[tikz, border=1mm]standalone arrows, shapes.gates.logic.US, calc (x) at (0, 1.5) a; (y) at (0, 1) b; (z) at (0, 0.5) c; (w) at (0, 0) d;

[not gate US, draw] at ((x) + (0.8, 0)) (notx) ; [not gate US, draw] at ((y) + (0.8, 0)) (noty) ; [not gate US, draw] at ((z) + (0.8, 0)) (notz) ; [not gate US, draw] at ((w) + (0.8, 0)) (notw) ;

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at ((w) + (2.5, 0.8)) (xory) ;

(x) – (notx.input); (y) – (noty.input); (z) – (notz.input); (w) – (notw.input);

(notx.output) – ([xshift=0.35cm]notx.output) |- (xory.input 1); (noty.output) – ([xshift=0.2cm]noty.output) |- (xory.input 2); (notz.output) – ([xshift=0.2cm]notz.output) |- (xory.input 3); (notw.output) – ([xshift=0.35cm]n |- (xory.input 4);

(x) -| ((x)+(1.6, −0.4)) |- (xory.input 1); (y) -| ((y)+(1.5, −0.1)) |- (xory.input 2); (z) -| ((z)+(1.5, 0.2)) |- (xory.input 3); (w) -| ((w) + (1.6, 0.3)) |- (xory.input 4);

(xory.output) – node[above]$\bar{a} + \bar{b} + c + d$ ((*xory*) + (3, 0));

(x0) at (0, 0*2+1.5) A; (y0) at (0, 0*2+1) B; (z0) at (0, 0*2+0.5) C; (w0) at (0, 0*2+0) D; (x) at (0, 4*2) X; (y) at (1, 4*2) Y;

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at ((w0) + (2.5, 0.8)) (xory0) ; (xory0.output) node[above]($B.C.D.\bar{A}$) ((*xory*0) + (2, 0));

[not gate US, draw] at ((x0)+(0.8, 0)) (notx0) ; (x0) – (notx0.input); (notx0.output) – ([xshift=0.35cm]notx0.o |- (xory0.input 1);

(y0) -| ((y0) + (1.5, −0.1)) |- (xory0.input 2); [not gate US, draw, rotate=270] at ((x) + (0, −0.4)) (notx) ; (x) – (notx.input); (y) -| ((y) + (0, −0.1)) |- (xory0.input 1); (x) -| ((x) + (0, 0)) |- (xory0.input 2); (notx.output) -| ((*notx.output*) + (0, 0)) |- (xory0.input 3);

(z0) -| ((z0) + (1.5, 0.2)) |- (xory0.input 3); (w0) -| ((w0) + (1.6, 0.3)) |- (xory0.input 4);

(x1) at (0, 1*2+1.5) A; (y1) at (0, 1*2+1) B; (z1) at (0, 1*2+0.5) C; (w1) at (0, 1*2+0) D;

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at ((w1) + (2.5, 0.8)) (xory1) ; (xory1.output) node[above]($\bar{A}.\bar{B}.\bar{C}$) ((*xory*1) + (2, 0));

[not gate US, draw] at ((x1)+(0.8, 0)) (notx1) ; (x1) – (notx1.input); (notx1.output) – ([xshift=0.35cm]notx1.o |- (xory1.input 1);

[not gate US, draw] at ((y1)+(0.8, 0)) (noty1) ; (y1) – (noty1.input); (noty1.output) – ([xshift=0.2cm]noty1.ou |- (xory1.input 2);

[not gate US, draw] at ((z1)+(0.8, 0)) (notz1) ; (z1) – (notz1.input); (notz1.output) – ([xshift=0.2cm]notz1.ou |- (xory1.input 3);

(x2) at (0, 2*2+1.5) A; (y2) at (0, 2*2+1) B; (z2) at (0, 2*2+0.5) C; (w2) at (0, 2*2+0) D;

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at ((w2) + (2.5, 0.8)) (xory2) ; (xory2.output) node[above]($\bar{A}.\bar{C}.\bar{D}$) ((*xory*2) + (2, 0));

[not gate US, draw] at ((x2)+(0.8, 0)) (notx2) ; (x2) – (notx2.input); (notx2.output) – ([xshift=0.35cm]notx2.o |- (xory2.input 1);

[not gate US, draw] at ((z2)+(0.8, 0)) (notz2) ; (z2) – (notz2.input); (notz2.output) – ([xshift=0.2cm]notz2.ou |- (xory2.input 3);

[not gate US, draw] at ((w2)+(0.8, 0)) (notw2) ; (w2) – (notw2.input); (notw2.output) – ([xshift=0.35cm]notw |- (xory2.input 4);

(x3) at (0, 3*2+1.5) A; (y3) at (0, 3*2+1) B; (z3) at (0, 3*2+0.5) C; (w3) at (0, 3*2+0) D;

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at ((w3)+(2.5, 0.8)) (xory3) ; (xory3) node[above]($A.C.\bar{D}$ ((*xory*3) + (5, 6)); (x3) -| ((x3) + (1.6, −0.4)) |- (xory3.input 1);

[not gate US, draw] at ((y3)+(0.8, 0)) (noty3) ; (y3) – (noty3.input); (noty3.output) – ([xshift=0.2cm]noty3.ou |- (xory3.input 2);

(z3) -| ((z3) + (1.5, 0.2)) |- (xory3.input 3);

[not gate US, draw] at ((w3)+(0.8, 0)) (notw3) ; (w3) – (notw3.input); (notw3.output) – ([xshift=0.35cm]notw |- (xory3.input 4);

[or gate US, draw, rotate=0, logic gate inputs=nnnnnnnnn] at (5, 4) (xory) ; (xory0.output) – ([xshift=0.4cm]xory0.output) |- (xory.input 7); (xory1.output) – ([xshift=0.3cm]xory1.output) |- (xory.input 6); (xory2.output) – ([xshift=0.3cm]xory2.output) |- (xory.input 5); (xory3.output) – ([xshift=0.4cm]xory3.outpu |- (xory.input 4);

(x) at (0, 3*1.5) A; (y) at (0.5, 3*1.5) B; (z) at (1, 3*1.5) C; (w) at (1.5, 3*1.5) D; [not gate US, draw, rotate=270] at ((x) + (0.25, −0.3)) (notx) ; (x) -| ((x) + (0, 0.1)) |- (notx.input); [not gate US,

draw, rotate=270] at ((y) + (0.25, −0.3)) (noty) ; (y) – (noty.input); [not gate US, draw, rotate=270] at ((z) + (0.25, −0.3)) (notz) ; (z) – (notz.input); [not gate US, draw, rotate=270] at ((w) + (0.25, −0.3)) (notw) ; (w) – (notw.input);

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at (2.5, 0*1.5) (xandy0) ; (xandy0.output) node[above]($A.B.C$) (($xandy0$) + (2, 0)); (x) -| ((x) + (0, 0)) |- (xandy0.input 1);

(y) -| ((y) + (0, 0)) |- (xandy0.input 2);

(z) -| ((z) + (0, 0)) |- (xandy0.input 3);

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at (2.5, 1*1.5) (xandy1) ; (xandy1.output) – node[above]$C.\bar{A}.\bar{B}.D$ (($xandy1$) + (2, 0));

[line width=0.25mm, red] (notx.output) – ([xshift=0cm]notx.output) |- (xandy1.input 1);

[line width=0.25mm, red] (noty.output) – ([xshift=0cm]noty.output) |- (xandy1.input 2);

(z) -| ((z) + (0, 0)) |- (xandy1.input 3);

[and gate US, draw, rotate=0, logic gate inputs=nnnn] at (2.5, 2*1.5) (xandy2) ; (xandy2.output) node[above]$(\bar{A}.\bar{C}.\bar{D})$ (($xandy2$) + (2, 0));

[line width=0.25mm, red] (notx.output) – ([xshift=0cm]notx.output) |- (xandy2.input 1);

[line width=0.25mm, red] (notz.output) – ([xshift=0cm]notz.output) |- (xandy2.input 3);

[line width=0.25mm, red] (notw.output) – ([xshift=0cm]notw.output) |- (xandy2.input 4); [or gate US, draw, rotate=0, logic gate inputs=nnn] at (5, 3*0.5) (xory) ; (xory.output) – node[above]F (($xory$) + (0.8, 0)); (xandy0.output) – ([xshift=1.40cm]xandy0.output) |- (xory.input 3);

(xandy1.output) – ([xshift=1.35cm]xandy1.output) |- (xory.input 2);

(xandy2.output) – ([xshift=1.40cm]xandy2.output) |- (xory.input 1);