

University of Asia Pacific (UAP)

Department of Computer Science & Engineering

Mid Term Examination

Year: 2nd year 2nd semester

Semester: Fall, 2020

Course no. CSE 209

Course title: Digital Logic & System Design

Credit: 4.0

Full Marks: 60

Time: 1 hour

Instructions:

1. There are **Three (3)** questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Discuss the universality of NOR gate. 05
b) Implement the following Boolean function with only NOR gate
$$y = AC' + A'B + B'C$$
 05
c) Implement the following function using K-map. 10
$$F(A, B, C, D) = \sum(0, 1, 2, 3, 6, 8, 10, 13, 14, 15)$$

OR

 - a) Draw the internal circuit of IC # 74293(Counter). 05
 - b) Design MOD 14 up counter using IC # 74293. 05
 - c) Design MOD 8 synchronous up/down counter using J-K flip-flop and briefly describe its operation. 10
2. a) Design a BCD adder using IC # 7483 (4-bit parallel adder) and NOR gates only. Briefly describe its operation. 10
b) Design MOD 10 Johnson counter using J-K flip-flop and briefly describe its operation. 10
3. a) Consider a counter circuit that contains eight JK FFs wired in the arrangement $Q_7Q_6Q_5Q_4Q_3Q_2Q_1Q_0$ 05
(i) Determine the counter's MOD number.
(ii) Determine the output frequency in KHz when the input clock frequency is 16 MHz.
(iii) What is the range of counting states for this counter?
(iv) Assume a starting state (count) of 01100111. What will be the counter's state after 1345 pulses?

b) A photo detector circuit is being used to generate a pulse each time a customer walks into a certain establishment. The pulses are fed to a seven-bit counter. The counter is used to count these pulses as a means for determining how many customers have entered the store. After closing the store, the proprietor checks the counter and finds that it shows a count of 0001101. He knows that this is incorrect because there were many more than thirteen people in his store. Assuming that the counter circuit is working properly.

(i) What could be the reason for the discrepancy?

(ii) How can you overcome from the discrepancy?

05

c) Design a logic circuit that follows the following requirements:

(i) Output X will equal to (C AND D) when A and B are the different.

(ii) X will remain HIGH when A and B are same.

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