Student Names: Emilcan ARICAN, Muhammed Mustafa KÜÇÜK
Student IDs: 2016400231, 2016400111
Group ID: 21
Session ID: 2

CMPE 240 2019 Experiment 2 Preliminary Work

Truth Table

#	r	c	g	p	b
0	0	0	0	0	0
1	0	0	0	1	0
2	0	0	1	0	0
3	0	0	1	1	0
4	0	1	0	0	0
5	0	1	0	1	0
6	0	1	1	0	1
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	1
11	1	0	1	1	0
12	1	1	0	0	1
13	1	1	0	1	0
14	1	1	1	0	1
15	1	1	1	1	1

Sum of Products (SOP)

b = (r'cgp') + (r'cgp) + (rc'gp') + (rcg'p') + (rcgp') + (rcgp)

Minimized SOP

b = (r'cgp') + (r'cgp) + (rc'gp') + (rcg'p') + (rcgp') + (rcgp)

= (r'cgp') + (r'cgp) + (rc'gp') + (rcg'p') + (rcgp') + (rcgp') + (rcgp) (Idempotent)
= (rcgp') + (rc'gp') + (r'cgp') + (r'cgp) + (rcg'p') + (rcgp') + (rcgp) (Commutative)
= (rgp').(c+c') + (r'cgp') + (r'cgp) + (rcg'p') + (rcgp') + (rcgp) (Distributive)
= (rgp').(1) + (r'cgp') + (r'cgp) + (rcg'p') + (rcgp') + (rcgp) (Complement)
= (rgp') + (r'cgp') + (r'cgp) + (rcg'p') + (rcgp') + (rcgp) (Identity)
= (rgp') + (r'cgp') + (r'cgp) + (rcg'p') + (rcgp') + (rcgp') + (rcgp) (Idempotent)

= (rgp’)+ (rcg’p’) + (rcgp’) + (r’cgp’) + (r’cgp) + (rcgp’) + (rcgp)
(Commutative)
= (rgp’)+ (rcp’).(g’+g) + (r’cgp’) + (r’cgp) + (rcgp’) + (rcgp)
(Distributive)
= (rgp’)+ (rcp’).(1) + (r’cgp’) + (r’cgp) + (rcgp’) + (rcgp)
(Complement)
= (rgp’)+ (rcp’) + (r’cgp’) + (r’cgp) + (rcgp’) + (rcgp)
(Identity)
= (rgp’)+ (rcp’) + (cg).(r’p’ + r’p) + (rcgp’) + (rcgp)
(Distributive)
= (rgp’)+ (rcp’) + (cg).(r’p’ + r’p + rp’) + (rcgp)
(Distributive)
= (rgp’)+ (rcp’) + (cg).(r’p’ + r’p + rp’ + rp)
(Distributive)
= (rgp’)+ (rcp’) + (cg).(r’(p’+p) + rp’ + rp)
(Distributive)
= (rgp’)+ (rcp’) + (cg).(r’(1) + rp’ + rp)
(Complement)
= (rgp’)+ (rcp’) + (cg).(r’ + rp’ + rp)
(Identity)
= (rgp’)+ (rcp’) + (cg).(r’ + r(p’ + p))
(Distributive)
= (rgp’)+ (rcp’) + (cg).(r’ + r(1))
(Complement)
= (rgp’)+ (rcp’) + (cg).(r’ + r)
(Identity)
= (rgp’)+ (rcp’) + (cg).(1)
(Complement)
= (rgp’)+ (rcp’) + (cg)
(Identity)

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Product of Sums (POS)

b =(r+c+g+p).(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c'+g+p)
.(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')

Minimized POS

b =(r+c+g+p).(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c'+g+p)
.(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')

=(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Idempotent)
=(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Idempotent)
=(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Idempotent)
=(r+c+g+p).(r+c+g+p').(r+c+g'+p).(r+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Commutative)
=((r+c)+(g+p).(g+p')).(r+c+g'+p).(r+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Distributive)
=((r+c)+(g+p).(g+p').(g'+p)).(r+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Distributive)
=((r+c)+(g+p).(g+p').(g'+p).(g'+p')).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Distributive)
=((r+c)+(g+pp').(g'+p).(g'+p')).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Distributive)
=((r+c)+(g+0).(g'+p).(g'+p')).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Complement)
=((r+c)+g.(g'+p).(g'+p')).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')

(Identity)
=((r+c)+g.(g'+pp')).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Distributive)
=((r+c)+g.(g'+0)).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Complement)
=((r+c)+gg').(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Identity)
=((r+c)+0).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Complement)
=(r+c).(r+c+g+p).(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Identity)
=(r+c).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Idempotent)
=(r+c).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c+g'+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g+p').(r'+c+g'+p').(r'+c'+g+p')
(Idempotent)
=(r+c).(r+c+g+p').(r+c+g'+p').(r'+c+g+p').(r'+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Commutative)
=(r+c).((c+p')+(r+g).(r+g')).(r'+c+g+p').(r'+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Distributive)
=(r+c).((c+p')+(r+g).(r+g').(r'+g)).(r'+c+g'+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Dsitributive)
=(r+c).((c+p')+(r+g).(r+g').(r'+g).(r'+g')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Distributive)
=(r+c).((c+p')+(r+gg').(r'+g).(r'+g')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Distributive)
=(r+c).((c+p')+(r+0).(r'+g).(r'+g')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Complement)
=(r+c).((c+p')+r.(r'+g).(r'+g')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Identity)
=(r+c).((c+p')+r.(r'+gg')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Distributive)
=(r+c).((c+p')+r.(r'+0)).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')
(Complement)

=(r+c).((c+p')+rr').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')

(Identity)

=(r+c).((c+p')+0).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')

(Complement)

=(r+c).(c+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')

(Identity)

=(r+c).(c+p').(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')

(Idempotent)

=(r+c).(c+p').(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c'+g+p')

(Idempotent)

=(r+c).(c+p').(r+c+g+p).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p).(r'+c+g+p').(r'+c+g+p').(r'+c'+g+p')

(Idempotent)

=(r+c).(c+p').(r+c+g+p).(r'+c+g+p).(r+c+g+p').(r'+c+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Commutative)

=(r+c).(c+p').(r+c+g+p).(r'+c+g+p).(r+c+g+p').(r'+c+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+(r+p).(r'+p)).(r+c+g+p').(r'+c+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+(r+p).(r'+p).(r+p')).(r'+c+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+(r+p).(r'+p).(r+p').(r'+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+(rr'+p).(r+p').(r'+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+(0+p).(r+p').(r'+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Complement)

=(r+c).(c+p').((c+g)+p.(r+p').(r'+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Identity)

=(r+c).(c+p').((c+g)+p.(rr'+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Distributive)

=(r+c).(c+p').((c+g)+p.(0+p')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')

(Complement)

=(r+c).(c+p').((c+g)+pp')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')
(Identity)
=(r+c).(c+p').((c+g)+0)).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')
(Complement)
=(r+c).(c+p').(c+g).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')
(Identity)
=(r+c).(c+p').(c+g).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')
(Idempotent)
=(r+c).(c+p').(c+g).(r+c+g+p).(r+c+g+p').(r+c+g+p').(r+c'+g+p).(r+c'+g+p').(r+c'+g+p').(r'+c+g+p').(r'+c'+g+p')
(Idempotent)
=(r+c).(c+p').(c+g).(r+c+g+p').(r'+c+g+p').(r+c'+g+p').(r'+c'+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Commutative)
=(r+c).(c+p').(c+g).((g+p')+(r+c).(r'+c)).(r+c'+g+p').(r'+c'+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).((g+p')+(r+c).(r'+c).(r+c')).(r'+c'+g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).((g+p')+(r+c).(r'+c).(r+c').(r'+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).((g+p')+(rr'+c).(r+c').(r'+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).((g+p')+(0+c).(r+c').(r'+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Complement)
=(r+c).(c+p').(c+g).((g+p')+c.(r+c').(r'+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Identity)
=(r+c).(c+p').(c+g).((g+p')+c.(rr'+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).((g+p')+c.(0+c')).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Complement)
=(r+c).(c+p').(c+g).((g+p')+cc').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Identity)
=(r+c).(c+p').(c+g).((g+p')+0).(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Complement)

=(r+c).(c+p').(c+g).(g+p').(r+c+g+p).(r+c+g+p').(r+c'+g+p).(r+c'+g+p')
(Identity)
=(r+c).(c+p').(c+g).(g+p').((r+g)+(c+p).(c+p')).(r+c'+g+p).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).(g+p').((r+g)+(c+p).(c+p').(c'+p)).(r+c'+g+p')
(Distributive)
=(r+c).(c+p').(c+g).(g+p').((r+g)+(c+p).(c+p').(c'+p).(c'+p'))
(Distributive)
=(r+c).(c+p').(c+g).(g+p').((r+g)+(c+pp').(c'+p).(c'+p'))
(Distributive)
=(r+c).(c+p').(c+g).(g+p').((r+g)+(c+0).(c'+p).(c'+p'))
(Complement)
=(r+c).(c+p').(c+g).(g+p').((r+g)+c.(c'+p).(c'+p'))
(Identity)
=(r+c).(c+p').(c+g).(g+p').((r+g)+c.(c'+pp'))
(Distributive)
=(r+c).(c+p').(c+g).(g+p').((r+g)+c.(c'+0))
(Complement)
=(r+c).(c+p').(c+g).(g+p').((r+g)+cc')
(Identity)
=(r+c).(c+p').(c+g).(g+p').((r+g)+0)
(Complement)
=(r+c).(c+p').(c+g).(g+p').(r+g)
(Identity)

Circuit