a) $f(x,y,w) = \sum m(۰,۲,۴,۵)$

$w'x' + xy'$

w \ xy	00	01	11	10
0	1	1	0	1
1	0	0	0	1

b) $f(y,w,x) = \sum m(0,۲,۴,۵)$

$x'y' + yw'$

x \ yw	00	01	11	10
0	1	1	0	1
1	0	0	0	1

c) $f(x,y,w,z) = xy + x'w'z + x'y'z'$

$xy + x'w'z + x'y'z'$

wz \ xy	00	01	11	10
00	1	0	1	0
01	1	1	1	0
11	0	0	1	0
10	1	0	1	0

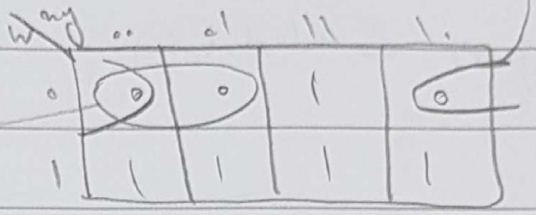
d) $f(x,y,w) = xy + x'w'$

w \ xy	00	01	11	10
0	1	1	1	0
1	0	0	1	0

e) $f(x,y,w,z) = (x+y+w).(x'+y'+z)(x+y'+z)(x'+y+z')$

wz \ xy	00	01	11	10
00	0	0	0	1
01	0	1	1	0
11	1	1	1	0
10	1	0	0	1

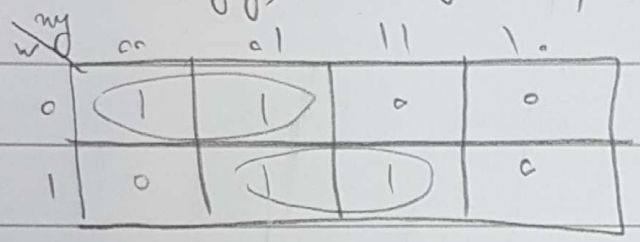
d) $f(x,y,w) = (x+w)(y+w)$



a) $f(x,y,w) = \sum m(0,2,3,5)$

$x'y'w' + x'yw' + x'yw + xyw = xw' + yw$

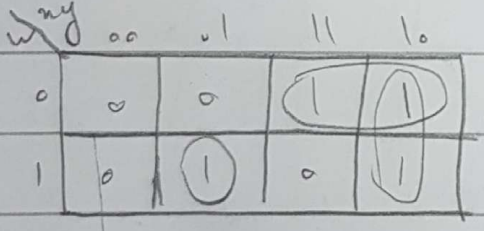
$xw'(y+y')$ $\quad$ $yw(x+x')$



$\rightarrow x'w' + yw$

b) $f(x,y,w) = \sum m(2,3,0,4)$

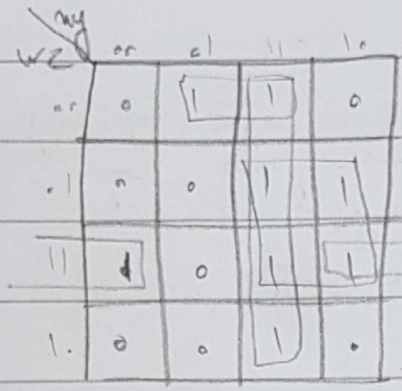
$x'yw + xy'w' + xy'w + xyw' = x'yw + xy' + xyw' = x'yw + xy' + xw'$



$x'yw + xy' + xw'$

c) $f(x,y,w,z) = \Pi M(0,1,5,2,8,4,7,10) = (x+y+w+z)(x+y+w+z')(x+y+w'+z)(x+y+w'+z')$
$\cdot (x+y'+w+z')(x+y'+w'+z)(x'+y+w+z)(x'+y+w'+z) = (x+y+w)(x+y+w')(x'+y+z)$
$(x+y'+w'+z)(x+y'+w+z') = (x+w+yz')(x+w'+yz)(x'+y+z) =$
$x'ywz + x'yw'z' + xy + xyw' + xyz + xyw + xyz' + yw'z' + xz + xw'z + xyz + xwz + ywz$
$= x'ywz' + xy + xz + xw'z + xwz + ywz = yw'z' + xy + xz + y'wz$

TAT



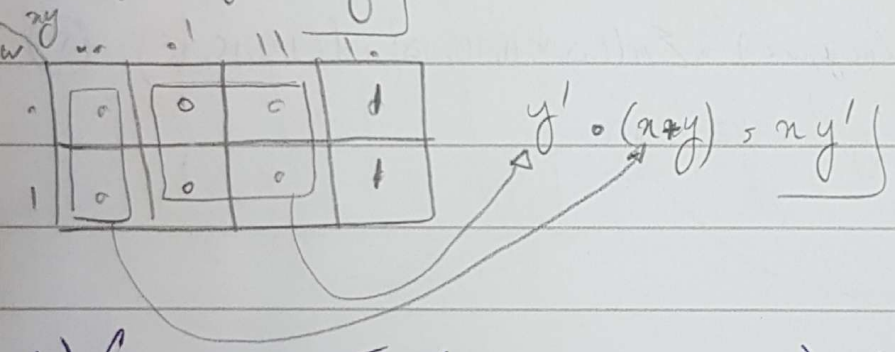
$= y'wz + xz + xy + yw'z'$

d) $f(x,y,w) = \prod M(0,1,5,6,9,11)$ $\rightarrow$ $(x+y+w)(x+y+w')(x+y'+w)(x+y'+w')(x'+y'+w)$

$(x'+y'+w') = (x+xy+xw'+yx+y+yw'+xw+yw)(x+xy'+xw'+xy'+y'+y'w'+xw+y'w)$

$(x'+x'y'+x'w'+x'y'+y'+y'w'+x'w+y'w) = (x+y)(x+y')(x'+y') = (x+y')(xy'+x'y)$

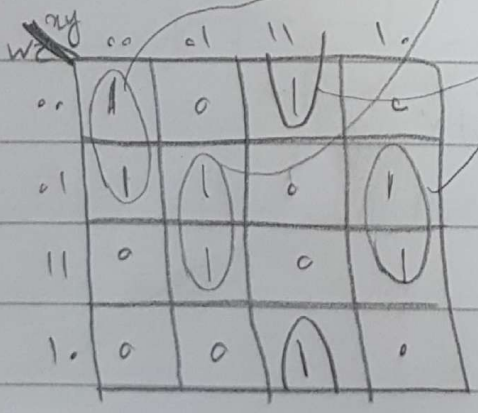
$= xy' + xy' = xy'$



$y' \cdot (x+y) = xy'$

e) $f(x,y,w,z) = \sum m(0,1,2,5,9,11,15,14) = x'y'z'w' + x'y'w'z + x'yw'z + x'ywz + xyw'z + xyw'z$

$+ xyw'z' + xywz' = x'y'w' + x'yz + xy'z + xyz'$



$x'y'w' + x'yz + xy'z + xyz'$

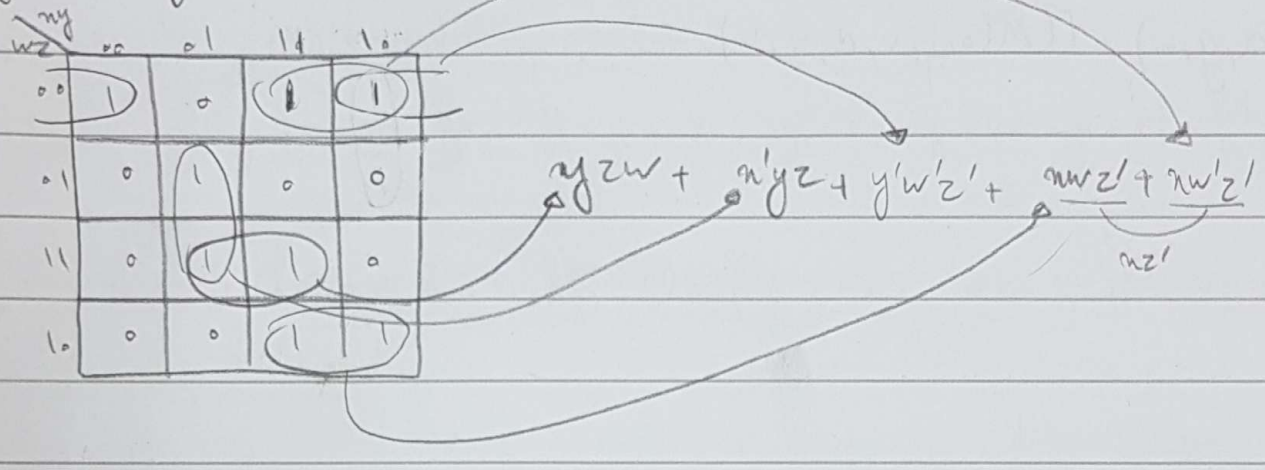
$f(x,y,w,z) = \sum m(0,2,4,5,10,12,13,15) = x'y'w'z' + x'yw'z + x'ywz + xyw'z' + xy'wz' + xywz'$

$+ xywz' + xywz = x'y'w'z' + ywz + xy'z' + xyz' = x'ywz + x'y'wz' + ywz + xz'$

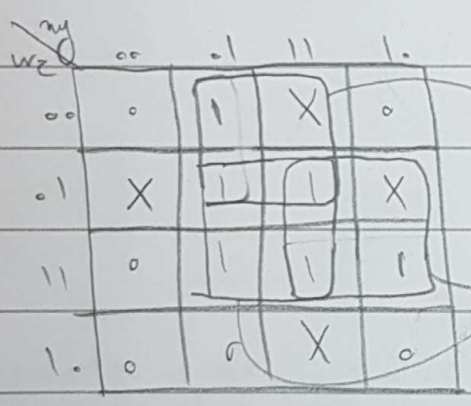
$yz(w + xw') \quad z'(x + x'(yw'))$

$w + x' \quad x + y'w'$

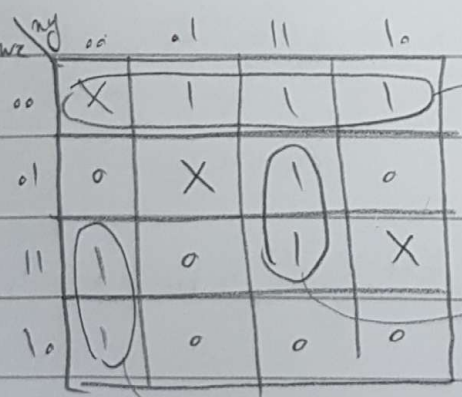
$= yzw + x'yz + xz' + y'w'z'$



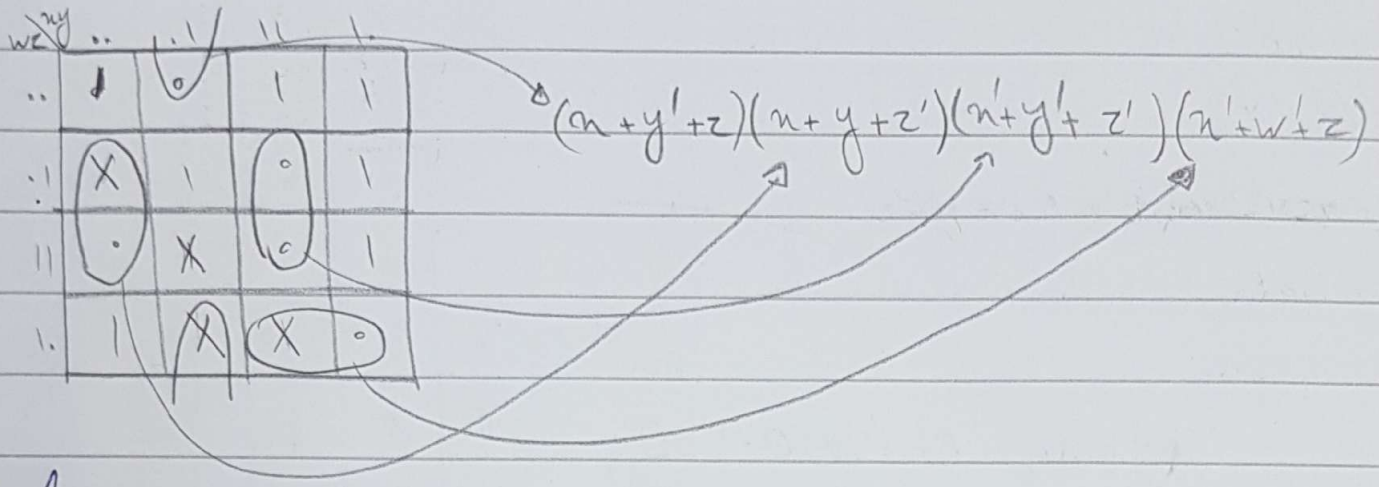
a) $f(x,y,w,z) = \sum m(2,3,4,11,12,13) + d(1,9,15,14)$ (٢)



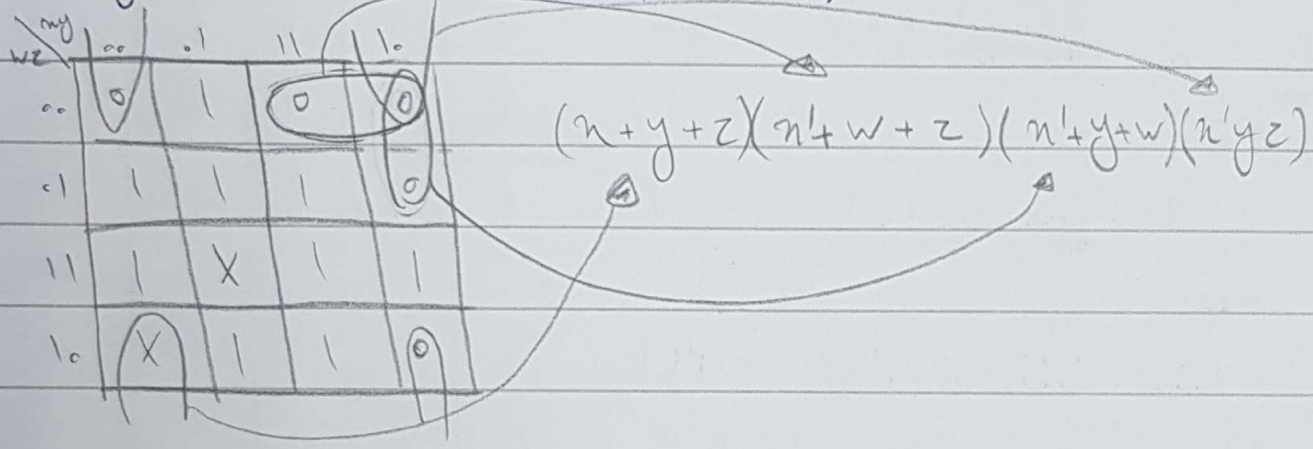
B1 b) $f(x,y,w,z) = \sum m(2,6,7,11,12,13,14) + d(0,3,11)$



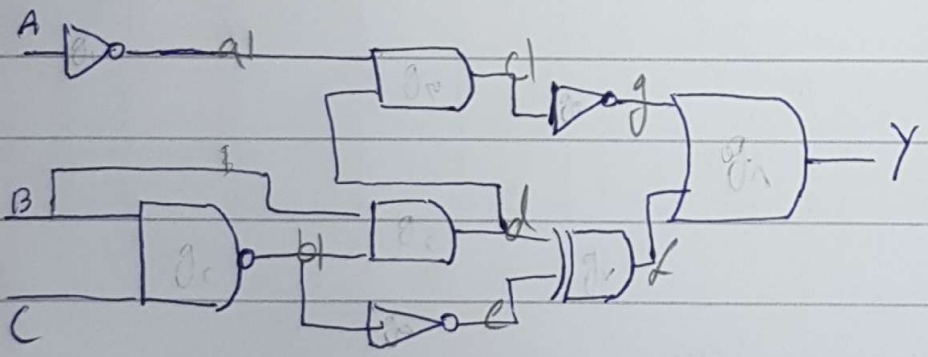
c) $f(x,y,w,z) = \prod M(5,6,10,13,15).\ D(4,11,12,14)$



d) $f(x,y,w,z) = \prod M(0,1,3,9,10,12).\ D(5,14)$



(3)




```
module circuit_one(A, B, C, Y);
input A, B, C;
output Y;
wire a1, b1, c1, d, e, f, g;

not #(1) (a1, A);
nand #(2) (b1, B, C);
not #(1) (e, b1);
and #(2) (d, b1, B);
and #(2) (c1, d, a1);

not #(1) (g, c1);
xor #(2) (f, d, e);
or #(2) (Y, g, f);
endmodule
```

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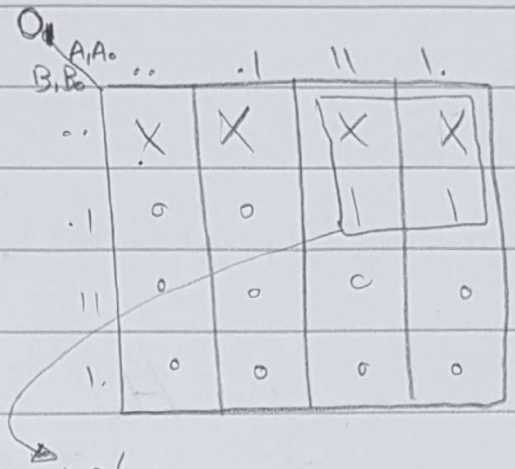
```
module circuit
reg A,B,C;
wire Y;
circuitcall(A,B,C,y);
initial
  begin
    A=1'b0; B=1'b0; C=1'b0;
  #20
    A=1'b0; B=1'b0; c=1'b1;
  #20
    A=1'b0; B=1'b1; C=1'b0;
  #20
    A=1'b0; B=1'b1; C=1'b1;
  #20
    A=1'b1; B=1'b0; C=1'b0;
  #20
    A=1'b1; B=1'b0; C=1'b1;
  #20
    A=1'b1; B=1'b1; C=1'b0;
  #20
    A=1'b1; B=1'b1; C=1'b1;
  #20 $finish;
end
endmodule
```

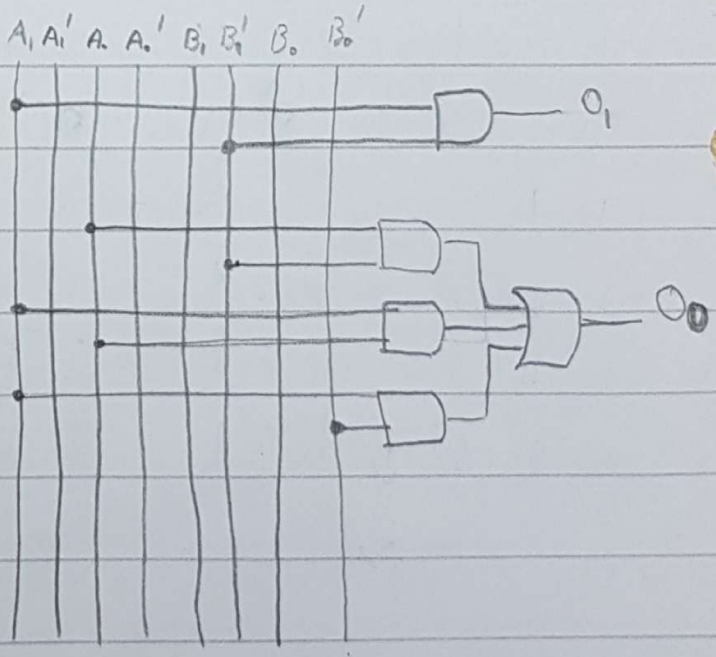
TAT

A_1	A_0	B_1	B_0	O_1	O_0
0	0	0	0	X	X
0	0	0	1	0	0
0	0	1	0	0	0
0	0	1	1	0	0
0	1	0	0	X	X
0	1	0	1	0	1
0	1	1	0	0	0
0	1	1	1	0	0
1	0	0	0	X	X
1	0	0	1	1	0
1	0	1	0	0	1
1	0	1	1	0	0
1	1	0	0	X	X
1	1	0	1	1	1
1	1	1	0	0	1
1	1	1	1	0	1



A_1B_1'

$A_0B_1' + A_1A_0 + A_1B_0'$



TAT

سوال اسپیدل

$H = fg$ ، $f = a'(c \oplus d) + ad(b \oplus c)'$ ، $g = (a+b+c'+d')(b'+c'+d)(a'+c+d')$ ②

a	b	c	d	f	g	H
0	0	0	0	0	X	0
0	0	0	1	1	1	1
0	0	1	0	1	1	1
0	0	1	1	0	X	0
0	1	0	0	0	X	0
0	1	0	1	1	1	1
0	1	1	0	1	0	0
0	1	1	1	0	X	0
1	0	0	0	0	X	0
1	0	0	1	0	X	0
1	0	1	0	0	X	0
1	0	1	1	0	X	0
1	1	0	0	0	X	0
1	1	0	1	0	X	0
1	1	1	0	0	X	0
1	1	1	1	1	1	1