



UNIVERSITY OF GHANA

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SCHOOL OF ENGINEERING SCIENCES
SECOND SEMESTER EXAMINATIONS: 2016/2017
LEVEL200: BACHELOR OF SCIENCE IN ENGINEERING
CPEN 202: COMPUTER SYSTEM DESIGN [2 CREDITS]

TIME ALLOWED: TWO (2) HOURS

INSTRUCTION:

Answer **ANY FIVE (5)** questions

1.

- a) Implement the circuit with the following function:
$$g(x_1, \dots, x_5) = \sum m(0, 1, 2, 4, 5, 8, 14, 15, 16, 18, 20, 24, 26, 28, 31) + D(10, 11, 12, 27).$$
 [8 marks]
- b) Redesign the circuit using *NAND-Gates* only. [4 marks]
- c) Write a VHDL code to implement your design. [8 marks]

2.

- a) Explain the usefulness of a 74F85 4-bit comparator chip. [2 marks]
- b) Draw the IEC/IEEE symbol of 74F85 4-bit comparator chip. [3 marks]
- c) Draw the 4-bit magnitude comparator logic diagram. [5 marks]
- d) Write a VHDL code to implement 2(a) above. [8 marks]
- e) Explain how you would achieve more 4-bit comparators. [2 marks]

3.

- a) From first principles, design a full Adder. [5 marks]
- b) Illustrate how a 4-bit full Adder may be constructed. [5 marks]
- c) Write a VHDL code to implement an 8-bit full Adder. [10 marks]

4.

- a) Clearly draw and label the general block diagram of a synchronous sequential machine. [4 marks]
- b) Design the circuit for a sequential machine to detect 1010. [15 marks]
- c) Name the type of sequential machine you have designed. [1 mark]

5.

- a) With the help of specific diagrams explain hazard in systems design. [3 marks]
- b) Explain how a stuck-at-fault may be overcome. [3 marks]
- c) Using K-map or otherwise deduce how an extra component may help solve a typical design fault. [4 marks]
- d) Find a hazard-free minimum cost implementation of the function:
$$f(x_1, \dots, x_5) = \sum m(1, 4, 5, 11, 17, 28) + D(10, 12, 14, 15, 20, 31).$$
 [10 marks]

6.

- a) Differentiate between synchronous and asynchronous sequential circuits. [5marks]
- b) Design an asynchronous sequential circuit from the function $AB + By = Y$ using *NAND-Gates* only. [10 marks]
- c) State any two (2) disadvantages of asynchronous circuits, and with the aid of a suitable diagram explain how they can be avoided. [5 marks]