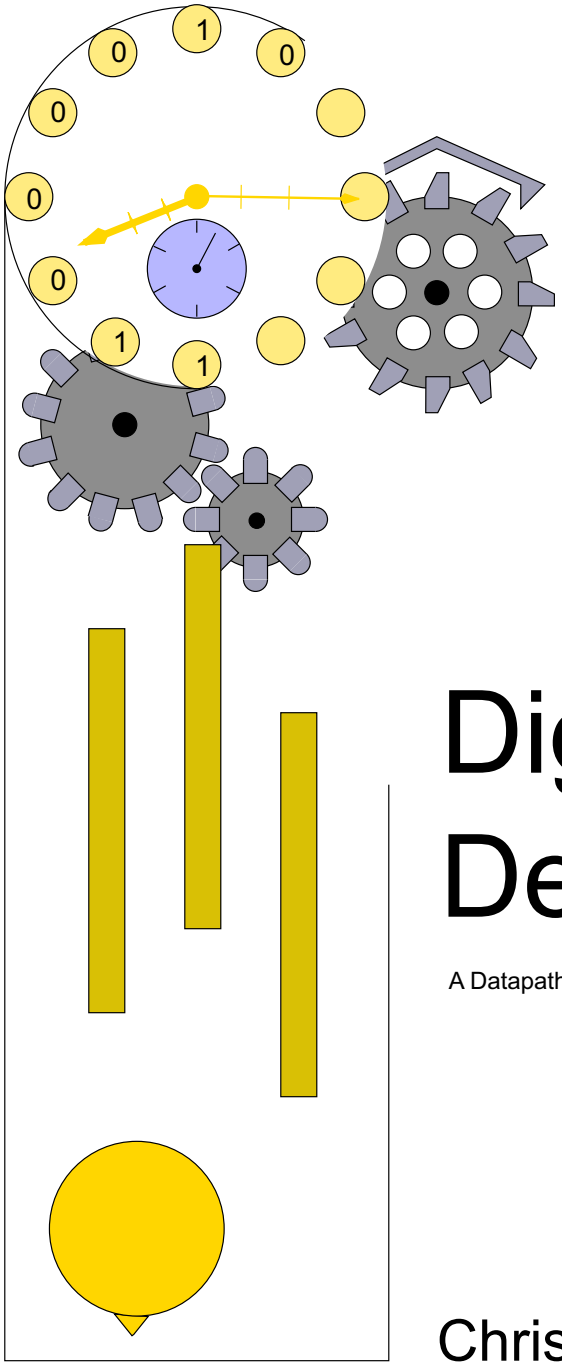


# Digital Design

A Datapath and Control Approach

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# Contents

## 0.1 Minimization of Logical Functions

### Definitions

#### Simplification Trick

### Problems

**Simplify** Utilize the simplification trick.

| A | B | C | F | G | H |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |

F(A,B,C)=
G(A,B,C)=
H(A,B,C)=

**Kmap 3 variable** Solve each kmap.

| A | B | C | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

F

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

G

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

H

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

I

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

J

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

K

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

L

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

M

**Minimize** Determine the SOP $_{\min}$ for the following functions.

**F(A,B,C)=A'BC' + A'BC + AB'C' + AB'C**

**G(A,B,C)=A'B' + AB'C' + AC**

**H(A,B,C)=B+AB'C + B'C'**

**I(A,B,C)=A(B+C')+A'B'C'**

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

F

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

G

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

H

| A \ BC | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |

I

**Minimize** Determine the SOP $_{\min}$ realization

$F(A,B,C,D) = \sum m(0,1,4,5,8,9)$

$G(A,B,C,D) = \sum m(0,5,7,10,11,14,15)$

$H(A,B,C,D) = \sum m(0,2,3,5,6,7,8,10,11,14,15)$

$I(A,B,C,D) = \sum m(1,4,6,9,11,12,14,15)$

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

F

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

G

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

H

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

I

**Minimize** Determine the SOP $_{\min}$ for the following functions.

$F(A,B,C,D,E) = \sum m(0,1,2,5,7,8,10,15,16,18,23,24,26,28,29,31)$
$G(A,B,C,D,E) = \sum m(0,2,4,6,7,8,9,15,16,18,20,21,22,24,25,29)$

| BC\DE | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

A=0

| BC\DE | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

A=1

F(A,B,C,D,E)=

| BC\DE | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

A=0

| BC\DE | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

A=1

G(A,B,C,D,E)=

**Minmize** Determine the SOP $_{\min}$ reaization of the following functions.

$F(A,B,C,D) = \sum m(0,1,5,14,15) + \sum d(4,13)$
$G(A,B,C,D) = \sum m(0,6,7,9,10,12) + \sum d(2,4,8,13)$

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

F

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | | | | |
| 11 | | | | |
| 10 | | | | |

G