

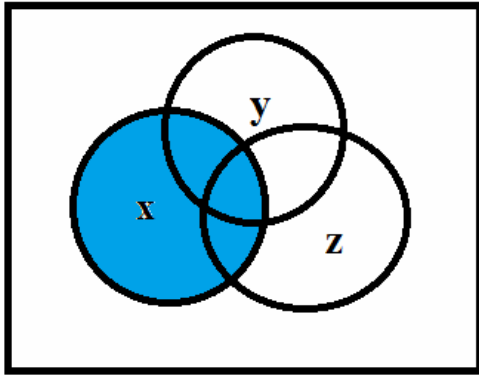
## Solution of Homework-1

2.2 Use the algebraic manipulation to prove that  $(x + y).(x + \bar{y}) = x$

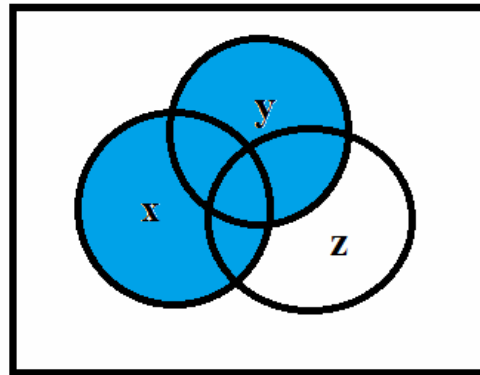
**Solution:**

$$\begin{aligned}LHS &= (x + y).(x + \bar{y}) \\&= x.x + x.y + x.\bar{y} + y.\bar{y} \\&= x(x + y + \bar{y}) + 0 \\&= x(x + 1) = x.1 = x\end{aligned}$$

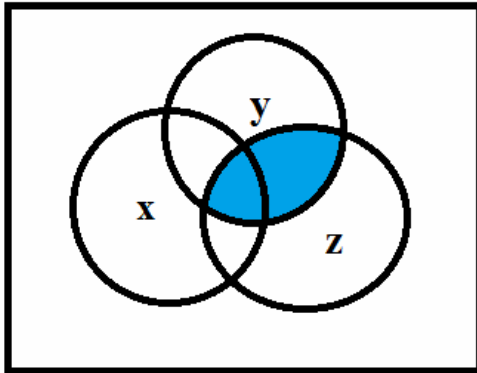
2.4 Use the Venn diagram to prove the identity  $x + yz = (x + y)(x + z)$



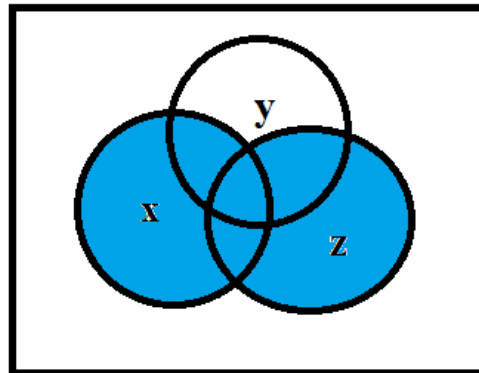
$x$



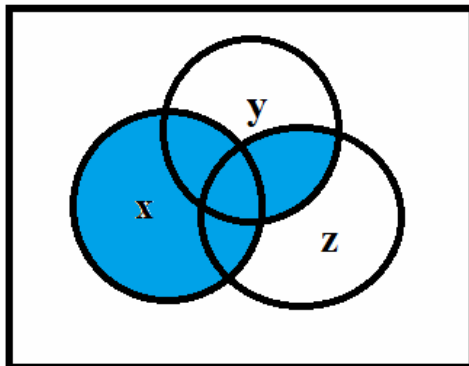
$x+y$



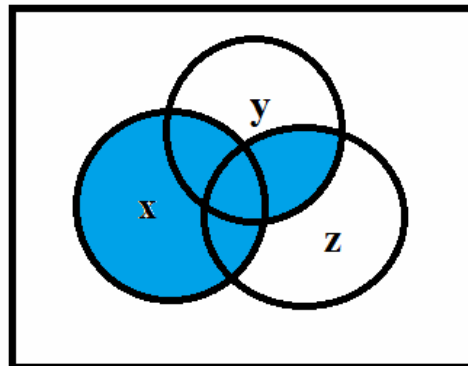
$y.z$



$x+z$



$x+y.z$



$(x+y)(x+z)$

2.7 Determine whether or not the following expressions are valid, i.e., whether the left and the right hand sides expressions the same function.

- (a)  $\overline{x_1}x_3 + x_1\overline{x_2}x_3 + \overline{x_1}x_2 + x_1\overline{x_2} = \overline{x_2}x_3 + x_1\overline{x_3} + x_2\overline{x_3} + \overline{x_1}x_2x_3$
- (b)  $x_1\overline{x_3} + x_2\overline{x_3} + \overline{x_2}x_3 = (x_1 + \overline{x_2} + x_3)(x_1 + x_2 + \overline{x_3})(\overline{x_1} + x_2 + \overline{x_3})$
- (c)  $(x_1 + x_3)(\overline{x_1} + \overline{x_2} + \overline{x_3})(\overline{x_1} + x_2) = (x_1 + x_2)(x_2 + x_3)(\overline{x_1} + \overline{x_3})$

Solution:

(a) Using the truth table

LHS

$x_1$	$x_2$	$x_3$	$\overline{x_1 x_3}$	$\overline{x_1 x_2 x_3}$	$\overline{x_1 x_2}$	$\overline{x_1 x_2}$	$\overline{x_1 x_3 + x_1 x_2 x_3 + x_1 x_2 + x_1 x_2}$
0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1
0	1	0	0	0	1	0	1
0	1	1	1	0	1	0	1
1	0	0	0	0	0	1	1
1	0	1	0	0	0	1	1
1	1	0	0	1	0	0	1
1	1	1	0	0	0	0	0

RHS

$x_1$	$x_2$	$x_3$	$\overline{x_2 x_3}$	$\overline{x_1 x_3}$	$\overline{x_2 x_3}$	$\overline{x_1 x_2 x_3}$	$\overline{x_2 x_3 + x_1 x_3 + x_2 x_3 + x_1 x_2 x_3}$
0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1
0	1	0	0	0	1	0	1
0	1	1	0	0	0	1	1
1	0	0	0	1	0	0	1
1	0	1	1	0	0	0	1
1	1	0	0	1	1	0	1
1	1	1	0	0	0	0	0

Valid.

(b) Using the truth table

LHS

$x_1$	$x_2$	$x_3$	$\overline{x_1 x_3}$	$\overline{x_2 x_3}$	$\overline{x_2 x_3}$	$\overline{x_1 x_3 + x_2 x_3 + x_2 x_3}$
0	0	0	0	0	1	1
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	1	0	1
1	0	0	1	0	1	1
1	0	1	0	0	0	0
1	1	0	1	0	0	1
1	1	1	0	1	0	1

RHS

$x_1$	$x_2$	$x_3$	$(x_1 + \overline{x_2 + x_3})$	$(x_1 + x_2 + \overline{x_3})$	$(\overline{x_1 + x_2 + x_3})$	$(x_1 + \overline{x_2 + x_3})(x_1 + x_2 + \overline{x_3})(\overline{x_1 + x_2 + x_3})$
0	0	0	1	1	1	1
0	0	1	1	0	1	0
0	1	0	0	1	1	0
0	1	1	1	1	1	1
1	0	0	1	1	1	1
1	0	1	1	1	0	0
1	1	0	1	1	1	1
1	1	1	1	1	1	1

Valid.

(c) Using the truth table

LHS

$x_1$	$x_2$	$x_3$	$(x_1 + x_3)$	$(\overline{x_1} + \overline{x_2} + \overline{x_3})$	$(\overline{x_1} + x_2)$	$(x_1 + x_3)(\overline{x_1} + \overline{x_2} + \overline{x_3})(\overline{x_1} + x_2)$
0	0	0	0	1	1	0
0	0	1	1	1	1	1
0	1	0	0	1	1	0
0	1	1	1	1	1	1
1	0	0	1	1	0	0
1	0	1	1	1	0	0
1	1	0	1	1	1	1
1	1	1	1	0	1	0

RHS

$x_1$	$x_2$	$x_3$	$(x_1 + x_2)$	$(x_2 + x_3)$	$(\overline{x_1} + \overline{x_3})$	$(x_1 + x_2)(x_2 + x_3)(\overline{x_1} + \overline{x_3})$
0	0	0	0	0	1	0
0	0	1	0	1	1	0
0	1	0	1	1	1	1
0	1	1	1	1	1	1
1	0	0	1	0	1	0
1	0	1	1	1	0	0
1	1	0	1	1	1	1
1	1	1	1	1	0	0

Not valid.