Assignment-01 EE22BTECH11025

EE1201

KJ

1.1) a) $(1431)_8 \rightarrow$ base 10

~~$(1431)_8 = 1\times10^3 + 4\times$~~

$(1431)_8 = 1\times8^3 + 4\times8^2 + 3\times8^1 + 1\times8^0$

$= 512 + 256 + 24 + 1$

$= (793)_{10}$

$(1431)_8 \rightarrow \boxed{793}_{10}$

b) 11001010.0101 → base 10

$(11001010.0101)_2 = 1\times2^7 + 1\times2^6 + 0\times2^5 + 0\times2^4 + 1\times2^3$

$+ 0\times2^2 + 1\times2^1 + 0\times2^0$

$+ 0\times2^{-1} + 1\times2^{-2} + 0\times2^{-3}$

$+ 1\times2^{-4}$

$= 128 + 64 + 0 + 0 + 8 + 0 + 2 + 0$

$+ \cancel{0.5}\ 0 + 0.25 + 0 + 0.0625$

$= (202.3125)_{10}$

$(11001010.0101)_2 \rightarrow (202.3125)_{10}$

c) $(11001010.0101)_2 \rightarrow$ base 8

$\cancel{(11001010.0101)_2 = 1\times8^7 +}$

$(11001010.0101)_2 \rightarrow \cancel{202}\ (202.3125)_{10} \rightarrow$ base 10

$202.3125 = (202) + (0.3125)$

$0.3125 \times 8 = 2.5$

$0.5 \times 8 = 4$

$(0.3125)_{10} = (0.24)_8$

$(202)_{10} = (312)_8$

	integer	remainder
	202/8	2
	25/8	1
	3/8	3

~~$(202.3125)_{10} = (312.0.24)$~~

$(202.3125)_{10} = (312.24)_8$ Ans

$(11001010.0101)_2 = (202.3125)_{10} \rightarrow$ base 4

$4 \times (.3125) = 1.25$

~~$4 \times (.286)$~~

$4 \times (.25) = 1.00$

202/8	2
50/4	2
12/4	0
3/4	3

$(202.3125)_{10} = (3022.11)_4$ Ans

d) $(1984)_{10} \rightarrow$ base 8

1984/8	0
248/8	0
31/8	7
3/8	3

$(1984)_{10} = (3700)_8$

e) $(1776)_{10} \rightarrow$ base 6

1776/6	0
296/6	2
49/6	1
8/6	2
1/6	1

$(1776)_{10} = (12120)_6$

f) $(53.1575)_{10} \rightarrow$ base 2

$2 \times (0.1575) = 0.315$
$2 \times (0.315) = 0.63$
$2 \times (0.63) = 1.26$
$2 \times (0.26) = 0.52$
$\cdots \qquad \cdots$
$\cdots \qquad \cdots$

53/2	1
26/2	0
13/2	1
6/2	0
3/2	1
1/2	1

$(53.1575)_{10} = (110101.0010.\ldots)_2$

g) $(3.1415\ldots)_{10} \rightarrow$ base 8

$8 \times (0.1415\ldots) = (1.1327\ldots)$
$8 \times (0.1327\ldots) = (1.0617\ldots)$
$8 \times (0.0617\ldots) = (0.4953\ldots)$
$\ldots \qquad \ldots$
$\ldots \qquad \ldots$

3/8	3

$(3.1415\ldots)_{10} = (3.110\ldots)_8$ Ans

$(3.1415\ldots)_{10} \rightarrow$ base 2

$2 \times (0.1415\ldots) = (0.2831\ldots)$
$2 \times (0.2831\ldots) = (0.56637\ldots)$
$2 \times (0.5663\ldots) = (1.1327\ldots)$

3/2	1
1/2	1

$(3.1415\ldots)_{10} = (11.001\ldots)_2$ Ans

1.2) a) $(16)_{10} = (100)_b$

$$16 = 1 \times b^2 + 0 \times b^1 + 0 \times b^0$$

$$\Rightarrow 16 = b^2$$

$$\Rightarrow \boxed{b = 4}$$ Ans

b) $(292)_{10} = (1204)_b$

$$292 = 1 \times b^3 + 2 \times b^2 + 0 \times b^1 + 4 \times b^0$$

$$\Rightarrow 292 = b^3 + 2b^2 + 4$$

$$\Rightarrow b^3 + 2b^2 - 288 = 0$$

$$\Rightarrow (b-6)(b^2 + 8b + 48) = 0$$

$$\Rightarrow \boxed{b = 6}$$ Ans

1.4) a) $1234 + 532 = 6666$

let base be 'b'

$b^3 + 2b^2 + 3b + 4 + 5b^3 + 4b^2 + 3b + 2 = 6b^3 + 2b^2 + 6b + 6$

$\Rightarrow 6b^3 + 6b^2 + 6b + 6 = 6b^3 + 6b^2 + 6b + 6$

$\because b \geq 6$

$b \in \{6, 7, 8, 9, 10\}$ Ans

b) $\frac{41}{3} = 13$

let base be 'b'

$\frac{4b+1}{3} = b + 3$

$\Rightarrow 4b + 1 = 3b + 9$

$\Rightarrow \boxed{b = 8}$ Ans

c) $\frac{33}{3} = 11$

let base be 'b'

$\frac{3b+3}{3} = 11$

$\Rightarrow b + 1 = b + 1$

$\because b \geq 4$

$b \in \{4, 5, 6, 7, 8, 9, 10 \ldots\}$

d) $23 + 44 + 14 + 32 = 223$

let base ~~to~~ be 'b'

$2b + 3 + 4b + 4 + b + 4 + 3b + 2 = 2b^2 + 2b + 3$

$\Rightarrow 10b + 13 = 2b^2 + 2b + 3$

$\Rightarrow 2b^2 - 8b - 10 = 0$

$\Rightarrow (b - 5)(b + 1) = 0$

$\Rightarrow \boxed{b = 5}$ Ans

e) $\frac{302}{20} = 12.1$

let base be 'b'

$$\frac{3b^2 + 0 \times b + 2}{2b + 0} = b + 2 + \frac{1}{b}$$

$$\Rightarrow \frac{3b^2 + 2}{2b} = \frac{b^2 + 2b + 1}{b} \quad \text{as } b \neq 0$$

$\Rightarrow 3b^2 + 2 = 2b^2 + 4b + 2$

$\Rightarrow b^2 = 4b$

$\Rightarrow \boxed{b = 4}$ Ans

f) $\sqrt{41} = 5$

let base be 'b'

$\sqrt{4b+1} = 5$

$\Rightarrow \quad 4b+1 = 25$

$\Rightarrow \quad b = \frac{24}{4} = 6$

$\Rightarrow \boxed{b = 6}$ Ans

3.3)

a) $x' + y' + xyz'$

$= x' + (y' + y(xz'))$

$= x' + (xz' + y')$

$= (x' + xz') + y'$

$= x' + z' + y'$

b) $\cancel{(x' + xyz') + (x' + xyz')(x + x'y'z)}$

$\cancel{= (x' + xyz')[1 + x +}$

$\cancel{= x'(x}$

b) $(x' + xyz') + (x' + xyz')(x + x'y'z)$

$= (x' + xyz')[1 + (x + x'y'z)]$

$= x' + xyz'$

$= x' + x(yz')$

$= x' + yz'$

c) $xy + wxyz' + x'y$

$= (x+x')y + wxyz'$

$= y + wxyz'$

$= y(1 - wxz')$

$= y$

d) $a + a'b + a'b'c + a'b'c'd + \ldots$

$= a + b + a'b'(c + c'd) + \ldots$

$= a + b + a'b'(c+d) + \ldots$

$= a + b + a'b'c + a'b'd + \ldots$

$= a + a'(b'c) + b + b'(a'd) + \ldots$

$= a + b'c + b + a'd + \ldots$

$= (a + a'd) + (b + b'c) + \ldots$

$= a + d + b + c + \ldots$

$= a + b + c + d + \ldots$

e) $xy + y'z' + wxz'$

$= xy(w+w') + y'z' + (wx)z'$

$= y(wx) + y'z' + (wx)z' + xyw'$ {consensus theorem}

$= y(wx) + y'z' + xyw'$

$= xy(w+w') + y'z'$

$= xy + y'z'$

f) $$w'x' + x'y' + w'z' + yz$$

$$= w'x'(y+y') + x'y' + w'z' + yz$$

$$= w'x'y + w'x'y' + x'y' + w'z' + yz$$

$$= w'x'y + x'y'(1+w') + w'z' + yz$$

$$= w'x'y + x'y' + w'z' + yz$$

$$= w'x'y(z+z') + x'y' + w'z' + yz$$

$$= w'x'yz + w'x'yz' + x'y' + w'z' + yz$$

$$= yz(1+w'x') + x'y' + w'z'(1+x'y)$$

$$= yz + x'y' + w'z'$$

Data ________
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3.7) $A' + AB = 0$, $AB = AC$, $AB + AC' + CD = C'D$

$A' + AB = 0$

$\Rightarrow A' = 0$ and $AB = 0$

$\Rightarrow \boxed{B = 0}$, $\boxed{A = 1}$

$AB = AC$

$\Rightarrow B = C$

$\Rightarrow \boxed{C = 0}$

$AB + AC' + CD = C'D$

$\Rightarrow 0 + 1 + 0 = C'D$

$\Rightarrow C'D = 1$

$\Rightarrow \boxed{D = 1}$ as, $C' = 1$

$\boxed{A = 1}$, $\boxed{B = 0}$, $\boxed{C = 0}$, $\boxed{D = 1}$ Ans

3.8) $w'x + yz' = 0 \quad -(1)$

$RHS = wx + y'(w' + z')$

$= wx + y'(w'z + z') + w'x + yz' \quad \{\text{from } (1)\}$

$\{w' + z' = w'z + z'\}$

$= (w + w')x + y'w'z + (y'z' + yz')$

$= x + y'w'z + z'$

$= x + z' + y'w'z$

$= (zx + z') + (x'z' + x) + y'w'z$

$= x'z' + xz + (x + z') + y'w'z$

$= x'z' + xz + y'w'z + x(w + w') + z'(y + y')$

$= x'z' + xz + y'w'z + wx + \overset{0}{\cancel{(w'x + yz')}} + y'z'$

$= x'z' + xz + y'w'z + wx + y'z'$

Now, $w'x + yz' = 0$

$\Rightarrow w'x + (y' + yz') = y'$

$\Rightarrow w'x + y' + z' = y'$

$\Rightarrow w'x + z' = 0$

$\Rightarrow y'w'x + y'z' = 0 \quad - (2)$

$y'(w'x + yz') = 0 \Rightarrow y'w'x = 0 \quad - (3)$

from (2) & (3)

$\boxed{y'z' = 0} \quad - (4)$

$\cancel{= x'z' + xz + wx + y'z'}$

$= x'z' + xz + y'w'z + wx \quad \{\text{from } (4)\}$

$= wx + xz + x'z' + y'w'z = RHS$

Proved

3.13) a) We know that,

$$g'(x_1, x_2, x_3, \ldots, x_n) = g(x_1', x_2', x_3', \ldots, x_n')$$

let $g = f'$,

$$\Rightarrow f'(x_1', x_2', x_3', \ldots, x_n') = f(x_1, x_2, x_3, \ldots, x_n)$$

$$= f_d$$

b) let $f = xy + yz + zx$

then, $f' = (x+y)(y+z)(z+x)$	$= xz + xy + yz + xy$
$= (x+y)[yz + (zx + z) + yx]$	$= xz + xy + yz$
$= (x+y)[(yz + z) + yx]$	$= f$
$= (x+y)(z + yx)$	Thus, $f = f'$

c) $g = Af + A'f_d$

let $f = x+y$, $A = z$

then, $f_d = xy$

$g = z(x+y) + z'xy$

$= zx + z'xy + zy$

$= x(z+z'y) + zy$

$= x(z+y) + zy$

$= xz + xy + yz$

which is a self-dual function

similarly if, $f = xy$, $f_d = \cancel{xy}\, x+y$

$$g = zxy + z'(x+y)$$

$$= zxy + z'x + z'y$$

$$= x(zy + z') + z'y$$

$$= x(z'+y) + z'y$$

$$= xz' + xy + z'y$$

which is a self-dual function.

Thus, 'g' is a self-dual function for any 'f'.

3.19) $M(x,y,z) = xy + xz + yz = (x+y)(y+z)(z+x)$

a) $M(a, b, M(c,d,e)) = (a+b)[b + M(c,d,e)][M(c,d,e) + a]$

$M(c,d,e) = (c+d)(d+e)(e+c)$

~~LHS = (a+b)[b+M(c,d,e)][+~~

~~= (a+b)[b+(c+d)(~~

$= (a+b)(b+cd+de+ce)(a+cd+de+ce)$

$= (a+b)(ab+bcd+bde+bce+acd+cd$

$+ cde + cde + ade + cde + de + cde + ace + cde$

$+ cde + ce)$

$= (a+b)(ab+bcd+bde+bce+acd+cd$

$+ cde + abe + de + ace + ce)$

$= ab + abcd + abde + abce + acd + acde + ade$

$+ ace + bcd + bde + bce + bcde + abde +$

$bde + abce + bce$

$= ab + abde + abec + (acd + acde)$

$+ ade + ace + (bcd + abcd) + bde$

$+ bce + bcde)$

$= ab + bde + bce + ade + ace + bcd + acd = LHS$

$RHS = M(M(a,b,c), d, M(a,b,e))$

$= abd + bcd + cad + dab + dbe + dae$

$+ (ab+bc+ca)(ab+be+ca)$

$= abd + bcd + acd + abd + bde + ade + ab + abe$

$+ abe + abc + bce + bcac + abc + acbe + ace$

$= ab + bde + bce + bcd + acd + abd + ade$

$+ abc + abce + ace$

$= ab + bde + bce + bcd + abd + acd + ade$

$+ abc + ace$

$= ab + bde + bce + bcd + abd + acd + ade + ace$

$= ab + bde + bce + bcd + acd + ade + ace$

$= LHS$

$LHS = RHS$, proved

b) We need to express majority function in terms of AND, OR, NOT operator

$AND(x,y) = M(x,y,0) = xy$

$OR(x,y) = M(x,y,1) = x+y$

$NOT(x) = M(x,0,0) = x'$

$x \text{ OR } y = x+y = NOT[(NOT(x)) \text{ AND } (NOT(y))]$

$= (x'y')' = M(x',y',0)$

let $f(x,y,z)$ be a switching function

$f(x,y,z) = xy + x'z$

$= M(M(x,y,0), M(x',z,0), 1)$

$= M(M(x,y,0), M(x',z,0), 0')$

Hence, $M(x,y,z)$; complementation ~~op~~ operation of '0' form a functionally complete set of operations

3.20) As C is the only executive who can open 'w' lock

so, 'C' is the ~~esen~~ essential executive {Ans (c)}

also, 'y' lock will be opened

Thus, only three other locks (v, x, z) are to be opened which can be a combination of {AD, AE, BD, DE}

$$f(A,B,C,D,E) = C(AD + AE + BD + DE)$$

$$= ADC + AEC + BDC + DEC$$ {Ans (b)}

also, The minimum number of executive required to open safe is '3' from above 'f'. {Ans (a)}

(M)

1.18)

a) 10011 − 10010

0_10010

1s' : 1_01101
+ 1

2s' : 1_01110
+ 0_10011

0_00001 (+ve)

Ans → 00001

b) 100010 − 100110

0_100110

1s' : 1_011001
+ 1

2s' : 1_011010
+ 0_100010

1_111100 (−ve)

1s' : 0_000011
+ 1

2s' : 0_000100

Ans → 000100

c) 1001 − 110101

0_110101

1s' : 1_001010
+1
2s' : 1_001011
+ 0_001001
1_010100 (−ve)

1s' : 0_101011
~~2s'~~ : +1
2s' : 0_101100

Ans → 101100

d) 101000 − 10101

0_010101

1s' : 1_101010

+1

2s' : 1_101011

+ 0_101000

0_010011 (+ve)

Ans → 010011

1.21) $+9742 = 009742$

$\rightarrow 990257$ (9's)

$\rightarrow 990258$ (10's)

$+641 = 000641$

$\rightarrow 999358$ (9's)

$\rightarrow 999359$ (10's)

a) $(+9742) + (+641) = 009742 + 000641$

$= 010383$ (+ve)

$= 10383$ Ans

b) $(+9742) + (-641) = 009742 + 999359$

$= \cancel{1}009101$ (+ve)

$= 9101$ Ans

$$\begin{array}{r} 009742 \\ 999359 \\ \hline \cancel{1}009101 \end{array}$$

classmate

Date

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c) $(-9742) + (+641) = 990258 + 000641$

$= 990899$ (-ve)

$$\begin{array}{r} -1000000 \\ 990899 \\ \hline -0009101 \end{array}$$

$= -9101$ Ans

$$\begin{array}{r} 990258 \\ 999359 \\ \hline \cancel{1}989617 \end{array}$$

d) $(-9742) + (-641) = 990258 + 999359$

$= 989617$ (-ve)

$$\begin{array}{r} -1000000 \\ 989617 \\ \hline -0010383 \end{array}$$

$= -10383$ Ans