# ITI1100Z

**Professor: Qi Hao**

## Assignment # 5

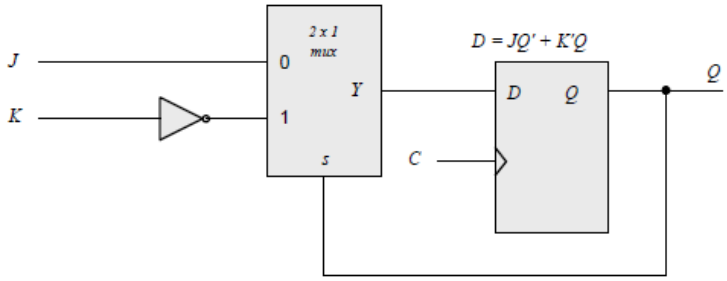
**Submission Deadline July 8, 2018 midnight (11h59 PM), Brightspace**

From the textbook Chapter five pages from 315 to 317 in the 6th edition, solve the following problems:

**5.2, 5.6, 5.9, 5.10, 5.12, 5.16(a)**

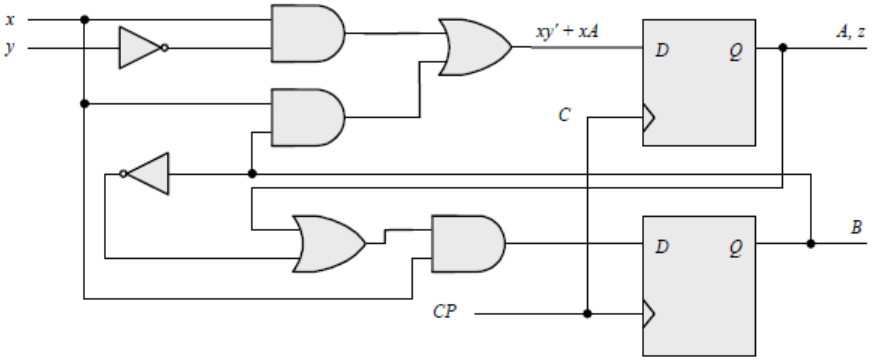
**5.2**

Total
5 points



**5.6**

Total
8 points




2 points

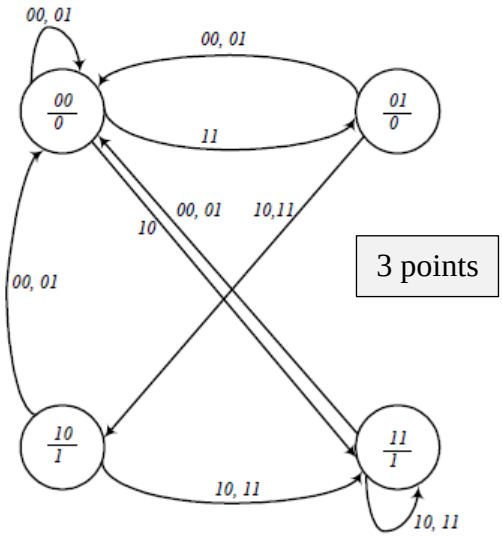
**(b)**

$A(t+1) = xy' + xB$
$B(t+1) = xA + xB'$
$z = A$

3 points

| Present state | | Inputs | | Next state | | Output |
|---|---|---|---|---|---|---|
| A | B | x | y | A | B | z |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**(c)**



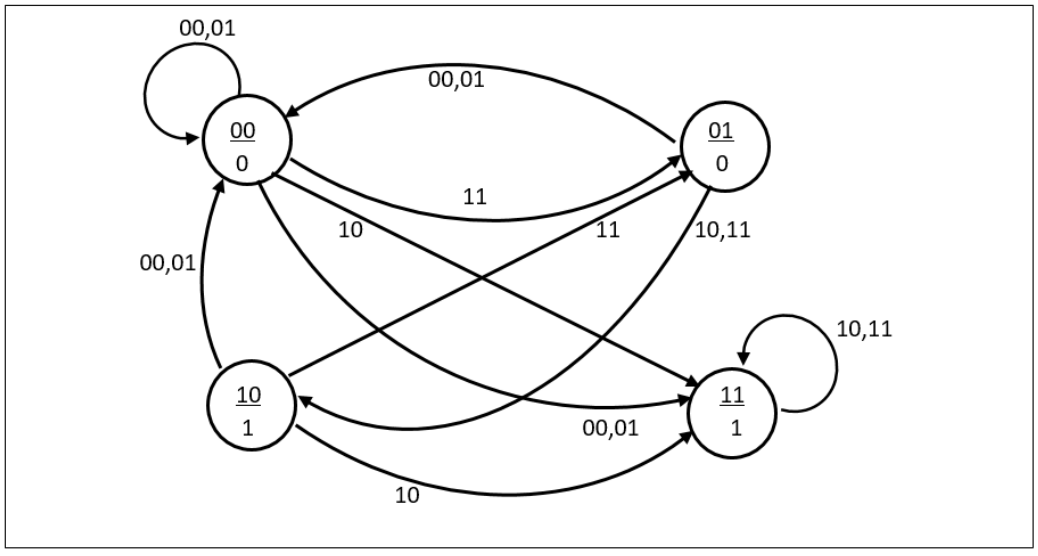

3 points

**Note: 5.6 (b) and (c) are wrong. Correct answers are:**

b)

| Present state | | Inputs | | Next state | | Output |
|---|---|---|---|---|---|---|
| A | B | X | Y | A | B | Z |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

c)



**5.9**

Total 6 points

$J_A = x \qquad K_A = B$

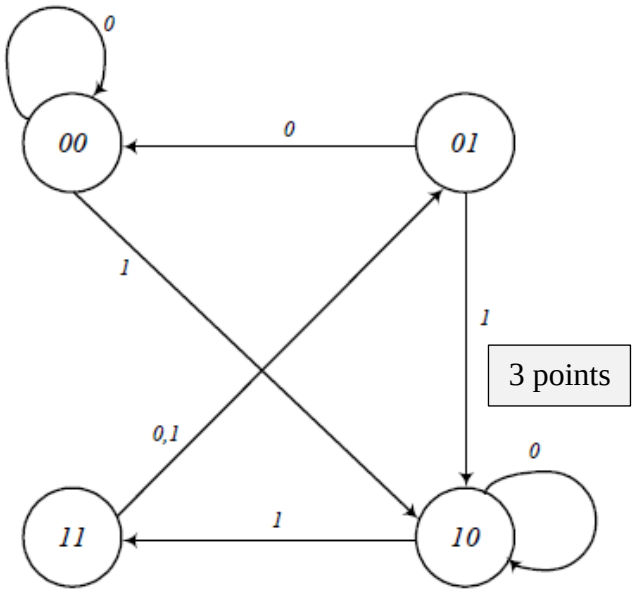
$J_B = x \qquad K_B = A'$

3 points

$A(t+1) = J_A A' + K_A' A = xA' + B'A$

$B(t+1) = J_B B' + K_B' B = xB' + AB$

| $x$ | $A$ | $B$ | $xA' + B'A$ | $xB' + AB$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |




3 points

**Note: 5.9 error correction**

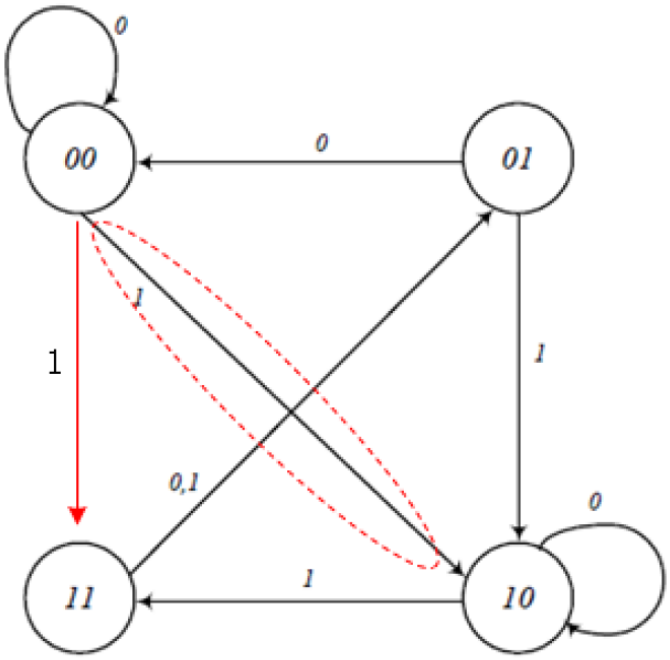
$J_A = x \qquad K_A = B$

$J_B = x \qquad K_B = A'$

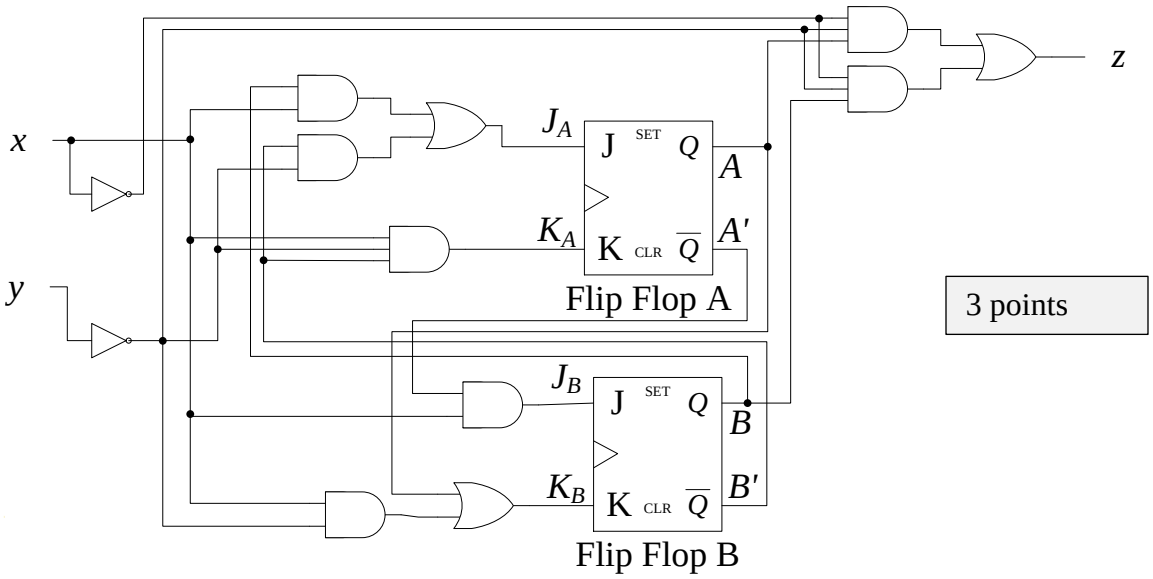
$A(t+1) = J_A A' + K_A' A = xA' + B'A$

$B(t+1) = J_B B' + K_B' B = xB' + AB$

| $x$ | $A$ | $B$ | $xA' + B'A$ | $xB' + AB$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |



**5.10** **(a)**




3 points

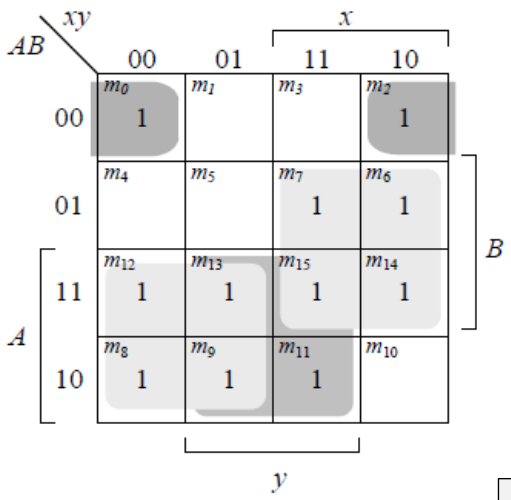
Total 10 points

**(b)**

| Present state A | Present state B | Inputs x | Inputs y | Next state A | Next state B | Output z | FF Inputs $J_A$ | FF Inputs $K_A$ | FF Inputs $J_A$ | FF Inputs $J_B$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 0 |
| 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 | 0 | 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 |

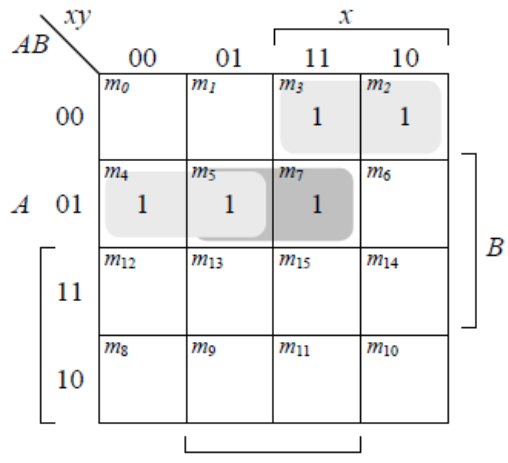
3 points
(1.5 points for next state/output)
(1.5 points for FF inputs)

**(c)**




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

2 points




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

2 points

**Note: 5.10 (**c) Error Correction: $B(t+1) = A'xy + A'B'x + A'Bx'$ , or $B(t+1) = A'B'x + A'B(x' + y)$

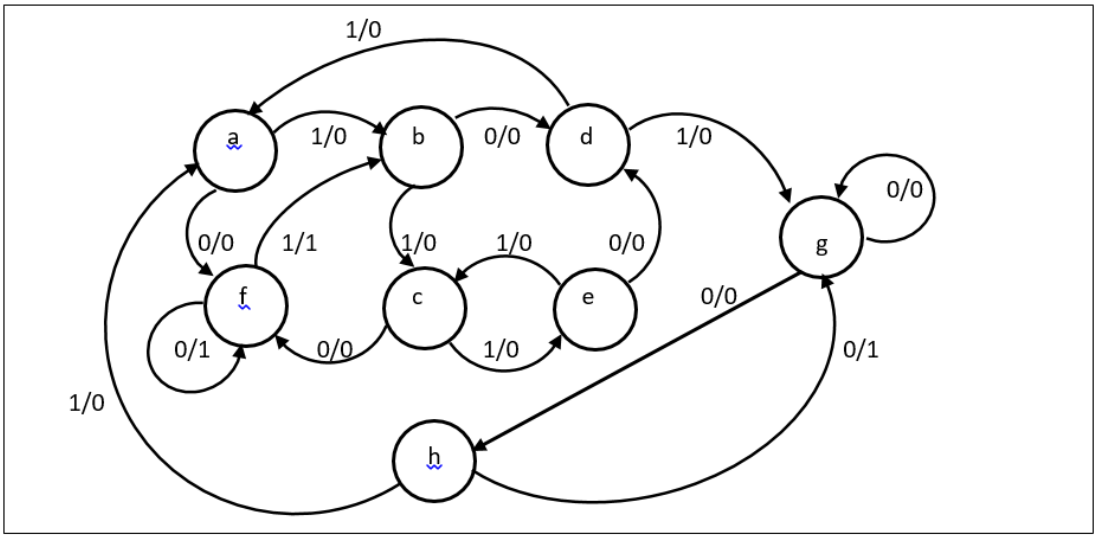
**5.12**

Total
7 points

| Present state | Next state 0 | Next state 1 | Output 0 | Output 1 |
|---|---|---|---|---|
| *a* | *f* | *b* | 0 | 0 |
| *b* | *d* | *a* | 0 | 0 |
| *d* | *g* | *a* | 1 | 0 |
| *f* | *f* | *b* | 1 | 1 |
| *g* | *g* | *d* | 0 | 1 |

**Note: 5.12 correct answers are:**

a)




Total
2 points

b)

| Present state | Next state X = 0 | Next state X = 1 | Output X = 0 | Output X = 1 |
|---|---|---|---|---|
| a | f | b | 0 | 0 |
| *b | d | c | 0 | 0 |
| c | f | e | 0 | 0 |
| d | g | a | 1 | 0 |
| *e | d | c | 0 | 0 |
| f | f | b | 1 | 1 |
| g | g | h | 0 | 1 |
| h | g | a | 1 | 0 |

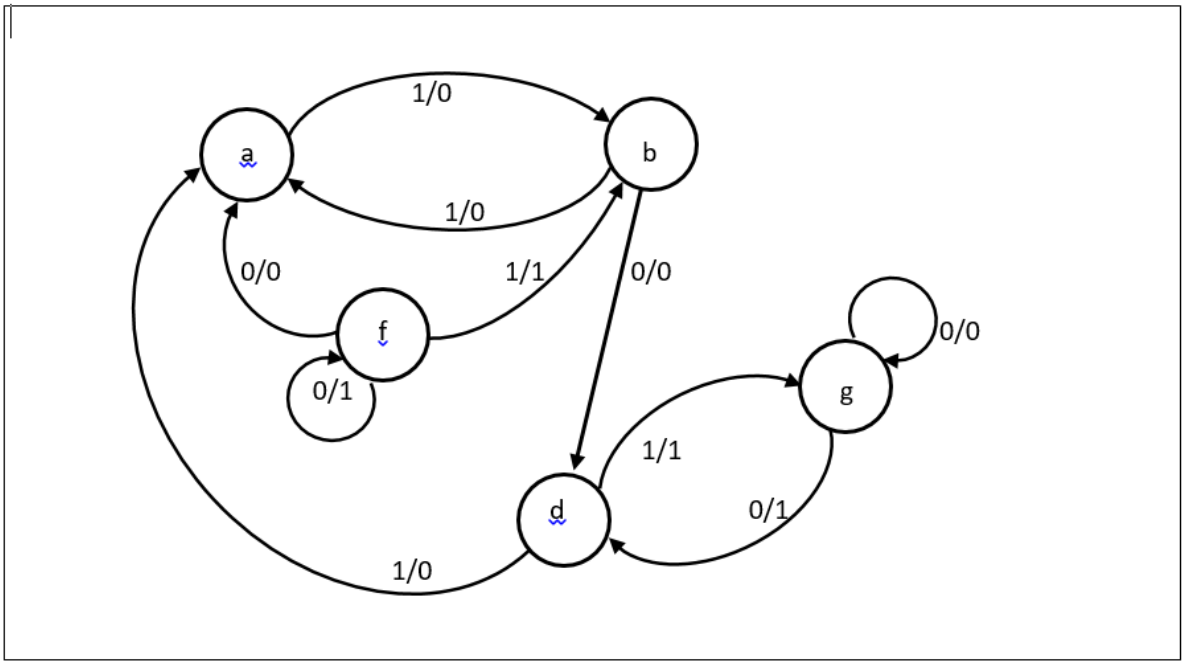
| Present state | Next state X = 0 | Next state X = 1 | Output X = 0 | Output X = 1 |
|---|---|---|---|---|
| *a | f | b | 0 | 0 |
| b | d | c | 0 | 0 |
| c | f | b | 0 | 0 |
| d | g | a | 1 | 0 |
| f | f | b | 1 | 1 |
| g | g | h | 0 | 1 |
| h | g | a | 1 | 0 |

Total
3 points

| Present state | Next state X = 0 | Next state X = 1 | Output X = 0 | Output X = 1 |
|---|---|---|---|---|
| a | f | b | 0 | 0 |
| b | d | a | 0 | 0 |
| *d | g | a | 1 | 0 |
| f | f | b | 1 | 1 |
| g | g | h | 0 | 1 |
| *h | g | a | 1 | 0 |

| Present state | Next state X = 0 | Next state X = 1 | Output X = 0 | Output X = 1 |
|---|---|---|---|---|
| a | f | b | 0 | 0 |
| b | d | a | 0 | 0 |
| d | g | a | 1 | 0 |
| f | f | b | 1 | 1 |
| g | g | d | 0 | 1 |

c)




Total
2 points

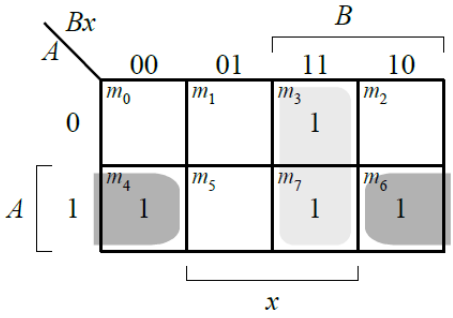
**5.16** Total 4 points

**(a)** $D_A = Ax' + Bx$

$D_B = A'x + Bx'$

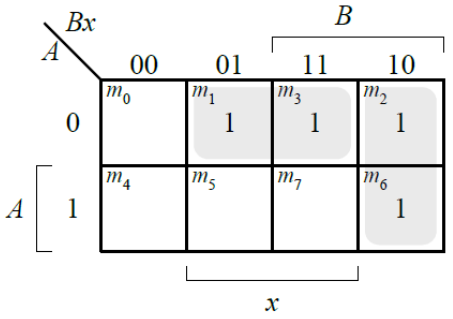
| *Present state* A | B | *Input* x | *Next state* A | B |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 |

1 point




$D_A = Ax' + Bx$

1 point




$D_B = A'x + Bx'$

1 point



1 point for circuit diagram