

University Examinations 2012/2013

SECOND YEAR, SECOND SEMESTER, EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN COMPUTER TECHNOLOGY, COMPUTER SCIENCE AND BUSINESS
INFORMATION TECHNOLOGY

ICS 2205: DIGITAL LOGIC

DATE: DECEMBER 2012

TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions

QUESTION ONE – 30 MARKS

- With the aid of suitable diagrams, show how the NAND gate can be used to realize the other basic gates (AND, NOT, OR AND NOR). (6 Marks)
- Distinguish between synchronous and asynchronous counters. (4 Marks)
- Implement a simple PLA circuit for the Boolean functions given below: (8 Marks)
 $F(A,B,C)=\Sigma m(0,2,4,6)$
- What is the difference between a demultiplexer and a decoder? (2 Marks)
- In regards to flip flops, what is the race condition and how is it taken care of? (4 Marks)
- Distinguish between synchronous and asynchronous inputs in flip flops. (3 Marks)
- List three applications of flip flops. (3 Marks)

QUESTION TWO – 20 MARKS

- Simplify the given expressions. (6 Marks)
 - $F = \bar{A} \bar{B} \bar{C} + \bar{A} B C + \bar{A} B C + A B \bar{A}$
 - $F = XY + XZ + XYZ (XY + Z)$
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- Design and way demultiplexer and explain its operation. (4 Marks)
- Minimize the following logic function using k-maps and realize it using logic gates (6 Marks)
 $F(A,B,C,D) = \Sigma m(1,3,4,5,6,7,9,12,13)$ (6 Marks)
- With the aid of a suitable diagram and truth table, explain the operation of a clocked RS flip flop. (4 Marks)

QUESTION THREE – 20 MARKS

- a. The diagram shows a seven segment. Find the expression for the “b” segment, minimize it and implement it using logic gates. (10 Marks)
- b. What is a half adder? With the aid of a truth table and a suitable diagram, explain how a 4 bit full adder works and explain how this 4-bit adder can be used as a subtractor. (10 Marks)

QUESTION FOUR – 20 MARKS

- a. What are universal gates? Construct a logic circuit using NAND gates only for the expression.
 $x = A, (B + C)$ (8 Marks)
- b. Derive the expressions for a digital magnitude comparator capable of comparing two 4 –bit numbers and give the three outputs $A = B$, $A > B$ and $A < B$ (6 Marks)
- c. With the help of clocked SR flip flops and waveforms explain the working of a 4-bit SISO shift register. (6 Marks)

QUESTION FIVE – 20 MARKS

- a. With the help of clocked JK flip flops and waveforms, explain the working of a three bit binary ripple down counter. (10 Marks)
- b. Draw the circuit of a TTL NAND gate and explain its operation in brief. (6 Marks)
- c. With reference to logic families, define:
- i. Propagation delay (2 Marks)
 - ii. Power consumption (2 Marks)