Introduction to Read-Muller Logic

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Positive Polarity Reed-Muller Form

- f(x1,x2,…xn) = a0 ^ a1x1 ^ a2x2 ^…^ anxn ^ … ^ amx1x2x3…xn
- All variables are positive polarities
- There is only 1 PPRM
- EX)
  - F = 1 ^ x1 ^ x2 ^ x1x2

Fixed Polarity Reed-Muller Form

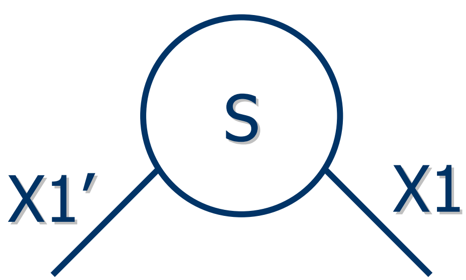
- Each variable has positive or negative polarity
- Polarity of variable is fixed
- There is only 2^n FPRMs
- EX)
  - $F = 1 \wedge x1 \wedge x2' \wedge x1x2'$

Generalized Reed-Muller Forms

- Each variable can have any polarity
- Polarity of variable is not fixed
- There is only $2^{n2^{n-1}}$ GRMs
- EX)
  - F = 1 ^ x1 ^ x2' ^ x1'x2'

Fundamental Expansions

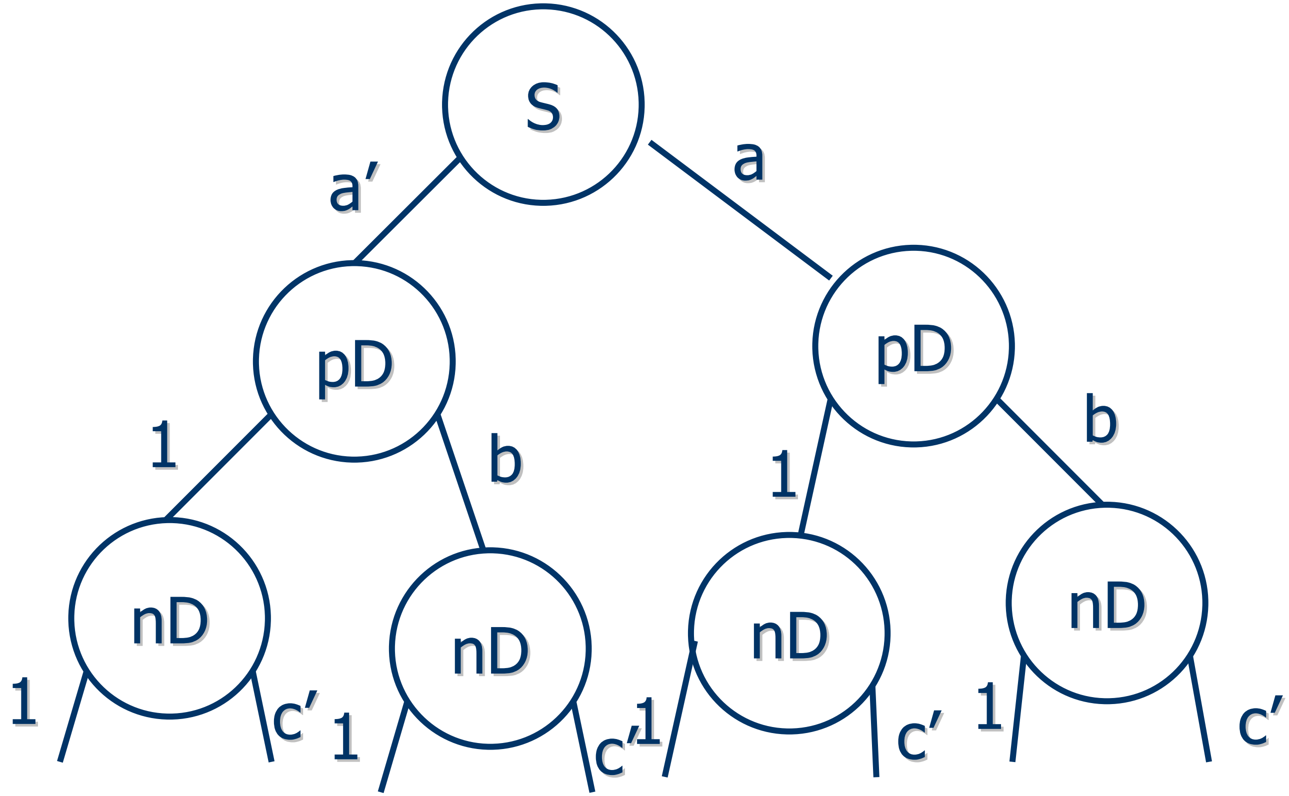
- Shannon Expansion – S
  - $f(x1,x2,\ldots,xn) = x1'f0(x2,\ldots xn) \wedge x1f1(x2,\ldots xn)$
- Positive Davio Expansion – pD
  - $f(x1,x2,\ldots,xn) = 1\ f0(x2,\ldots xn) \wedge x1f2(x2,\ldots xn)$
  - $f2 = f0 \wedge f1$



Fundamental Expansions(2)

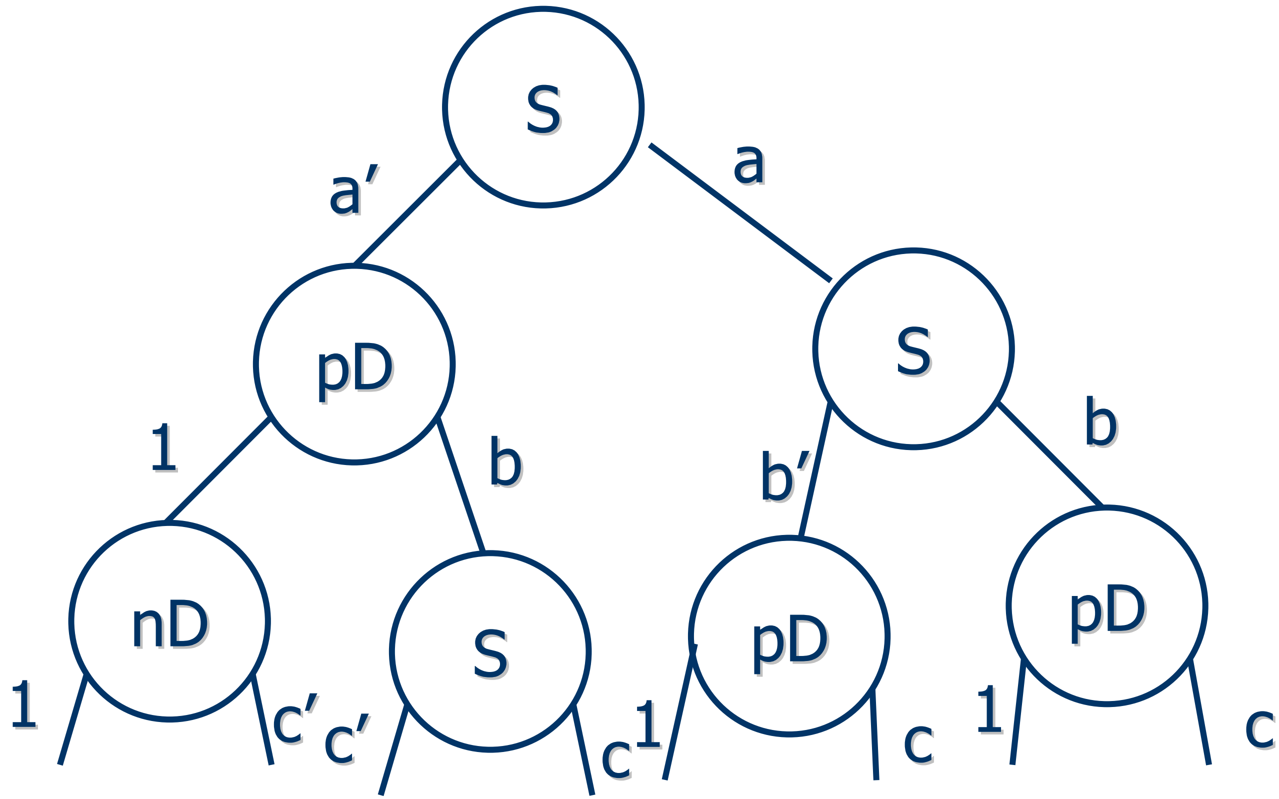
- Negative Davio Expansion – nD
  - $f(x1,x2,\ldots,xn) = 1\ f0(x2,\ldots xn)\ \wedge\ x1'f2(x2,\ldots xn)$
- Generalized Davio Expansion – D
  - $f(x1,x2,\ldots,xn) = 1\ f0(x2,\ldots xn)\ \wedge\ \underline{x1}f2(x2,\ldots xn)$
  - $\underline{x1}$ means both negative and positive

Kronecker Forms - KRO



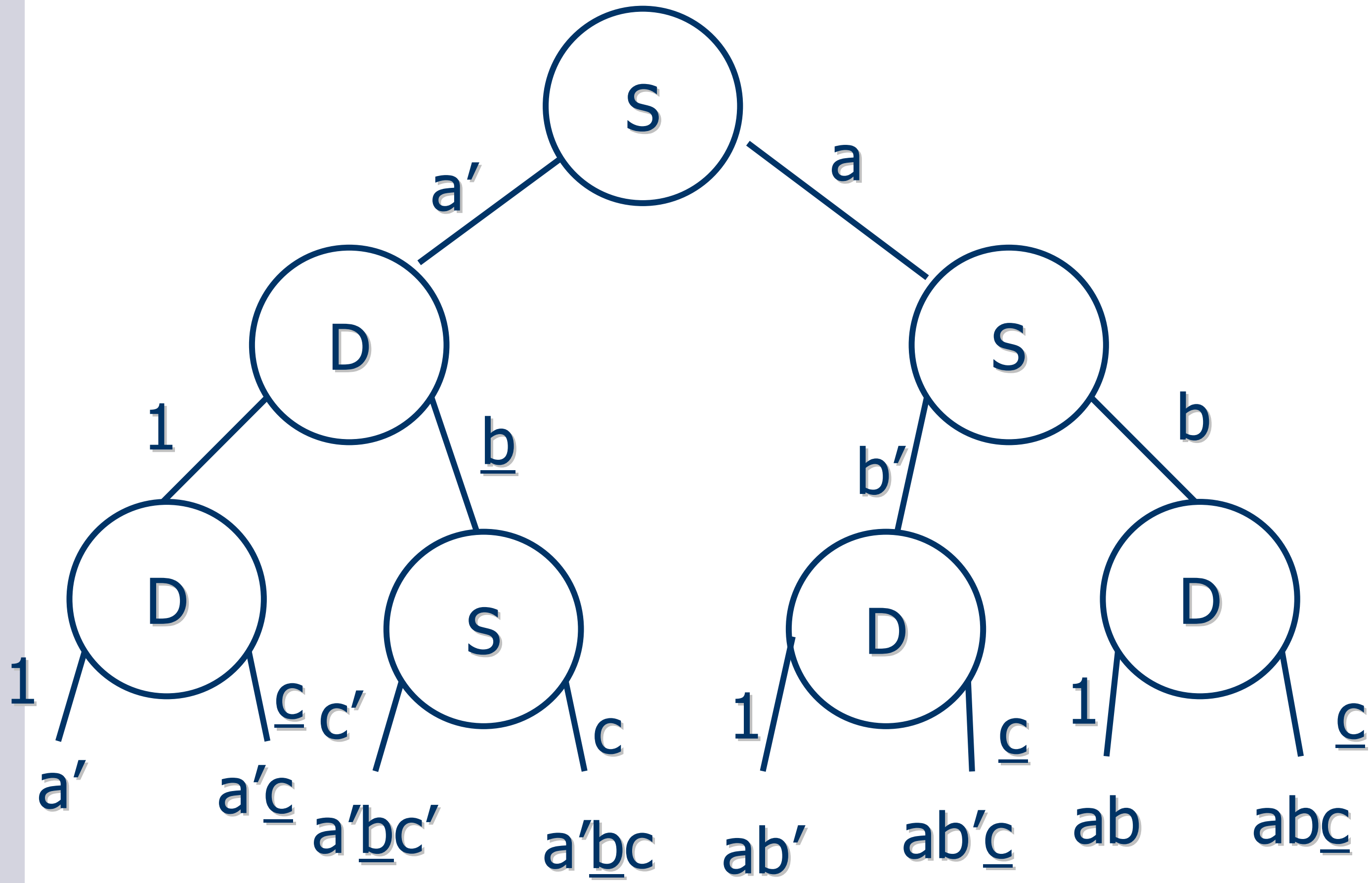
- Using S, pD, nD for each variable
- The same expansion must be used for the same variable

Pseudo-KRO Form - PDSKRO



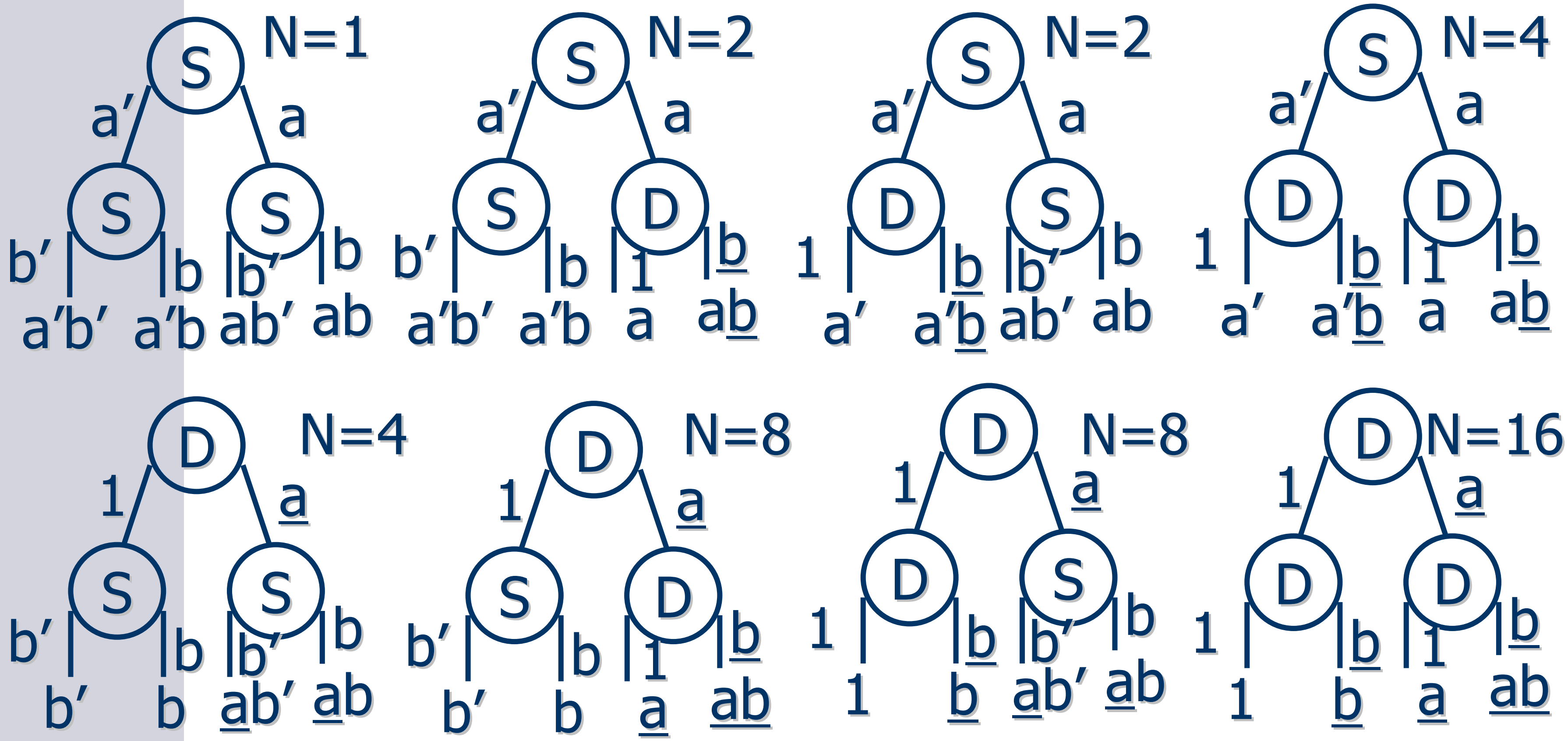
- Using S, pD, nD for each variable

S/D Tree



- Using Shannon(S) and Generalized Davio(D)

Inclusive Forms for Two Variables



- $N_{IF} = (1+2+2+4)+(4+8+8+16) = 45$