EEE119 Digital Systems – N.J.Powell Problem Sheet 4 - Solutions

1. (i) $26.125_{10} = 11010.001_2$ (ii) $49.875_{10} = 110001.111_2$

2. (i) $110111_2 = 55_{10}$ (ii) $1000010.101_2 = 66.625_{10}$

3. $266_{10} = 10A_{16} = 412_8 = 001001100110_{BCD}$

4.

b_2	b_1	b_0	g_2	g_1	g_0
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	1	1	0
1	0	1	1	1	1
1	1	0	1	0	1
1	1	1	1	0	0

$g_2 = b_2$ by observation

$g_1 = \bar{b}_2 b_1 \bar{b}_0 + \bar{b}_2 b_1 b_0 + b_2 \bar{b}_1 \bar{b}_0 + b_2 \bar{b}_1 b_0$

$= \bar{b}_2 b_1 (\bar{b}_0 + b_0) + b_2 \bar{b}_1 (\bar{b}_0 + b_0)$

$= \bar{b}_2 b_1 + b_2 \bar{b}_1 = b_2 \oplus b_1$

$g_0 = \bar{b}_2 \bar{b}_1 b_0 + \bar{b}_2 b_1 \bar{b}_0 + b_2 \bar{b}_1 b_0 + b_2 b_1 \bar{b}_0$

$= \bar{b}_1 b_0 (\bar{b}_2 + b_2) + b_1 \bar{b}_0 (\bar{b}_2 + b_2)$

$= \bar{b}_1 b_0 + b_1 \bar{b}_0 = b_1 \oplus b_0$

5. Look up ASCII characters on the internet.

6.

(a) $00000101 + 00001011 = 00010000$

(b) $00010111 + 00100111 = 00111110$

(c) $00100101 + 00011101 = 01000010$

7.

$\bar{S} = \bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}$

$S = \overline{\bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}} = (A+B+C)(A+\bar{B}+\bar{C})(\bar{A}+B+\bar{C})(\bar{A}+\bar{B}+C)$

$\bar{C} = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}\bar{C}$

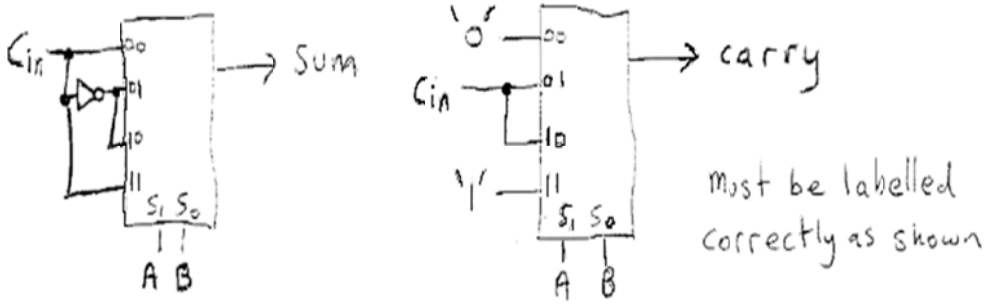
$C = \overline{\bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}\bar{C}} = (A+B+C)(A+B+\bar{C})(A+\bar{B}+C)(\bar{A}+B+C)$

8. 00011001

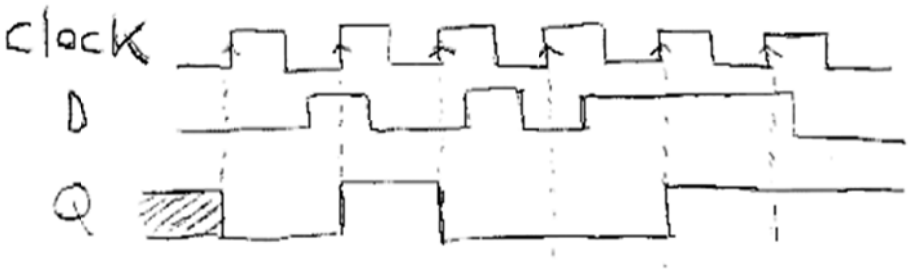
9. (a) 50ns (b) 1ns

10. *Preset* sets flip-flop to '1' *Clear* to '0' both immediately and independent of the clock.

11.


Cin
00
01
10
11
S1 S0
A B
Sum
'0'
Cin
'1'
carry
must be labelled
correctly as shown

12.


clock
D
Q