Due: 7-Oct

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Digital Logic: Asn #1

Problem set: Chapter 1
1-8, 10, 13, 15, 18, 23-27

1) powers-of-10 summation of 827_{10}

100	10	1
8	2	7

$$827 = 8\cdot 100 + 2\cdot 10 + 7\cdot 1$$
$$= \boxed{8\cdot 10^2 + 2\cdot 10^1 + 7\cdot 10^0}$$

~~=8~~

2) powers-of-2 summation of 223_{10}

$$223_{10} = 11011111_2$$

256	128	64	32	16	8	4	2	1
2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	1	1	0	1	1	1	1	1

$$223_{10} = 0\cdot 2^8 + 1\cdot 2^7 + 1\cdot 2^6 + 0\cdot 2^5 + 1\cdot 2^4 + 1\cdot 2^3 + 1\cdot 2^2 + 1\cdot 2^1 + 1\cdot 2^0$$
$$= 1\cdot 2^7 + 1\cdot 2^6 + 1\cdot 2^4 + 1\cdot 2^3 + 1\cdot 2^2 + 1\cdot 2^1 + 1\cdot 2^0$$

~~not answere~~

$$\boxed{= 2^7 + 2^6 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0}$$
answer

3) 8-bits are needed to represent 223_{10} in unsigned binary.

$223_{10} =$
11011111
~~0000 1101 1111~~
1101 1111 0000

4) $223_{10} = 11011111$

nibbles: 0000 1101 1111

Powers of 2 summation:

$$0000\,1101\,1111 = 0\cdot2^{11}+0\cdot2^{10}+0\cdot2^{9}+0\cdot2^{8}+1\cdot2^{7}+1\cdot2^{6}+0\cdot2^{5}+1\cdot2^{4}+1\cdot2^{3}+1\cdot2^{2}+1\cdot2^{1}+1\cdot2^{0}$$

$$= 2^7+2^6+2^4+2^3+2^2+2^1+2^0$$

2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	0	0	1	1	0	1	1	1	1	1

$223_{10} = 000011011111$

Hexadecimal:

0000 1101 1111

$= 0 \quad D \quad F_{16}$

$= 0\cdot16^2 + 13\cdot16^1 + 15\cdot16^0$

$= 208 + 15$

$= 223_{10} = 0DF_{16}$

~~1101 1111 0000~~

5) powers-of-10 summation for 1022_{10}

$1022_{10} = \cancel{\overset{1024}{2^{10}}\ \overset{512}{2^{9}}\ \overset{256}{2^{8}}\ \overset{128}{2^{7}}\ \overset{64}{2^{6}}\ \overset{32}{2^{5}}\ \overset{16}{2^{4}}\ \overset{8}{2^{3}}\ \overset{4}{2^{2}}\ \overset{2}{2^{1}}\ \overset{1}{2^{0}}}$

$1022_{10} =$

1000	100	10	1
1	0	2	2
10^3	10^2	10^1	10^0

$$\boxed{1022_{10} = 10^3 + 2 \cdot 10^1 + 2 \cdot 10^0}$$

6) $1022_{10} =$

1024	512	256	128	64	32	16	8	4	2	1
2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
$\boxed{0}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{0}$

$$\boxed{1022_{10} = 01111111110}$$

$$
\begin{array}{rl}
1022 & \\
-512 & 2^9 \\
\hline
510 & \\
-256 & 2^8 \\
\hline
254 & \\
-128 & 2^7 \\
\hline
126 & \\
-64 & 2^6 \\
\hline
62 & \\
-32 & 2^5 \\
\hline
30 & \\
-16 & 2^4 \\
\hline
14 & \\
-8 & 2^3 \\
\hline
6 & \\
-4 & 2^2 \\
\hline
2 & \\
-2 & 2^1 \\
\hline
\end{array}
$$

7) $1022_{10} = \underbrace{0\,11}\,\underbrace{1111}\,\underbrace{1110}$

0011 1111 1110

3 F E_{16}

$$\boxed{1022_{10} = 3FE_{16}}$$

8)

1110 1101

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
$\boxed{1}$	$\boxed{1}$	$\boxed{1}$	$\boxed{0}$	$\boxed{1}$	$\boxed{1}$	$\boxed{0}$	$\boxed{1}$

$= 2^7 + 2^6 + 2^5 + 2^3 + 2^2 + 2^0$

$= 128 + 64 + 32 + 8 + 4 + 1$

$= \boxed{237_{10}} = 1110\ 1101_2$

10) $1019_{10} = 1111111011_2$

$= 0011\quad 1111\quad 1011$

3 F B

$= 3FB_{16}$

13) 0xFAB

	F	A	B
=	1111	1010	1011
=	15	10	11

$= 15 \cdot 16^2 + 10 \cdot 16^1 + 11 \cdot 16^0$

$\boxed{= 4011_{10}}$

15) 0xCAFE to binary

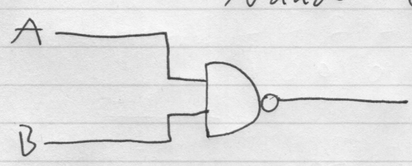
	C	A	F	E
	~~1100~~	~~1010~~		
=	12	10	15	14
	1100	1010	1111	1110

$\boxed{= 1100\,1010\,1111\,1110}$

18) $\boxed{\text{12-bits can represent } 2^{12} \text{ integers (aka 4096)}}$

23)

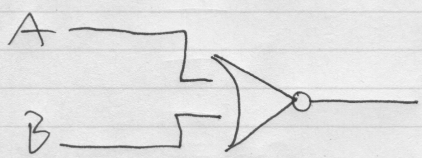
Nand Gate



$\neg(A \land B)$

24)

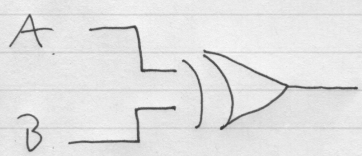
Nor Gate



$\neg(A \lor B)$

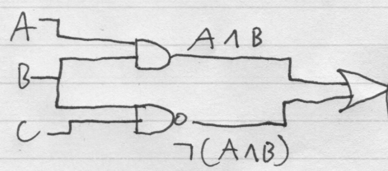
25)

Xor Gate



$(A \land \neg B) \lor (\neg A \land B)$

26)



$\boxed{(A \land B) \lor \neg(A \land B)}$

~~27) $(A \lor \neg B) \land$~~

27) $(A \vee \neg B) \wedge \neg(B \vee C)$