1 = 1$ ,  $S_0 = 0$ ,  $C_0 = 1$ , the output V will equal to: AF+G BF-G CF+1 DF-1

After  $S_1 = 1$ ,  $S_0 = 1$ ,  $C_0 = 1$ , the output V will equal to: A F + G B F - G F + 1 D F - 1 E F

