Answers

(1)

$$\begin{array}{cccc} & & & 1 \\ + & & 1 & 1 \\ \hline & 1 & 0 & 0 \end{array}$$

(2)

$$\begin{array}{cccc} & & 1 & 1 \\ + & 1 & 0 & 0 \\ \hline & 1 & 1 & 1 \end{array}$$

(3)

$$\begin{array}{ccccc} & & 1 & 0 & 1 \\ + & & 1 & 0 & 1 \\ \hline & 1 & 0 & 1 & 0 \end{array}$$

(4)

$$\begin{array}{ccccc} & & 1 & 0 & 1 \\ + & & 1 & 1 & 0 \\ \hline & 1 & 0 & 1 & 1 \end{array}$$

(5)

$$\begin{array}{ccccc} & & 1 & 1 & 0 \\ + & 1 & 0 & 0 & 0 \\ \hline & 1 & 1 & 1 & 0 \end{array}$$

(6)

$$\begin{array}{cccc} & 1 & 1 & 0 \\ - & & 1 & 1 \\ \hline & & 1 & 1 \end{array}$$

(7)

$$\begin{array}{cccc} & 1 & 1 & 1 \\ - & 1 & 0 & 0 \\ \hline & & 1 & 1 \end{array}$$

(8)

$$\begin{array}{ccccc} & 1 & 0 & 1 & 0 \\ - & & 1 & 1 & 1 \\ \hline & & & 1 & * \end{array}$$

(9)

$$\begin{array}{ccccc} & 1 & 0 & 1 & 0 \\ - & & & 1 & 1 \\ \hline & & 1 & 1 & 1 \end{array}$$

(10)

$$\begin{array}{ccccc} & 1 & 0 & 1 & 0 \\ - & & 1 & 0 & 1 \\ \hline & & 1 & 0 & 1 \end{array}$$

(11)(a) $\frac{1}{5} = 0.001100110011\ldots_2$, (b) $\frac{3}{7} = 0.011011011011\ldots_2$.

(12) $x_1 = 1, x_2 = 0, x_4 = 1$ and $x_8 = 0$.
$y_1 + y_3 + y_5 + y_7 + y_9 + y_{11} + y_{13} + y_{15}$ is odd,
$y_2 + y_3 + y_6 + y_7 + y_{10} + y_{11} + y_{14} + y_{15}$ is odd,
$y_4 + y_5 + y_6 + y_7 + y_{12} + y_{13} + y_{14} + y_{15}$ is even, and
$y_8 + y_9 + y_{10} + y_{11} + y_{12} + y_{13} + y_{14} + y_{15}$ is odd,
so the received message has an error in position 1 + 2 + 8 = 11.

(13) $\sqrt{3} = 1.7320\ 5080\ 7568\ 8772\ 9353$ to 20 decimal places.

(14) If you use weights that are powers of 3 (1, 3, 9, 27, ...), any whole number of units can be weighed in exactly one way.