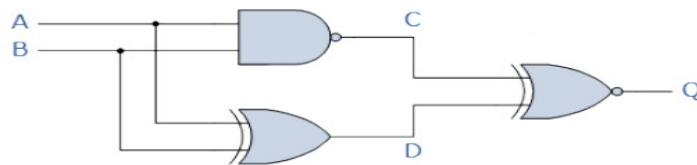# CHUKA UNIVERSITY
SECOND YEAR FIRST SEMESTER EXAMINATIONS FOR BACHELORS OF COMPUTER SCIENCE

COSC 211: DIGITAL ELECTRONICS

SECTION A (COMPULSORY)
QUESTION 1(COMPULSORY) [30 MARKS]

a) Using a circuit diagram, explain the operation of a full substractor.   (6marks)

b) With the help of a circuit diagram, describe what we mean by a combinational circuit.   (4marks)

c) Below is a circuit. Use it to answer the questions that follow:-

   i)   Write the truth table of the circuit above   (4marks)
   ii) From the truth table, can the circuit be minimized? If so draw the minimized circuit.   (2marks)
   iii) Explain a benefit of simplifying digital circuits   (1mark)

d) Outline FOUR differences between digital and analogue electronics (4marks)

e) Explain FOUR characteristics of a shift register   (4marks)

f) Prove that the following equations are the same.   (5marks)

$$ABC + A\overline{B} \cdot (\overline{\overline{A}\ \overline{C}}) = A(\overline{B} + C)$$

SECTION B (Answer **two question** from this section)
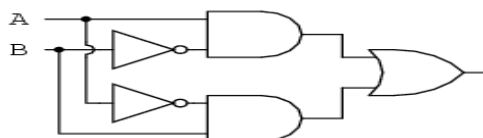
QUESTION 2 [20 MARKS]

a) Distinguish between sequential access and direct access methods of storage devices, naming an example in each case.   (4marks)

b) With reference to the following SOP

$$Z = f(A, B, C) = \overline{A}B + B\overline{C} + BC + A\overline{B}\overline{C}$$

   i)   Minimize above equation using Karnaugh Map   (4marks)
   ii)   Minimize the above equation using Boolean laws   (4marks)
   iii) Write the resultant truth table of the minimised circuit   (3marks)
   iv)   Draw the resultant circuit   (2marks)

c) Draw a circuit that is minimal and equivalent to the circuit below (show the processes).   (3marks)

QUESTION 3 [20 MARKS]

a) Draw the diagram and the truth table of an SR flip flop   (4marks)

b) Name FOUR computer ports, hence explain their functions in a digital computer
                                                                                    (4marks)

c) Below is un-minimised circuit. Use it to answer the questions below: -
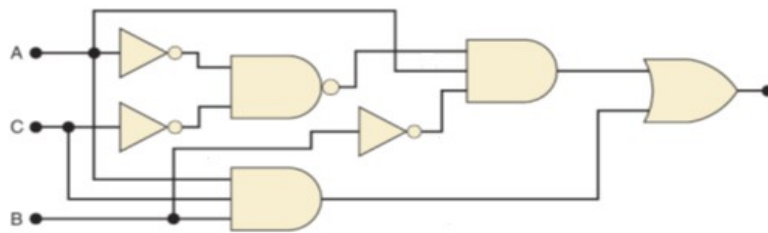

    i) Simplify the above circuit (show the simplification process)   (5marks)

    ii) Draw a resultant circuit after the simplification.   (2marks)

d) With the help of a diagram, explain the process of recording data on a magnetic tape
                                                                                    (5marks)

QUESTION 4 [20 MARKS]

a) Design a simple circuit incorporating three LEDs, such that each one of the three LEDs lights when inputs 00, 01 and 11 respectively are applied on the circuit's inputs A and B. (Hint. show the truth table but do not minimize circuit)   (4marks)

b) Explain four basic types of registers found in a computer CPU   (4marks)

c) Explain THREE classification of combinational logic circuits, giving an example in each case.   (6 marks)

d) Using a Boolean logic example in each case, explain the following laws: -
    i)   Adsorption   (2 marks)
    ii)   Consensus theorem   (2 marks)
    iii)   Idempotent   (2 marks)

QUESTION 5 [20 MARKS]

a) With the help of a Truth table, draw the circuit diagram and explain the working operation of a PIPO shift register.   (9marks)

b) Minimize the logic circuit below, and draw the minimised circuit (answer in POS)
$$Y = (A+B) (A+\bar{B}+C) (\bar{B}+C)$$ (3 marks)

c) Use the circuit below to answer the following questions
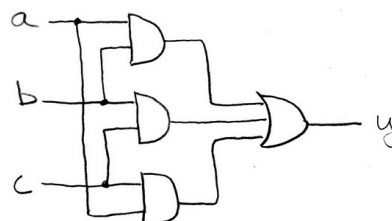
    i)   Write output y in terms of a, b and c   (2marks)
    ii)   Draw a truth table of the circuit above.   (3marks)
    iii)   Draw electrical timing diagram of the resultant circuit (3marks)