Coen 21 - Winter 2022

Tushar Shrivastav

Homework #2

1.2

a) $(30)_{10}$

		Rem
30/2	15	0
15/2	7	1
7/2	3	1
3/2	1	1
1/2	0	1

$\boxed{\text{Binary: } 11110}$

b) $(110)_{10}$

		Rem
110/2	55	0
55/2	27	1
27/2	13	1
13/2	6	1
6/2	3	0
3/2	1	1
1/2	0	1

$\boxed{\text{Binary: } 1101110}$

c) $(259)_{10}$

		Rem
259/2	129	1
129/2	64	1
64/2	32	0
32/2	16	0
16/2	8	0
8/2	4	0
4/2	2	0
2/2	1	0
1/2	0	1

$\boxed{\text{Binary: } 100000011}$

d) $(500)_{10}$

		Rem
500/2	250	0
250/2	125	0
125/2	62	1
62/2	31	0
31/2	15	1
15/2	7	1
7/2	3	1
3/2	1	1
1/2	0	1

Binary: 111110100

e) $(20480)_2$

		Rem
20480/2	10240	0
10240/2	5120	0
5120/2	2560	0
2560/2	1280	0
1280/2	640	0
640/2	320	0
320/2	160	0
160/2	80	0
80/2	40	0
40/2	20	0
20/2	10	0
10/2	5	0
5/2	2	1
2/2	1	0
1/2	0	1

Binary: 101000000000000

1.7

a) $(110010)_2$

32 16 8 4 2 1 $\quad 32+16+2 = \boxed{50}$

b) $(1100100)_2$

64 32 16 8 4 2 1 $\quad 64+32+4 = \boxed{100}$

c) $(11001000)_2$

128 64 32 16 8 4 2 1 $\quad 128+64+8 = \boxed{200}$

d) $(110010000)_2$

256 128 64 32 16 8 4 2 1 $\quad 256+128+16 = \boxed{400}$

1.8.

a) $(270)_{10}$ $\quad 2^8 < 270 < 2^9-1$

$256 < 270 \; 512$

$\boxed{9 \text{ bits}}$

b) $(520)_{10}$ $\quad 2^9 < 520 < 2^{10}-1$

$\boxed{10 \text{ bits}}$

c) $(780)_{10}$ $\quad 2^9 < 780 < 2^{10}-1$

$\boxed{10 \text{ bits}}$

d) $(1029)_{10}$ $\quad 2^{10} < 1029 < 2^{11}-1$

$\boxed{11 \text{ bits}}$

2.1 prove: $x + yz = (x+y)\cdot(x+z)$

Prove LHS = RHS

using theorem for multiplying out & Factoring

$\therefore x + yz = x\cdot x + x\cdot z + y\cdot x + y\cdot z$

using idempotent laws to simplify $x \cdot x$

$\therefore x + yz = x + x\cdot z + yx + y\cdot z$

using simplification theorem $(x + xy = x)$

$\therefore x + yz = x + yx + y\cdot z$

using simplification theorem

$\therefore x + yz = x + yz$ ✓

LHS = RHS ✓

2.2. prove: $(x+y)\cdot(x+\bar{y}) = x$

prove: LHS = RHS

using theorem for multiplying out

$\therefore x\cdot x + x\cdot\bar{y} + y\cdot x + y\cdot\bar{y} = x$

using idempotent laws & laws of complementarity

$\therefore x + x\bar{y} + yx + 0 = x$

→ using simplification theorem ($x + xy = x$) twice
→ to get rid of $x\bar{y}$ & yx

$\therefore x + 0 = x$

→ using identity laws ($x + 0 = x$)

$\therefore x = x$ ✓

LHS = RHS ✓

2.3. prove: $xy + yz + \bar{x}z = xy + \bar{x}z$

using identity law

$\therefore xy + (y\cancel{z}\cdot 1) + \bar{x}z = xy + \bar{x}z$

using complimentary law

$\therefore xy + yz(x + \bar{x}) + \bar{x}z = xy + \bar{x}z$

multiply out

$\therefore xy + yzx + yz\bar{x} + \bar{x}z = xy + \bar{x}z$

factor out (1+z)

$\therefore xy(1 + z) + \bar{x}z(1 + y) = xy + \bar{x}z$

using annulment laws ($X + 1 = 1$)

$\therefore xy + \bar{x}z = xy + \bar{x}z$ ✓

LHS = RHS ✓