

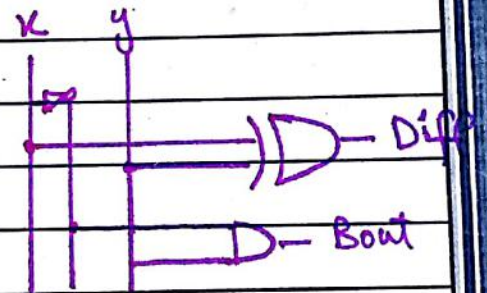
DATE: \_\_\_\_\_

# Q-1

(a)

## HALF SUBTRACTOR

x	y	Diff	Bout
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0



K-Map for Diff:

x \ y	0	1
0	0	1
1	1	0

$$\text{Diff} = xy' + x'y = x \oplus y \quad \text{--- (1)}$$

K-Map for Bout:

x \ y	0	1
0	0	1
1	0	0

$$\text{Bout} = x'y \quad \text{--- (2)}$$



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Q-1

(b)

## FULL SUBTRACTOR

x	y	Bin	Diff	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

K-Map for Difference

x \ y Bin	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$$= xy'Bin' + x'y'Bin + xyBin + x'yBin'$$

$$= (xy' + x'y)Bin' + (xy + x'y')Bin$$

$$= (x \oplus y)Bin' + (x \oplus y)'Bin$$

$$\text{Diff} = x \oplus y \oplus Bin$$

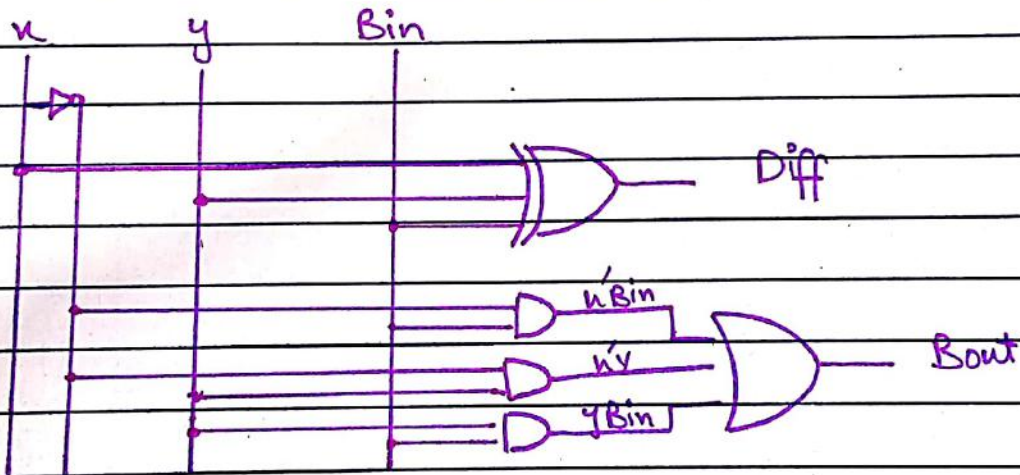


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K-Map for Bout

	$y \text{ Bin}$			
$x$	00	01	11	10
0	0	1	1	1
1	0	0	1	0

$$\text{Bout} = x' \text{Bin} + x'y + y \text{Bin}$$





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Q-1

(c)

FULL SUBTRACTOR using two HALF SUBTRACTOR

x	y	Bin	Diff	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

K-Map for Diff

	00	01	11	10
0	0	1	0	1
1	1	0	1	0

Diff =  $x \oplus y \oplus \text{Bin}$   
(as calculated in b part)



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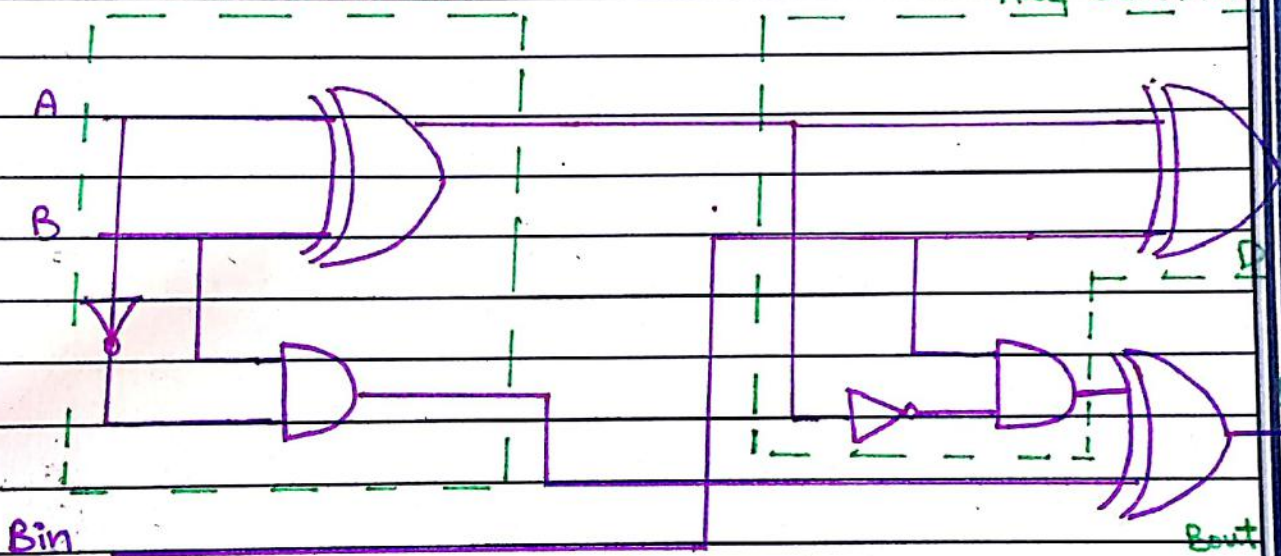
K-Map for Bout

n \ Bout	00	01	11	10
0	0	1	1	1
1	0	0	1	0

$$\begin{aligned}
 \text{Bout} &= \bar{n}\bar{y}'\text{Bin} + \bar{n}y'\text{Bin}' \\
 &\quad + \bar{n}y\text{Bin} + n\bar{y}\text{Bin}' \\
 &= \text{Bin}(n\bar{y} + \bar{n}y) + \bar{n}y(\text{Bin} + \text{Bin}') \\
 &= \text{Bin}(n \oplus y)' + \bar{n}y
 \end{aligned}$$

HALF SUBTRACTOR

Half Subtractor





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Q-2

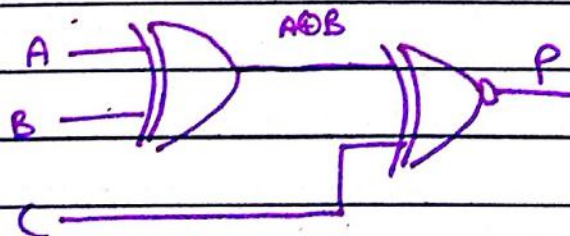
• Three Bit Parity Generator

A	B	C	P
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

A \ B	00	01	11	10
0	1	0	1	0
1	0	1	0	1

$$\begin{aligned}
 P &= A'B'C' + A'BC' + A'BC + A'B'C \\
 &= A'(B'C' + BC' + BC + B'C) \\
 &= A'(B \odot C) + A'(B \oplus C) \\
 &= A'(B \odot C) + A(B \odot C) \\
 &\Rightarrow P = A \oplus B \odot C
 \end{aligned}$$

• Circuit





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• Four Bit Parity Checker

A	B	C	P	C
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

		C			
AB	CP	00	01	11	10
		0	0	0	0
01		0	0	0	0
11		0	0	0	0
10		0	0	0	0

$$\text{Checker "C"} = A'B'C'P + A'B'CP + A'BC'P + A'BCP + AB'C'P + ABC'P + ABCP + AB'CP$$

$$= A'B'(C'P + CP) + A'B(C'P + CP) + AB(C'P + CP) + AB'(C'P + CP)$$

$$= A'B'(C \oplus P) + A'B(C \oplus P) + AB(C \oplus P) + AB'(C \oplus P)$$

$$= (A'B' + AB)(C \oplus P) + (A'B + AB')(C \oplus P)$$

$$= (A \oplus B)(C \oplus P) + (A \oplus B)(C \oplus P)$$

$$\text{Checker "C"} \Rightarrow (A \oplus B) \cdot (C \oplus P)$$



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• Circuit

