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CSE260

Section: 02

Ans no 1

a) $(4693.23450)_{10}$

$$
\begin{array}{r|l}
2 & 4693 \\
2 & 2346 - 1 \\
2 & 1173 - 0 \\
2 & 586 - 1 \\
2 & 293 - 0 \\
2 & 146 - 1 \\
2 & 73 - 0 \\
2 & 36 - 1 \\
2 & 18 - 0 \\
2 & 9 - 0 \\
2 & 4 - 01 \\
2 & 2 - 0 \\
2 & 1 - 0 \\
& 0 - 1 \\
\end{array}
$$

$(4693)_{10} = (1001001010101)_2$

$0.23450 \times 2 = 0.469$

$0.469 \times 2 = 0.938$

$0.938 \times 2 = 1.876$

$0.876 \times 2 = 1.752$

$0.752 \times 2 = 1.504$

$(0.23450)_{10} = (0.00111)_2$

$\therefore (4693.23450)_{10} = (1001001010101.00111\ldots)_2$

b) $(4976.250363)_{10}$

```
2 | 4976
2 | 2488 - 0
2 | 1244 - 0
2 | 622 - 0
2 | 311 - 0
2 | 155 - 1
2 | 77 - 1
2 | 38 - 1
2 | 19 - 0
2 | 9 - 1
2 | 4 - 1
2 | 2 - 0
2 | 1 - 0
    0 - 1
```

$(4976)_{10} = (1001101110000)_2$

$0.250363 \times 2 = 0.500726$

$0.500726 \times 2 = 1.001452$

$0.001452 \times 2 = 0.002904$

$0.002904 \times 2 = 0.005808$

$0.005808 \times 2 = 0.011616$

$(0.250363)_{10} = (0.01000)_2$

$(4976.250363)_{10} = (1001101110000.01000\cdots)_2$

a) $(8712)_9$

$= 8 \times 9^3 + 7 \times 9^2 + 1 \times 9^1 + 2 \times 9^0$

$= 5832 + 567 + 9 + 2$

$= (6410)_{10}$

```
5 | 6410
5 | 1282 - 0      ↑
5 | 256  - 2
5 | 51   - 1
5 | 10   - 1
5 | 2    - 0
    0    - 2
```

$\therefore (8712)_9 = (201120)_5$

b) $(234.256)_9$

$= 2 \times 9^2 + 3 \times 9^1 + 4 \times 9^0 + 2 \times 9^{-1} + 5 \times 9^{-2} + 6 \times 9^{-3}$

$= 162 + 27 + 4 + \dfrac{2}{9} + \dfrac{5}{81} + \dfrac{2}{243}$

$= (193.2921811)_{10}$

$$
\begin{array}{r|l}
5 & 193 \\
\hline
5 & 38 - 3 \\
\hline
5 & 7 - 3 \\
\hline
5 & 1 - 2 \\
\hline
& 0 - 1
\end{array}
$$

$(193)_{10} = (1233)_5$

$0.2921811 \times 5 = 1.4609055$

$0.4609055 \times 5 = 2.3045275$

$0.3045275 \times 5 = 1.5226375$

$0.5226375 \times 5 = 2.6131875$

$0.6131875 \times 5 = 3.0659375$

$(234.256)_9 = (1233.12123\ldots)_5$

Ans no 3

a) $(101010101010)_2$

$= (AAA)_{16}$

(b) $(110101110111.111010101011111)_2$

$= (1101\ 0111\ 0111.1110\ 1010\ 1011\ 1100)_2$

$= (D77.EABC)_{16}$

Ans no 4

a) $(101010101010)_2$

$= \cancel{5242}$

$= (5252)_8$

b) $(110101110111.111010101011110)_2$

$= (6567.72536)_8$

a) $(38A)_{13}$

$= 3 \times 13^2 + 8 \times 13^1 + 10 \times 13^0$

$= (621)_{10}$

$\begin{array}{r|l}
7 & 621 \\
\hline
7 & 88 \quad - \; 5 \\
\hline
7 & 12 \quad - \; 4 \\
\hline
7 & 1 \quad - \; 5 \\
\hline
 & 0 \quad - \; 1
\end{array}$

$\therefore (38A)_{13} = (1545)_7$

b) $(10110111)_7$

$= 1 \times 7^7 + 0 \times 7^6 + 1 \times 7^5 + 1 \times 7^4 + 0 \times 7^3 + 1 \times 7^2 + 1 \times 7^1 + 1 \times 7^0$

$= 823543 + 16807 + 2401 + 49 + 7 + 1$

$= (842808)_{10}$

$\begin{array}{r|l}
4 & 842808 \\
\hline
4 & 210702 \quad - \; 0 \\
\hline
4 & 52675 \quad - \; 2 \\
\hline
4 & 13168 \quad - \; 3 \\
\hline
4 & 3292 \quad - \; 0 \\
\hline
4 & 823 \quad - \; 0 \\
\hline
4 & 205 \quad - \; 3 \\
\hline
 & 51 \quad - \; 1
\end{array}$

$\begin{array}{r|l}
4 & 51 \\
\hline
4 & 12 \quad - \; 3 \\
\hline
4 & 3 \quad - \; 0 \\
\hline
 & 0 \quad - \; 3
\end{array}$

$(10110111)_7 = (30\ 31300320)$.

(c) $(0011)_{BCD} = (?)_5$

$= (3)_{10}$

$5 \underline{|3}$
$0 - 3$

$\therefore \quad \cancel{3} (0011)_{BCD} = (3)_5$

d) $(0011)_{10}$

$$
\begin{array}{cccc}
0 & 0 & 1 & 1 \\
+ \ 3 & 3 & 3 & 3 \\
\hline
3 & 3 & 4 & 4 \\
\downarrow & \downarrow & \downarrow & \downarrow \\
0011 & 0011 & 0100 & 0100
\end{array}
$$

$\therefore (0011)_{10} = (0011001101000100)_{excess\ 3}$

e) $(1100011)_{10}$

```
    1    1    0    0    0    1    1
  + 5    5    5    5    5    5    5
  ─────  ───  ───  ───  ───  ───  ───
    6    6    5    5    5    6    6
    ↓    ↓    ↓    ↓    ↓    ↓    ↓
  0110  0110 0101 0101 0101 0110  0110
```

$\therefore (1100011)_{10} = (0110\ 0110\ 0101\ 0101\ 0101\ 0110\ 0110)_{excess5}$

⑥

Addition

$$
\begin{array}{r}
5\ 1\ 3 \\
3\ 3\ 5 \\
\hline
(1\ 0\ 5\ 0)_8
\end{array}
$$

Subtraction

$$
\begin{array}{r}
5\ 1\ 3 \\
3\ 3\ 5 \\
\hline
(1\ 5\ 6)_8
\end{array}
$$

Division

```
335) 513 (001
      0
     ─────
     5 1
      0
     ─────
     5 1 3
     3 3 5
     ─────
     1 5 6
```

Remainder = 156

Quotient = 1

Multiplication

```
       5 1 3
       3 3 5
     ─────────
       3 1 6 7
     1 7 4 1 0
   1 7 4 1 0 0
  ─────────────
  (2 1 6 6 7 7)₈
```

$$8|15|1 \qquad 8|25|3$$
$$\quad \underline{8} \qquad\qquad \underline{24}$$
$$\quad 7 \qquad\qquad\quad 1$$

$$8|9|1 \qquad 8|14|1 \qquad 8|9|1$$
$$\; \underline{8} \qquad\quad \underline{8}$$
$$\; 1 \qquad\quad\; 6$$

Verification

$$(513)_8 = 5 \times 8^2 + 1 \times 8^1 + 3 \times 8^0$$

$$= (331)_{10}$$

$$(335)_8 = 3 \times 8^2 + 3 \times 8^1 + 5 \times 8^0$$

$$= (221)_{10}$$

$$\begin{array}{r} 3\ 3\ 1 \\ +\ 2\ 2\ 1 \\ \hline (5\ 5\ 2)_{10} \end{array}$$

$$\begin{array}{r|ll} 8 & 552 & \\ 8 & 69 & -\ 0 \\ 8 & 8 & -\ 5 \\ 8 & 1 & -\ 0 \\ & 0 & -\ 1 \end{array}$$

$$\therefore (552)_{10} = (1050)_8$$

$$\begin{array}{r} 3\ 3\ 1 \\ -\ 2\ 2\ 1 \\ \hline (1\ 1\ 0)_{10} \end{array}$$

$$\begin{array}{r|ll} 8 & 110 & \\ 8 & 13 & -\ 6 \\ 8 & 1 & -\ 5 \\ & 0 & -\ 1 \end{array}$$

$$\therefore (110)_{10} = (156)_8$$

$$331 \times 221 = (73151)_{10}$$

$$
\begin{array}{r|l}
8 & 73151 \\
\hline
8 & 9143 - 7 \\
\hline
8 & 1142 - 7 \\
\hline
8 & 142 - 6 \\
\hline
8 & 17 - 6 \\
\hline
8 & 2 - 1 \\
\hline
& 0 - 2
\end{array}
$$

$$(73151)_{10} = (216677)_8$$

∴ Vanified

$$
\begin{array}{r}
221 \overline{)\ 331\ (\ 1} \\
221 \\
\hline
110
\end{array}
$$

Quotient $= (1)_{10} = (1)_8$

Remainder $= (110)_{10} = (156)_8$

∴ Vanified.

⑦

214
$+115$
$\overline{(333)_6}$

$6\,)\,9\,(\,1$
$\underline{6}$
3

214
$-\,115$
$\overline{(055)_6}$

214
$\times\,115$
$\overline{1522}$
2140
21400
$\overline{(25502)_6}$

$6)\,20\,(3$
$\underline{18}$
2

$6)\,6\,(1$
$\underline{6}$
0

$6)\,8\,(1$
$\underline{6}$
2

$6)\,11\,(1$
$\underline{6}$
5

$115)\,214\,(001 \;\to\; \text{Quotient}$
$\underline{0}$
21
$\underline{0}$
214
$\underline{115}$
$55 \;\to\; \text{Remainder}$

Verification

$(214)_6 = 2 \times 6^2 + 1 \times 6^1 + 4 \times 6^0$

$= 72 + 6 + 4$

$= (82)_{10}$

$(115)_6 = 1 \times 6^2 + 1 \times 6^1 + 5 \times 6^0$

$= (47)_{10}$

$82 + 47 = (129)_{10}$

$$\begin{array}{r|l}
6 & 129 \\
6 & 21 - 3 \\
6 & 3 - 3 \\
& 0 - 3
\end{array} \uparrow$$

$(129)_{10} = (333)_6$

$82 - 47 = (35)_{10}$

$$\begin{array}{r|l}
6 & 35 \\
6 & 5 - 5 \\
& 0 - 5
\end{array}$$

$(35)_{10} = (55)_6$

$82 \times 47 = (3854)_{10}$

$$\begin{array}{r|l}
6 & 3854 \\
6 & 642 - 2 \\
6 & 107 - 0 \\
6 & 17 - 5 \\
6 & 2 - 5 \\
& 0 - 2
\end{array} \uparrow$$

$(3854)_{10} = \cancel{(20552)}_6 \, (25502)_6$

$\cancel{82 \div 47 = (1.74468)_{10}}$

$$\begin{array}{r|l}
6 & 1 \\
& 0 - 1
\end{array}$$

0.74468

$\therefore$ Vanified.

$$47) \; 82 \; (1$$
$$\underline{47}$$
$$35$$

$\therefore$ Quotient $= (1)_{10} = (1)_6$

Remainder $= (35)_{10} = (55)_6$

$$\begin{array}{r|l}
6 & 35 \\
6 & 5 - 5 \\
& 0 - 5
\end{array} \uparrow$$

⑨ $(10101010 1000011)_{2s}$

0101010101111100

$+1$

$\overline{0101010101111101}$

$= 1 \times 2^{13} + 0 \times 2^{12} + 1 \times 2^{11} + 0 \times 2^{10} + 1 \times 2^{9} + 0 \times 2^{8} + 1 \times 2^{7}$
$ + 0 \times 2^{6} + 1 \times 2^{5} + 1 \times 2^{4} + 1 \times 2^{3} + 1 \times 2^{2} + 0 \times 2^{1} + 1 \times 2^{0}$

$= (-10941)_{10}$

(10) $(0100101010101111)_{,S}$

$= 1 \times 2^{13} + 0 \times 2^{12} + 0 \times 2^{11} + 1 \times 2^{10} + 0 \times 2^{9} + 1 \times 2^{8} + 0 \times 2^{7}$
$\quad + 1 \times 2^{6} + 0 \times 2^{5} + 1 \times 2^{4} + 1 \times 2^{3} + 1 \times 2^{2} + 1 \times 2^{1} + 1 \times 2^{0}$

$= (+9567)_{10}$

(11) $(1010101010100011)_{,S}$

0101010101111100

$= 1 \times 2^{13} + 0 \times 2^{12} + 1 \times 2^{11} + 0 \times 2^{10} + 1 \times 2^{9} + 0 \times 2^{8} + 1 \times 2^{7}$
$\quad + 0 \times 2^{6} + 1 \times 2^{5} + 1 \times 2^{4} + 1 \times 2^{3} + 1 \times 2^{2} + 0 \times 2^{1} + 0 \times 2^{0}$

$= (-10940)_{10}$

(8) $(0100101010111111)_{2S}$

$= 1 \times 2^{13} + 0 \times 2^{12} + 0 \times 2^{11} + 1 \times 2^{10} + 0 \times 2^{9} + 1 \times 2^{8} + 0 \times 2^{7} + 1 \times 2^{6}$
$\quad + 0 \times 2^{5} + 1 \times 2^{4} + 1 \times 2^{3} + 1 \times 2^{2} + 1 \times 2^{1} + 1 \times 2^{0}$

$= (+9567)_{10}$

⑫ $27 - 13 = 27 + (-13)$

$27 = 11011$

$+27 = 011011$

$\qquad = 0011011 \quad (7\,bit)$

$13 = 1101$

$+13 = 01101$

$\qquad = 0001101 \quad (7\,bit)$

$\qquad \quad 1110010$
$\qquad \qquad \quad +1$
$\overline{\qquad\qquad\qquad\qquad}$
$-13 = (1110011)_{2s}$

$\quad\; 0011011$
$\quad\; 1110011$
$\overline{\qquad\qquad}$
$\quad 10001110$

Ans $= 0001110$

No overflow.

According to the rule, if we add two different sign number, it represents no overflow.

(13) $98 - 45 = 98 + (-45)$

$98 = 1100010$

$+98 = 01100010$

$= 000001100010 \quad (12 \text{ bit})$

$45 = 101101$

$+45 = 0101101$

$= 000000101101 \quad (12 \text{ bit})$

111111010010

$+1$

$-45 = (111111010011)_{2s}$

$$000001100010$$
$$111111010011$$
$$\overline{1000000110101}$$

Aws $= 000000110101$

No overflow.

According to the rule, if we add two different sign number it represents no overflow.

(14) 13 + 27

$\qquad$ 13 = 1101

$\qquad$ +13 = 01101

$\qquad\qquad$ = 001101   (6 bit)

$\qquad$ 27 = 11011

$\qquad$ +27 = 011011

$\qquad$ 001101
$\qquad$ 011011
$\qquad$ ————————
$\qquad$ 101000
$\qquad$ ↳ diff sign

Yes, overflow.

According to the rule, add two same signed number if answer has different sign represetn overflow.

(15) a) $91 - 499 = 91 + (-499)$

$91 = 1011011$

$+91 = 01011011$

$= 0000001011011 \quad (13 \text{ bit})$

$499 = 111110011$

$+499 = 0111110011$

~~$-499 = (1000001100)_{1s}$~~

$= 0000111110011$

$-499 = (1111000001100)_{1s}$

$\quad\quad 0000001011011$
$\quad\quad 1111000001100$
$\overline{(1111001100111)_{1s}}$

$+499 = 0000111110011$
$\quad\quad\quad 1111000001100$
$\quad\quad\quad\quad\quad\quad\quad +1$
$\overline{-499 = (1111000001101)_{2s}}$

$\quad\quad 0000001011011$
$\quad\quad 1111000001101$
$\overline{(1111001101000)_{2s}}$

In both case, we add two different sign
number, so no overflow.

b) 379 + 98

379 = 101111011

+ 379 = 0101111011

  = 0000101111011   (13 bit)

98 = 1100010

+ 98 = 01100010

  = 0000001100010   (13 bit)

0000101111011
0000001100010
———————————————
0001110111101

~~yes~~ no overflow.

Here we add two same sign number
and got same sign ans that represent
no overflow.