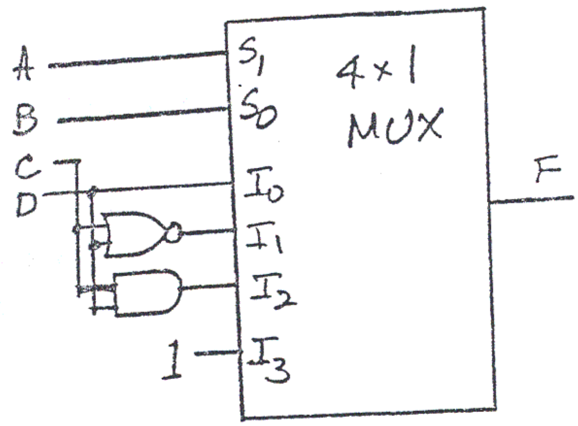
| ABCD | F | |
|---|---|---|
| 0000 | 0 | AB=00 |
| 0001 | 1 | F=D |
| 0010 | 0 | |
| 0011 | 1 | |
| 0100 | 1 | AB=01 |
| 0101 | 0 | $F=C'D'$ |
| 0110 | 0 | $=(C+D)'$ |
| 0111 | 0 | |
| 1000 | 0 | AB=10 |
| 1001 | 0 | F=CD |
| 1010 | 0 | |
| 1011 | 1 | |
| 1100 | 1 | AB=11 |
| 1101 | 1 | F=1 |
| 1110 | 1 | |
| 1111 | 1 | |




* Similar to pb. 1

-10

| Inputs ABCD | Outputs wxyz |
|---|---|
| 0000 | 0000 |
| 0001 | 1111 |
| 0010 | 1110 |
| 0011 | 1101 |
| 0100 | 1100 |
| 0101 | 1011 |
| 0110 | 1010 |
| 0111 | 1001 |
| 1000 | 1000 |
| 1001 | 0111 |
| 1010 | 0110 |
| 1011 | 0101 |
| 1100 | 0100 |
| 1101 | 0011 |
| 1110 | 0010 |
| 1111 | 0001 |

| AB \ CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | 1 | 1 | 1 |
| 01 | 1 | 1 | 1 | 1 |
| 11 | | | | |
| 10 | 1 | | | |

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

| | | | |
|---|---|---|---|
| | 1 | 1 | 1 |
| 1 | | | |
| 1 | | | |
| | 1 | 1 | 1 |

$x = B'(C+D)+BC'D'$
$= B \oplus (C+D)$

| | | | |
|---|---|---|---|
| | 1 | | 1 |
| | 1 | | 1 |
| | 1 | | 1 |
| | 1 | | 1 |

$y = CD'+C'D$
$= C \oplus D$

| | | | |
|---|---|---|---|
| | 1 | 1 | |
| | 1 | 1 | |
| | 1 | 1 | |
| | 1 | 1 | |

$z = D$

For 5-bit 2's complementer with input E and output v
$v = E \oplus (A+B+C+D)$

b $JA = Bx + B'y'$ $JB = A'x$ $z = Axy + Bx'y'$

$KA = B'xy'$ $KB = A + xy'$

| Present state AB | Inputs xy | Next state AB | output z | FF inputs JA | KA | JB | KB |
|---|---|---|---|---|---|---|---|
| 0 0 | 0 0 | 1 0 | 0 | 1 | 0 | 0 | 0 |
| 0 0 | 0 1 | 0 0 | 0 | 0 | 0 | 0 | 0 |
| 0 0 | 1 0 | 1 1 | 0 | 1 | 1 | 1 | 1 |
| 0 0 | 1 1 | 0 1 | 0 | 0 | 0 | 1 | 0 |
| 0 1 | 0 0 | 0 1 | 1 | 0 | 0 | 0 | 0 |
| 0 1 | 0 1 | 0 1 | 0 | 0 | 0 | 0 | 0 |
| 0 1 | 1 0 | 1 0 | 0 | 1 | 0 | 1 | 1 |
| 0 1 | 1 1 | 1 1 | 0 | 1 | 0 | 1 | 0 |
| 1 0 | 0 0 | 1 0 | 0 | 1 | 0 | 0 | 1 |
| 1 0 | 0 1 | 1 0 | 0 | 0 | 0 | 0 | 1 |
| 1 0 | 1 0 | 0 0 | 0 | 1 | 1 | 0 | 1 |
| 1 0 | 1 1 | 1 0 | 1 | 0 | 0 | 0 | 1 |
| 1 1 | 0 0 | 1 0 | 1 | 0 | 0 | 0 | 1 |
| 1 1 | 0 1 | 1 0 | 0 | 0 | 0 | 0 | 1 |
| 1 1 | 1 0 | 1 0 | 0 | 1 | 0 | 0 | 1 |
| 1 1 | 1 1 | 1 0 | 1 | 1 | 0 | 0 | 1 |

(c)

| AB \ xy | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | 1 |
| 01 | | | 1 | 1 |
| 11 | 1 | 1 | 1 | 1 |
| 10 | 1 | 1 | 1 | |

$A(t+1) = Ax' + Bx + Ay + A'B'y'$

| AB \ xy | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | 1 | 1 |
| 01 | 1 | 1 | 1 | |
| 11 | | | | |
| 10 | | | | |

$B(t+1) = A'B'x + A'B'(x'+y)$

* Notice : This similar to pb. 3

5-19 (a)

| Present state ABC | Input x | Next state ABC | output y |
|---|---|---|---|
| 000 | 0 | 011 | 0 |
| 000 | 1 | 100 | 1 |
| 001 | 0 | 001 | 0 |
| 001 | 1 | 100 | 1 |
| 010 | 0 | 010 | 0 |
| 010 | 1 | 000 | 1 |
| 011 | 0 | 001 | 0 |
| 011 | 1 | 010 | 1 |
| 100 | 0 | 010 | 0 |
| 100 | 1 | 011 | 0 |

$d(A,B,C,x) = \Sigma(10,11,12,13,14,15)$

| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | 1 | 1 | |
| 01 | | | | |
| 11 | X | X | X | X |
| 10 | | | X | X |

$DA = A'B'x$

| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | |
| 01 | 1 | | 1 | |
| 11 | X | X | X | X |
| 10 | 1 | 1 | X | X |

$DB = A + C'x' + BCx$

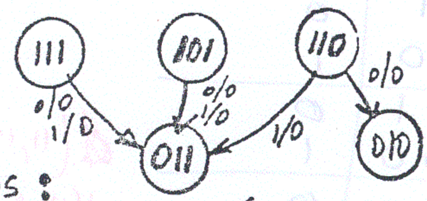
| | | | |
|---|---|---|---|
| 1 | | | 1 |
| | | | 1 |
| X | X | X | X |
| | 1 | X | X |

$DC = Cx' + Ax + A'B'x'$

| | | | |
|---|---|---|---|
| | 1 | 1 | |
| | 1 | 1 | |
| X | X | X | X |
| | | X | X |

$y = A'x$

self-correcting




(b) Use JK flip flops:
same state table as in part (a).

Flip-flop inputs

| JA | KA | JB | KB | JC | KC |
|---|---|---|---|---|---|
| 0 | X | 1 | X | 1 | X |
| 1 | X | 0 | X | 0 | X |
| 0 | X | 0 | X | X | 0 |
| 1 | X | 0 | X | X | 1 |
| 0 | X | X | 0 | 0 | X |
| 0 | X | X | 1 | 0 | X |
| 0 | X | X | 1 | X | 0 |
| 0 | X | X | 0 | X | 1 |
| X | 1 | 1 | X | 0 | X |
| X | 1 | 1 | X | 1 | X |

$JA = B'x$ $\quad KA = 1$

$JB = A + C'x'$ $\quad KB = C'x + Cx'$

$JC = Ax + A'B'x'$ $\quad KC = x$

$y = A'x$

Self-correcting because $KA = 1$

5-20

From state table Table 5-4

$T_A(A,B,x) = \Sigma(2,3,6)$

$T_B(A,B,x) = \Sigma(0,3,4,6)$

| A \ Bx | | | B | B |
|---|---|---|---|---|
| | | | 1 | 1 |
| A | | | | 1 |

$T_A = A'B + Bx'$

| A \ Bx | | | B | B |
|---|---|---|---|---|
| | 1 | | 1 | |
| A | 1 | | | 1 |

$T_B = B'x' + Ax' + A'Bx$