galois

Exercise 1:

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// Wiring diagram
f74181_netlist c a0 a1 a2 a3 b0 b1 b2 b3 m s0 s1 s2 s3 =
[f0,f1,f2,f3,cout,p,g,a_b]
  where
    w0 = ~m
    w1 = ~b0
    w2 = ~b1
    w3 = ~b2
    w4 = ~b3
    w5 = a0
    w6 = b0 /\ s0
    w7 = s1 /\ w1
    w8 = w1 /\ s2 /\ a0
    w9 = a0 /\ s3 /\ b0
    w10 = a1
    w11 = b1 /\ s0
    w12 = s1 /\ w2
    w13 = w2 /\ s2 /\ a1
    w14 = a1 /\ s3 /\ b1
    w15 = a2
    w16 = b2 /\ s0
    w17 = s1 /\ w3
    w18 = w3 /\ s2 /\ a2
    w19 = a2 /\ s3 /\ b2
    w20 = a3
    w21 = b3 /\ s0
    w22 = s1 /\ w4
    w23 = w4 /\ s2 /\ a3
    w24 = a3 /\ s3 /\ b3
    w25 = ~(w5 \/ w6 \/ w7)
    w26 = ~(w8 \/ w9)
    w27 = ~(w10 \/ w11 \/ w12)
    w28 = ~(w13 \/ w14)
    w29 = ~(w15 \/ w16 \/ w17)
    w30 = ~(w18 \/ w19)
    w31 = ~(w20 \/ w21 \/ w22)
    w32 = ~(w23 \/ w24)
    w33 = (w25 ^ w26)
    w34 = (w27 ^ w28)
    w35 = (w29 ^ w30)
    w36 = (w31 ^ w32)
    w37 = ~(w0 /\ c)
    w38 = w0 /\ w25
    w39 = (w0 /\ w26 /\ c)
    w40 = (w0 /\ w27)
    w41 = (w0 /\ w25 /\ w28)
```

```
  w42 = (w0 /\ w28 /\ w26 /\ c)
  w43 = (w0 /\ w29)
  w44 = (w0 /\ w27 /\ w30)
  w45 = (w0 /\ w25 /\ w30 /\ w28)
  w46 = (w0 /\ w30 /\ w28 /\ w26 /\ c)
  w47 = ~(w26 /\ w28 /\ w30 /\ w32)
  w48 = ~(c /\ w26 /\ w28 /\ w30 /\ w32)
  w49 = (w25 /\ w28 /\ w30 /\ w32)
  w50 = (w27 /\ w30 /\ w32)
  w51 = (w29 /\ w32)
  w52 = w31
  w53 = w37
  w54 = ~(w38 \/ w39)
  w55 = ~(w40 \/ w41 \/ w42)
  w56 = ~(w43 \/ w44 \/ w45 \/ w46)
  w57 = ~(w49 \/ w50 \/ w51 \/ w52)
  w58 = (w53 ^ w33)
  w59 = (w54 ^ w34)
  w60 = (w55 ^ w35)
  w61 = (w56 ^ w36)
  w62 = (~w48 \/ ~w57)
  w63 = (w58 /\ w59 /\ w60 /\ w61)
  f0 = w58
  f1 = w59
  f2 = w60
  f3 = w61
  a_b = w63
  p = w47
  cout = w62
  g = w57
```

Exercise 2:

```
logicStuff a0 a1 a2 a3 b0 b1 b2 b3 s0 s1 s2 s3 =
  if s == 0 then ~(a) else
  if s == 1 then ~(a || b) else
  if s == 2 then (~a && b) else
  if s == 3 then 0 else
  if s == 4 then ~(a && b) else
  if s == 5 then ~b else
  if s == 6 then (a ^ b) else
  if s == 7 then a && ~b else
  if s == 8 then ~a || b else
  if s == 9 then ~(a ^ b) else
  if s == 10 then b else
  if s == 11 then a && b else
  if s == 12 then 15 else
  if s == 13 then a || ~b else
  if s == 14 then a || b else a
    where
      a = [a0,a1,a2,a3]:[4];
      b = [b0,b1,b2,b3]:[4];
      s = [s3,s2,s1,s0]:[4]
```

Exercise 3:

```
logicStuffWorks a0 a1 a2 a3 b0 b1 b2 b3 s0 s1 s2 s3 =
  (logicStuff a0 a1 a2 a3 b0 b1 b2 b3 s0 s1 s2 s3) ==
  (f74181_spec True a0 a1 a2 a3 b0 b1 b2 b3 True s0 s1 s2 s3)@@[0,1,2,3]
```