PART B [15 MARKS]

Instruction: Answer all questions. You must show all necessary working clearly.

1. Convert the logic circuit in Figure 1 to logic circuit using 2-input NOR universal gates only. [2.5 marks]

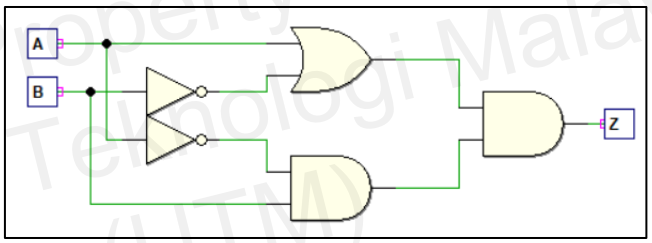

Figure 1

2. Convert the logic circuit in Figure 2 to logic circuit using basic gates (AND, OR, NOT) only. [5 marks]

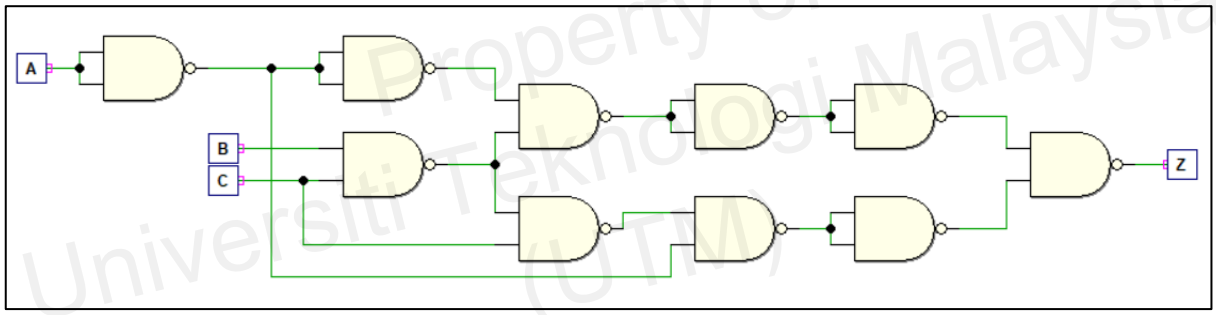

Figure 2

3. Simplify expression F using Boolean Algebra rules. [2.5 marks]

$$F = (A + B)\,\bar{B} + (A + B)(\bar{A} + \bar{B})$$

4. Simplify expression X using De Morgan theorem and Boolean Algebra rules. [5 marks]

$$X = \overline{(B\bar{C} + C) + (B + \bar{B}E + D)}$$

PART C [20 MARKS]
Instruction: Answer all questions. You must show all necessary working clearly.

Figure 1 shows a schematic diagram of an LED array light. You are required to design a combinational logic circuit to be embedded into the Circuit Box.

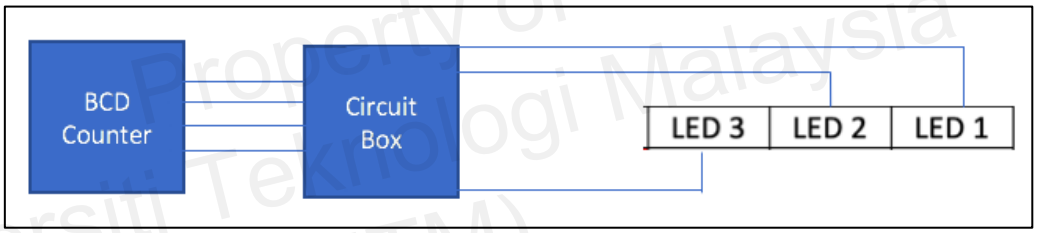

Figure 1

The Circuit Box receives a BCD sequence from a BCD counter as its input, and then lit the LED array according to Table 1.

Table 1

Decimal	LED 3	LED 2	LED 1
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			

Legend:
Active High LED is OFF
Active High LED is lit

You are required to:

1. Produce the truth table that defines the function of the Circuit Box. [9m]

2. Derive the simplified SOP Boolean equation of LED1, LED2 and LED3 using K-Map. [6m]

3. Sketch the combinational logic circuit of the Circuit Box using basic gates only. [5m]