Subject:
Year. Month. Date. ( )

به نام خدا

تمرینات سری چهارم درس طراحی مدارهای منطقی

اجباری

1)

a) $(\bar{x}+\bar{y})(xy+z) \xrightarrow{\text{مکمل}} \bar{a} = (xy) + ((\bar{x}+\bar{y})\,\bar{z})$

b) $(A+B\bar{C})(\bar{A}+\bar{D}E) \xrightarrow{\text{مکمل}} \bar{b} = (\bar{A}\cdot(\bar{B}+C)) + (A\cdot(D+\bar{E}))$

c) $(\bar{A}+\bar{B})(A+\bar{A}B)(\bar{A}+\bar{B}+ABC) + \overline{(A+B)}(A+C)$

$\bar{c} = AB + (\bar{A}\cdot(A+\bar{B})) + (AB\cdot(\bar{A}+\bar{B}+\bar{C}))\cdot(A+B)(\bar{A}\bar{C})$

$F(A,B) = \overline{\overline{A\cdot\overline{AB}}\cdot\overline{B\cdot\overline{AB}}} \xrightarrow{\text{دمورگان}} A(\bar{A}+\bar{B}) + B(\bar{A}+\bar{B})$

$\xrightarrow{\text{فاکتورگیری}} (\bar{A}+\bar{B})(A+B) \underset{\text{انجام ضرب}}{\Longrightarrow} \cancel{A\bar{A}} + \bar{A}B + A\bar{B} + \cancel{B\bar{B}}$

$\boxed{= (\bar{A}B + A\bar{B}) = A \oplus B}$

$G(x,A,B,C) = \underbrace{\bar{x} + xAB\bar{C}}_{\text{توزیع جمع نسبت به ضرب}} + \bar{B}C = \underbrace{\cancel{(\bar{x}+x)}}_{\text{توزیع عضو خنثی در جمع}}(\bar{x}+AB\bar{C}) + \bar{B}C$

$\boxed{\rightarrow \bar{x} + AB\bar{C} + \bar{B}C}$

دمورگان

$H(A,B,C,D) = A\bar{B}C + \bar{A}\bar{B}CD + \overline{ABD} + \bar{A}BC\bar{D}$

$\xrightarrow[\text{دمورگان}]{\text{فاکتورگیری}} A\bar{B}C + \bar{A}CD\underbrace{(B+\bar{B})}_{\text{توزیع عضو خنثی در جمع}} + \bar{A} + \bar{B} + \bar{D} \xrightarrow{\text{فاکتورگیری}}$

$\boxed{\underbrace{\bar{A}(1+CD) + \bar{B}(AC+1)}_{\text{وجود ۱ در جمع}} + \bar{D} = \bar{A}+\bar{B}+\bar{D}}$

PaPCO

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$$I(v, w, x, y, z) = (\bar{x} + y)wz + x\bar{y}v + vwz$$

$$\bar{x}wz + wyz + x\bar{y}v + vwz \xrightarrow[\text{vwz حذف شده است}]{\text{قانون اجماع}} \boxed{\bar{x}wz + wyz + x\bar{y}v}$$

$$j(A, B, C, D) = \bar{A}B(\bar{D} + \bar{C}D) + B(A + \bar{A}CD) \xrightarrow{\text{انجام عملیات ضرب}}$$

$$\bar{A}B\bar{D} + \bar{A}B\bar{C}D + AB + \bar{A}BCD \xrightarrow{\text{فاکتورگیری}}$$

$$\bar{A}B(\bar{D} + \underbrace{\bar{C}D + CD}_{D(\cancel{C+\bar{C}})}) + AB = \bar{A}B(\cancel{D + \bar{D}}) + AB =$$

فاکتورگیری و توزیع عطف

فاکتورگیری $B(\cancel{A + \bar{A}}) = \boxed{B}$

توزیع عطف در جمع

$$K(A, B, C, D) = ABC + \overline{(A\bar{B}C\bar{D} + \overline{(B + D)})} = ABC + \overline{(\bar{B}\bar{D}(\cancel{AC+1}))}$$

اعمال قانون دمورگان و فاکتورگیری

$$= \underbrace{ABC + B}_{\text{فاکتورگیری}} + D = B(\cancel{AC + 1}) + D = \boxed{B + D}$$

a) $(K'+M'+N)(\overset{A}{K'+M})(L+M'+N')(\underbrace{K'+L+M}_{A+L})(M+N)$ (3

$(A)(A+L) = A + AL = A(L+1) = A$ ①

$\xrightarrow{①} (K' + \underbrace{(M'+N)(M)}_{M'M+NM})\ \underbrace{(L+M'+N')(M+N)}_{LM+LN+\cancel{M'M}+M'N+MN'+NN'} =$

$(K'+MN)(LM+LN+M'N+MN') = K'LM+K'LN+K'M'N+K'MN'$

$+ LMN + \underset{}{\overset{\text{مشترک}}{LMN}} + MN\cancel{M'N} + MN\cancel{MN'} = \boxed{K'LM+K'LN+K'M'N+K'MN'+LMN}$

b) $(K'+L'+M')(K+M+N')(K+L)(\underbrace{K'+N}_{②})(K'+\underbrace{M+N}_{①})$

$(M+(K+N')(K'+N)) = M+KN+K'N'$ ①

$(K'+N)(M+1) = K'+N$ ②

$(K'+L'+M')(K+L) = K'L+KL'+M'K+M'L$ ③

$\xrightarrow{①,②,③} (M+KN+K'N')(K'+N)(K'L+KL'+M'K+M'L)$

$= \underbrace{MK'L+MK'LN}_{MK'L} + \underbrace{MNKL'+KL'N}_{KL'N} + \underbrace{KM'N+KNM'L}_{KM'N} + \underbrace{K'N'L+K'N'M'L}_{K'N'L}$

$= MK'L+KL'N+KM'N+K'N'L$

a) $\underline{a'b+b'c}+c'a \overset{?}{=} a'b'+bc'+ca'$ 14

a

با کمک قانون ' جامع می‌توان از طرف اول به طرف دوم رسید.

b) $(a+b)(b+c)(c+a) \overset{?}{=} (a'+b')(b'+c')(c'+a')$

طرف چپ $(b+ac)(a+c) = ab+bc+ac+\overset{ac}{ac} = \boxed{ab+bc+ac}$

طرف راست $(b'+a'c')(a'+c') = a'b'+b'c'+a'c'+\overset{a'c'}{a'c'} = a'b'+b'c'+a'c'$

$+bc'd$ مساوی برقرار نیست.

c) $abc+ab'c'+b'cd+ad = abc+ab'c'+b'cd+bc'd$

طرف چپ: $a(bc+b'c')+d(\overset{x}{b'c+bc'})+ad =$

$a\bar{x}+dx+ad(x+\bar{x}) = a\bar{x}(d+1)+dx(a+1) = \boxed{a\bar{x}+dx}$

طرف راست: $a(bc+b'c')+d(b'c+bc') \overset{?}{=} \boxed{a\bar{x}+dx}$

مساوی برقرار است.

d) $\underbrace{(x+y)(y+z)}_{}(x+z) = (x'+y')(y'+z')(x'+z')$ $(x+yz)$

طرف راست: $xy+xz+yz$

دو طرف مساوی با هم برابر نیستند.

طرف چپ: $\overline{(xy)+(yz)+(xz)}$

a) $\bar{A}\bar{B} + \bar{A}CD + \bar{A}D\bar{E} = \bar{A}(\bar{B} + D(C + \bar{E})) = \bar{A}(\bar{B} + D)(\bar{B} + \bar{C} + \bar{E})$5

b) $A'B'C + B'CD' + EF' = B'C(A' + D') + EF'$

$= (B'C(A' + D') + E)(B'C(A' + D') + F') =$

$(B' + E)(E + C)(E + A' + D')(F' + B')(F' + C)(F' + A' + D')$

فاکتور

c) $w\bar{x}y + \bar{w}\bar{x} + \bar{w}\bar{y} \rightsquigarrow w\bar{x}y + \bar{w}(\bar{x} + \bar{y})$

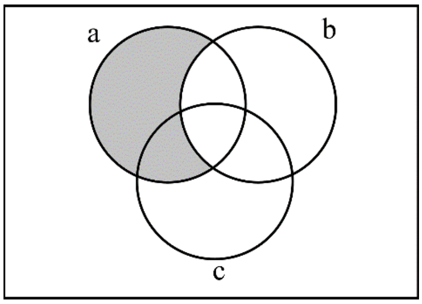
این راه حل قابل قبول است

$= (\underbrace{w\bar{x}y + \bar{w}}_{\bar{w} + \bar{x}y})(\underbrace{w\bar{x}y + \bar{x} + \bar{y}}_{\bar{x} + \bar{y}}) = (\bar{w} + \bar{x}y)(\bar{x} + \bar{y})$

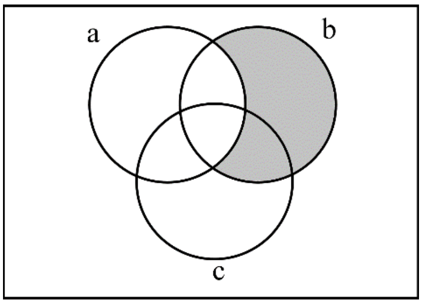
یا $(\bar{w} + \bar{x}y)(\bar{y} + \bar{x} + w\bar{x}) = (w + \bar{x})(\bar{w} + y)(\bar{x} + \bar{y})$

سوال ۱ امتیازی. a)

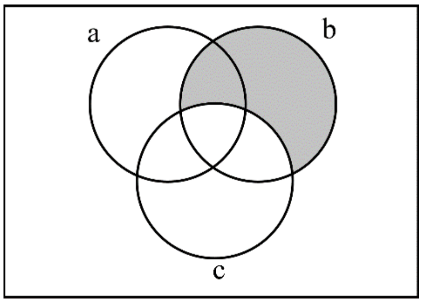
ab’



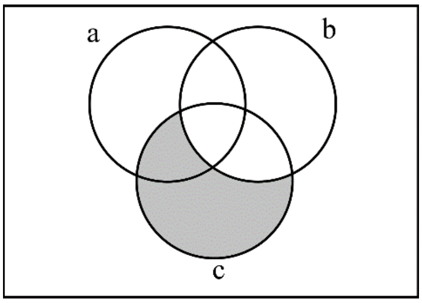
a’b



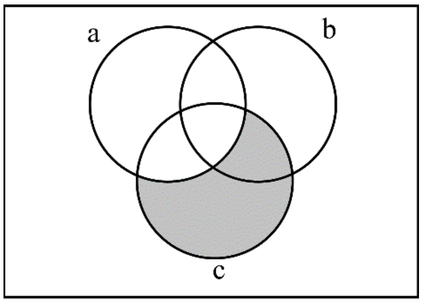
bc’



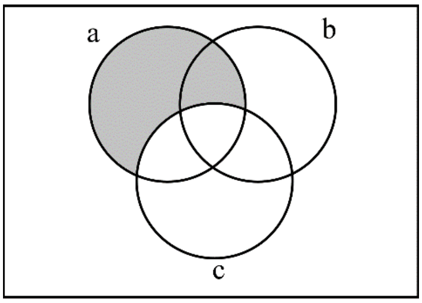
b’c



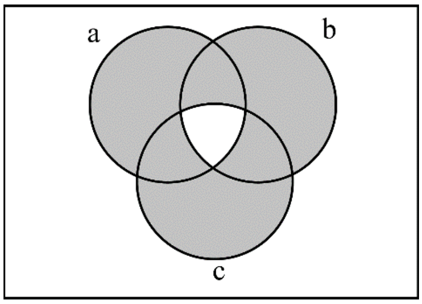
ca’



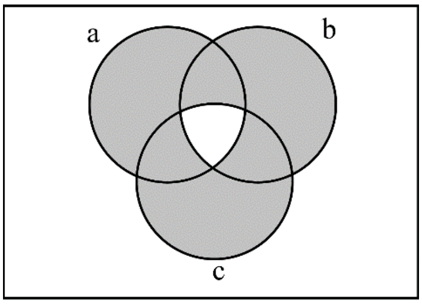
c’a



ab’+bc’+ca’



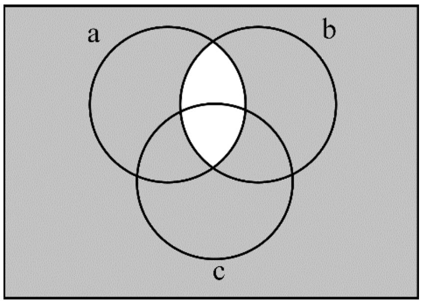
a’b+b’c+c’a



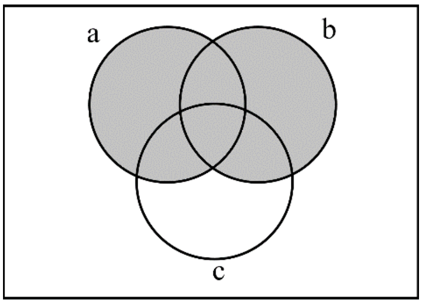
برابر است

سوال ۱ امتیازی. b)

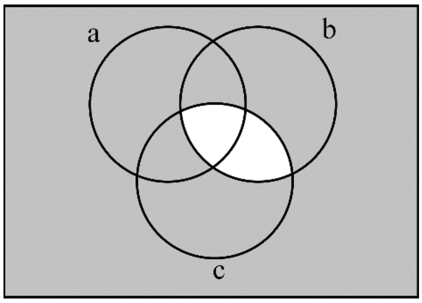
(a'+b')



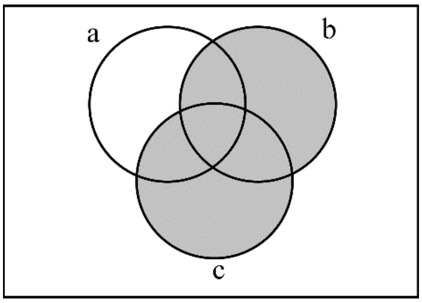
a+b



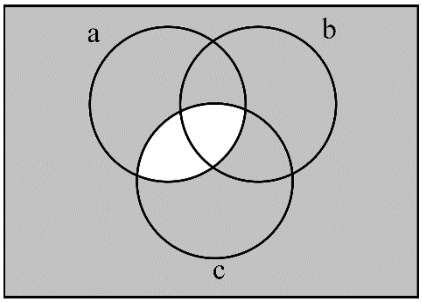
(b'+c')



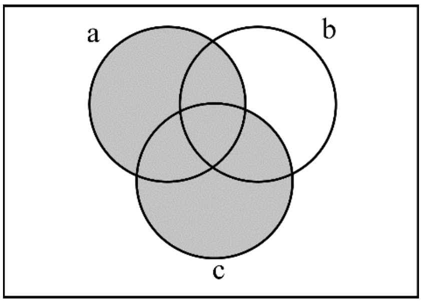
b+c



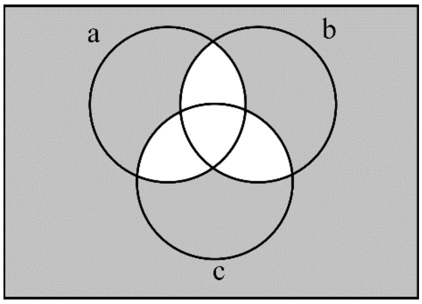
(c'+a')



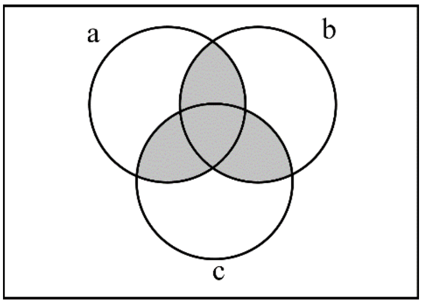
a+c



(a'+b')(b'+c')(c'+a')



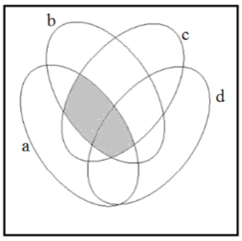
(a+b)(b+c)(a+c)



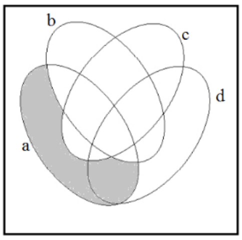
برابر نیست.

سوال ۱ امتیازی. c)

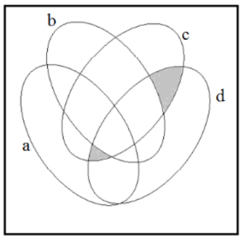
abc



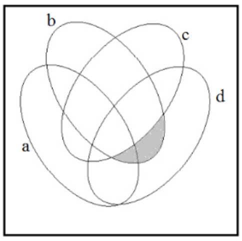
ab’c’



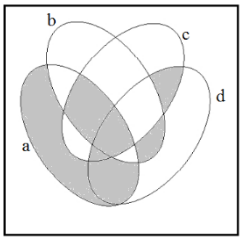
b’cd



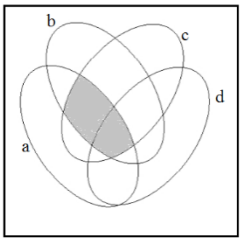
bc’d



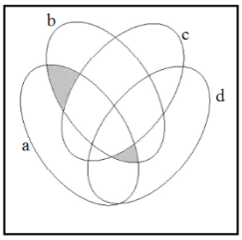
abc+ab’c’+b’cd+bc’d



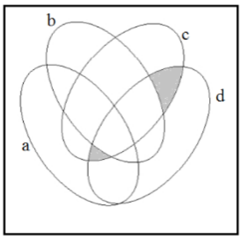
abc



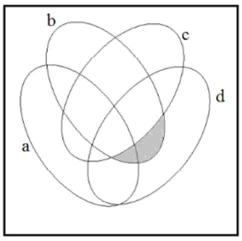
ab’c’



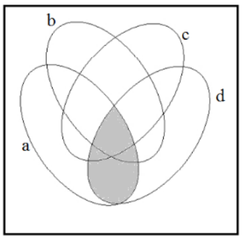
b’cd



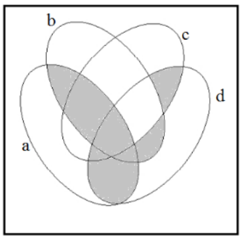
bc’d



ad



abc+ab’c’+b’cd+bc’d+



امتیازی 2) الف)

#	A	B	C	D	f
0	0	0	0	0	0
1	0	0	0	1	0
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	0
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	0
15	1	1	1	1	0

$$f = \Sigma(2, 3, 5, 7, 11, 13)$$

$$= \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BCD + A\bar{B}CD + AB\bar{C}D$$

ب)

$$f = \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BCD + A\bar{B}CD + AB\bar{C}D$$

$$\bar{A}\bar{B}C + B\bar{C}D + \bar{A}BD + A\bar{B}CD$$

ج)