

$$q = a \text{ div } d$$

$$r = a \text{ mod } d$$

$$\begin{array}{r} d \swarrow \quad \nwarrow a \\ 7 \overline{) 111} \leftarrow q \\ \underline{7} \\ 4 \leftarrow r \end{array}$$

$$a \equiv r \pmod{d}$$

$$\left. \begin{array}{l} 7 \equiv 2 \pmod{5} \\ 11 \equiv 1 \pmod{5} \end{array} \right\}$$

$$\left\{ \begin{array}{l} 7+11 \equiv 2+1 \pmod{5} \\ 18 \equiv 3 \pmod{5} \\ 7 \cdot 11 \equiv 2 \cdot 1 \pmod{5} \\ 77 \equiv 2 \pmod{5} \end{array} \right.$$

$$a_1 = r_1 \pmod{d}$$

$$a_2 = r_2 \pmod{d}$$

$$a_1 + a_2 = (r_1 + r_2) \pmod{d}$$

$$a_1 \cdot a_2 = r_1 \cdot r_2 \pmod{d}$$

$$b^n \text{ mod } m = r ?$$

$$3^{644} \text{ mod } 645 = r ?$$

$$n = (644)_{10} = (\overset{a_{k-1}}{1} \overset{a_0}{0} 10000100)_2$$

$$x = 1 \quad \text{power} = b \text{ mod } m = 3 \text{ mod } 645 = 3$$

$$a_0 = 0, x = 1, 3^2 \text{ mod } 645 = 9$$

$$a_1 = 0, x = 1, 9^2 \text{ mod } 645 = 81$$

$$\Rightarrow a_2 = 1, x = 1 \cdot 81 \text{ mod } 645 = 81, 81^2 \text{ mod } 645 = 111$$

$$a_3 = 0, x = 81, 111^2 \text{ mod } 645 = 66$$

$$a_4 = 0, x = 81, 66^2 \text{ mod } 645 = 486$$

$$a_5 = 0, x = 81, 486^2 \text{ mod } 645 = 126$$

$$a_6 = 0, x = 81, 126^2 \text{ mod } 645 = 396$$

$$a_7 = 1, x = 81 \cdot 396 \text{ mod } 645 = 471$$

$$396^2 \text{ mod } 645 = 81$$

$$a_8 = 0, x = 471, 81^2 \text{ mod } 645 = 111$$

$$a_9 = 1, x = 471 \cdot 111 \text{ mod } 645 = \underline{\underline{36}}$$