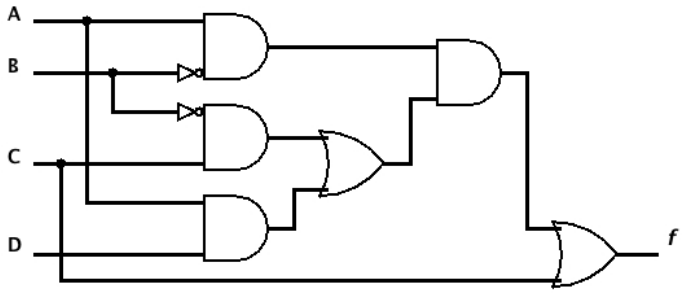
Digital Systems

Representation and simplification of functions

1. Using gates AND, OR and NOT, draw the simplified functions that you obtained in exercise 2 of from exercise sheet 3 – "Binary functions and Boole algebra".

2. Given the following logical circuit:



   (a) Define the function $f(A, B, C, D)$

   (b) Simplify the function

   (c) Draw the logical circuit of the simplified function

3. For the function defined in exercise 5 of exercise sheet 3 – "Binary functions and Boole algebra", draw the logical circuit using:

   (a) gates AND, OR and NOT

   (b) gates NAND

   (c) gate NOR

4. Consider the following truth table

A	B	C	$f(A,B,C)$
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

   (a) Write the function $f(A,B,C)$ in the canonical form AND-OR, using the decimal simbology

   (b) Represent the function using a Karnaugh map

   (c) Use the map to simplify the function in the form AND-OR

   (d) Use the map to simplify the function in the form OR-AND

5. Using Karnaugh maps, simplify the following functions using the forms AND-OR and AND-AND:

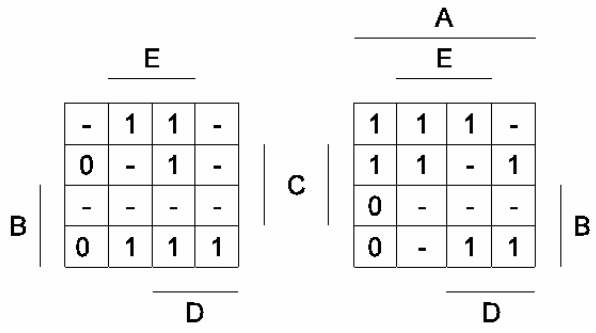
   (a) $F(A,B,C,D) = \sum m(4,5,8,12,13,14,15)$

   (b) $F(A,B,C,D) = \prod M(2,3,6,7,10,12,13,14)$

   (c) $F(A,B,C,D) = (A + \overline{B} + C) \cdot (\overline{A} + D) \cdot (B + C + \overline{D})$

   (d) $F(A,B,C,D) = \overline{A}\ C\ \overline{B} + A\ D + B\ \overline{D} + C\ \overline{D} + A\ \overline{C} + \overline{A}\ \overline{B}$

6. Interpret the following Karnaugh map and simplify the function using the forms AND and OR-AND:



7. Using the "bridging" method, implement the function $F(A,B,C) = \prod(1,4,5,6)$, using as component the function $G(A,B,C) = A\ \overline{B} + B\ C$.