Introduction to informatics

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Labor 02

Revision

- Convert from ten base to p-base system (p=2..16)
- Convert from p-base to ten base system (p=2..16)
- Connection between binary and octal systems
- Connection between binary and hexadecimal systems

Exercises

- $23612.352_{(9} =?_{(10}$
- $32918.35_{(10} =?_{(7}$
- $B7E3DAC_{(16} =?_{(2} =?_{(8}$
- $10100101101111010110111_{(2} =?_{(8} =?_{(16}$

Arithmetic operations

- Addition of **binary** numbers

Rules

- 0+0=0
- 1+0=1
- 0+1=1
- 1+1=10
- 1+1+1=10+1=11

Arithmetic operations

- Additions of **binary** numbers

$$\begin{array}{r} 1\ 1\ 0\ 1 \\ +\ 0\ 1\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 1\ 1.\ 0\ 1 \\ +\ 1\ 1\ 0\ 1.\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 1\ 1\ 1.\ 0\ 1 \\ +\ 1\ 1\ 1\ 0\ 1.\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 1\ 0\ 1\ 0.\ 1\ 1\ 1 \\ +\ 1\ 0\ 1\ 1\ 1\ 0.\ 1\ 0\ 1 \\ \hline \end{array}$$

Arithmetic operations

- Subtractions of **binary** numbers
- 10−1=1

$$\begin{array}{r} 1\ 1\ 0\ 1.\ 0\ 1 \\ -\ 1\ 0\ 1\ 1.\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 0\ 0.\ 1\ 0 \\ -\ \ \ 1\ 1\ 1.\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 0\ 1\ 0.\ 1\ 1\ 1\ 0 \\ -\ \ \ 1\ 1\ 0\ 1.\ 1\ 0\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 0\ 0.\ 1\ 1 \\ -\ 1\ 1\ 0\ 1.\ 0\ 1 \\ \hline \end{array}$$

Arithmetic operations

- Additions and subtractions of **ternary** numbers

$$\begin{array}{r} 1\ 1\ 1\ 0\ 2 \\ +\ 1\ 2\ 2\ 1\ 2 \\ \hline \end{array}$$

$$\begin{array}{r} 2\ 2\ 2\ 1\ 1 \\ +\ 1\ 0\ 1\ 2\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2\ 2\ 2\ 0\ 1 \\ -\ 1\ 0\ 2\ 2\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2\ 2\ 2\ 2\ 1 \\ -\ 1\ 2\ 1\ 0\ 2 \\ \hline \end{array}$$

Arithmetic operations

- Additions and subtractions of **quinary** numbers

$$\begin{array}{r} 2\,2\,1\,0\,0 \\ +\ 3\,4\,0\,2\,2 \\ \hline \end{array}$$

$$\begin{array}{r} 4\,0\,4\,0\,3 \\ +\ 2\,0\,3\,0\,1 \\ \hline \end{array}$$

$$\begin{array}{r} 3\,1\,3\,3\,0 \\ -\ 2\,4\,3\,0\,1 \\ \hline \end{array}$$

$$\begin{array}{r} 3\,1\,2\,2\,1 \\ -\ 1\,3\,2\,4\,2 \\ \hline \end{array}$$

Arithmetic operations

- Additions and subtractions of **octal** numbers

$$\begin{array}{r} 4\ 7\ 5\ 4 \\ +\ 3\ 1\ 4\ 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5\ 6\ 1\ 2\ 3 \\ +\ \ \ 7\ 4\ 5\ 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5\ 1\ 4\ 3 \\ -\ 1\ 6\ 5\ 2 \\ \hline \end{array}$$

$$\begin{array}{r} 7\ 6\ 5\ 2 \\ -\ 3\ 7\ 4\ 6 \\ \hline \end{array}$$

Arithmetic operations

- Additions of **hexadecimal** numbers

$$\begin{array}{r} F\ 9\ 0\ A \\ +\ 1\ 6\ C\ 3 \\ \hline \end{array}$$

$$\begin{array}{r} C\ E\ C\ 8\ C.\ A\ D \\ +\ \ \ 9\ 5\ 7\ F.\ 3\ 8 \\ \hline \end{array}$$

$$\begin{array}{r} A\ 5\ C\ 9.\ E\ F \\ +\ 3\ 9\ 2\ 3.\ 7\ D \\ \hline \end{array}$$

$$\begin{array}{r} B\ C\ 4\ 6.\ 9\ F\ B \\ +\ A\ 7\ 8\ D.\ 2\ 4\ 3 \\ \hline \end{array}$$

Arithmetic operations

- Subtractions of **hexadecimal** numbers

$$\begin{array}{r} C\ A\ 7\ 4\ 5.\ 3\ 3 \\ -\quad 4\ 8\ 8\ 1.\ 2\ C \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 0\ 1\ 0.\ 1\ 1\ 1\ 0 \\ -\quad 1\ 1\ 0\ 1.\ 1\ 0\ 1\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} F\ 6\ F\ 9.\ 1\ 5 \\ -\quad D\ B\ C.\ B\ E \\ \hline \end{array}$$

$$\begin{array}{r} A\ B\ C\ E.\ A\ C\ E \\ -\ A\ D\ 9\ B.\ 5\ 1\ A \\ \hline \end{array}$$

Exercises

$$\begin{array}{r} 110011011_{(2} \\ +101111101_{(2} \\ \hline {}_{(2} \end{array}$$

$$\begin{array}{r} 2346453_{(7} \\ -3624025_{(7} \\ \hline {}_{(7} \end{array}$$

$$\begin{array}{r} 3467251_{(9} \\ +8276573_{(9} \\ \hline {}_{(9} \end{array}$$

$$\begin{array}{r} A\ 7\ B\ 6\ C\ 5\ D\ 2_{(16} \\ +\ 6\ E\ 4\ 3\ A\ D\ F\ 5_{(16} \\ \hline {}_{(16} \end{array}$$