Review Question Solutions

1. (a) $A59.FCE = \underbrace{1010}\ \underbrace{0101}\ \underbrace{1001} \bullet \underbrace{1111}\ \underbrace{1100}\ \underbrace{1110}$

(b)
$$16\overline{)1400}\ \overset{87}{}\ \leftarrow\ 16\overline{)87}\ \overset{5}{}\ \leftarrow\ 16\overline{)5}\ \overset{0}{}$$
$$\underline{1392}\qquad\qquad \underline{80}\qquad\qquad \underline{0}$$
$$8\qquad\qquad 7\qquad\qquad 5$$
$.16\times16 = \mathbf{2}.56 \rightarrow .56\times16 = \mathbf{8}.96 \rightarrow .96\times16 = \mathbf{F}.36 \rightarrow .36\times16 = \mathbf{5}.76.....$
$= (578.28F5....)_{16}$

(c) $\underbrace{101}_{5}\underbrace{011}_{3}\underbrace{100}_{4}.\underbrace{000}_{0}\underbrace{111}_{7}$
$= (534.07)_8$

(d)
$$2\overline{)166}\ \overset{83}{}\ \leftarrow\ 2\overline{)83}\ \overset{41}{}\ \leftarrow\ 2\overline{)41}\ \overset{20}{}\ \leftarrow 2\overline{)20}\ \overset{10}{}\ \leftarrow 2\overline{)10}\ \overset{5}{}\ \leftarrow 2\overline{)5}\ \overset{2}{}\ \leftarrow 2\overline{)2}\ \overset{1}{}\ \leftarrow 2\overline{)1}\ \overset{0}{}$$
$$\underline{166}\qquad \underline{82}\qquad \underline{40}\qquad \underline{20}\qquad \underline{10}\qquad \underline{4}\qquad \underline{2}\qquad \underline{0}$$
$$0\qquad 1\qquad 1\qquad 0\qquad 0\qquad 1\qquad 0\qquad 1$$

$= (10100110)_2$

2.

Decimal	Sign Mag.
127	01111111
-0	10000000
-55	10110111

3.

Decimal	1's Comp.
43	0000101011
-1	1111111110
-128	1101111111

4. (a) 01111001 (positive number) $\rightarrow$ 121

(b)
$11111111(\mathbf{2's}) \xrightarrow{-1} 11111110(\mathbf{1's}) \xrightarrow{\text{complement}} 00000001(\mathbf{magnitude}) \rightarrow -1$

(c) $10000(\mathbf{2's}) \xrightarrow{-1} 01111(\mathbf{1's}) \xrightarrow{\text{complement}} 10000(\mathbf{magnitude}) \rightarrow -16$

(d)

$$10000001(\mathbf{2's}) \xrightarrow{-1} 10000000(\mathbf{1's}) \xrightarrow{\text{complement}} 01111111(\mathbf{mag.}) \rightarrow -127$$

5.

(a) 27 + 38

```
  00011011
+ 00100110
  01000001 ———→ 65
```

(b) 55 + 75

```
  00110111
+ 01001011
  10000010 ———→ -126
```

(reflect an overflow situation i.e. the correct result cannot be represented with the available number of bits.)

6. $(00100)_{SM} = (00100)_{2's}$ [the number is positive]
$(10100)_{2's} + (00100)_{SM} = (10100)_{2's} + (00100)_{2's} = (11000)_{2's}$
Convert to integers and verify your result!

7. A=1000

8. The result is available at 100ns. This is because there is no delay for the gates.

9. (b) wire clock, D, Q;

10. The synthesized circuit is a 4-to-1 multiplexer. Inputs are a, b, c, d, output is out, 2-bit control signal is used to select the input.

11. From the given truth table, we can write following two K-maps.
K-map for S,

C_i / AB	0	1
00	0	1
01	1	0
11	0	1
10	1	0

From the K-map, we have
$S = \bar{A}\bar{B}C_i + \bar{A}B\overline{C_i} + ABC_i + A\bar{B}\overline{C_i} = (\bar{A}B + A\bar{B})\overline{C_i} + (\bar{A}\bar{B} + AB)C_i =$
$A \oplus B \oplus C_i$

K-map for C_o

C_i / AB	0	1
00	0	0
01	0	1
11	1	1
10	0	1

From the K-map, we have

$C_i = AB + BC_i + AC_i = AB + (\bar{A}B + A\bar{B})C_i = \mathrm{AB} + (A \oplus B)C_i$

12 A 16-bit CSA adder implementation. The critical path is shaded in grey.