

## **SC1005 Digital Logic Tutorial 4**

### **Combinational Logic**

1. Given the following truth table, determine:
  - a. The canonical sum-of-minterms expression
  - b. The minimum cost sum-of-products (SOP) expression from (a) using algebraic manipulation.
  - c. The canonical product-of-maxterms expression
  - d. The minimum cost product-of-sums (POS) expression from (c) using algebraic manipulation.
  - e. The NAND gate only implementation of the minimum cost SOP expression.
  - f. The NOR gate only implementation of the minimum cost POS expression.
  - g. That the two expressions in (b) and (d) are identical using algebraic manipulation.

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

## **Karnaugh maps**

2. Simplify the following expressions using Karnaugh map:

(a)  $X = AB'D' + A'BC'D + A'BCD + A'B'D'$

(b)  $Y = (P+Q'+R+S')(P+Q'+R'+S')(P'+Q'+R+S')(P'+Q'+R'+S')$

3. Simplify the Boolean function F together with the don't care condition d, using the K-map method. Give your answer in SOP.

$$F(A, B, C, D) = \sum m(0, 5, 6, 8, 14)$$

$$d(A, B, C, D) = \sum m(2, 7, 15)$$

4. Repeat Question 3. Give your answer in POS.

## **Answers**

1.

- a.  $F_{\text{SOP}} = A'B'C + A'BC + AB'C' + ABC' + ABC$
- b.  $F = AB + A'C + AC'$
- c.  $F_{\text{POS}} = (A+B+C).(A+B'+C).(A'+B+C')$
- d.  $F = (A+C).(A'+B+C')$
- e.  $F = ((AB)'. (A'C)'. (AC')')'$
- f.  $F = ((A+C)' + (A'+B+C')')'$

2. (a)  $X = B'D' + A'BD$

(b)  $Y = Q' + S'$

3. (a)  $F = BC + A'BD + B'C'D'$

(b)  $F = (A'+D')(B+D')(B+C')(B'+C+D)$