

Modular Arithmetic

Addition and Subtraction

Modulus 9

$$0 \bmod 9 = 0$$

$$1 \bmod 9 = 1$$

$$2 \bmod 9 = 2$$

$$3 \bmod 9 = 3$$

$$4 \bmod 9 = 4$$

$$5 \bmod 9 = 5$$

$$6 \bmod 9 = 6$$

$$7 \bmod 9 = 7$$

$$8 \bmod 9 = 8$$

$$9 \bmod 9 = 0$$

$$10 \bmod 9 = 1$$

$$11 \bmod 9 = 2$$

$$12 \bmod 9 = 3$$

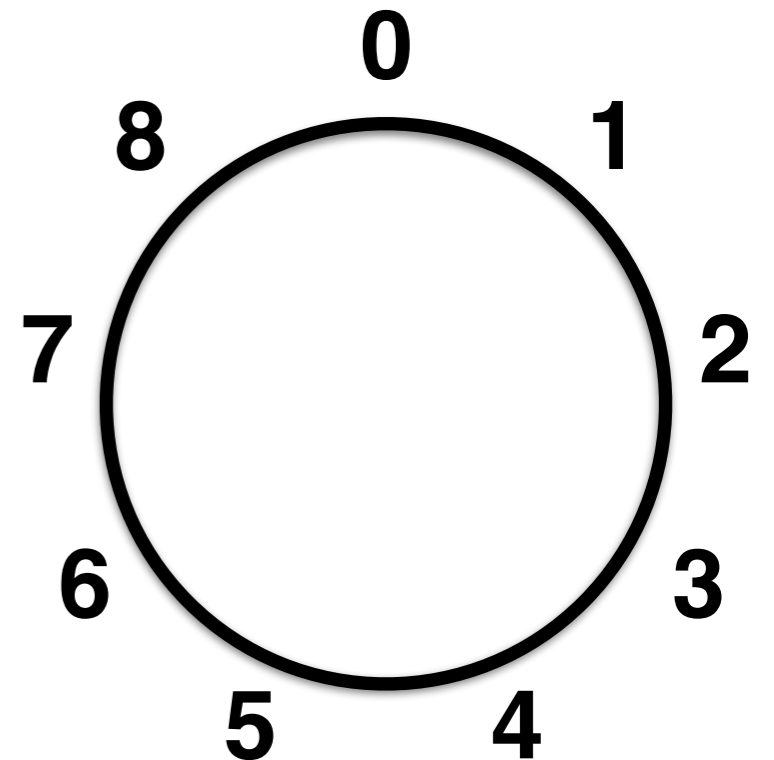
$$13 \bmod 9 = 4$$

$$14 \bmod 9 = 5$$

$$15 \bmod 9 = 6$$

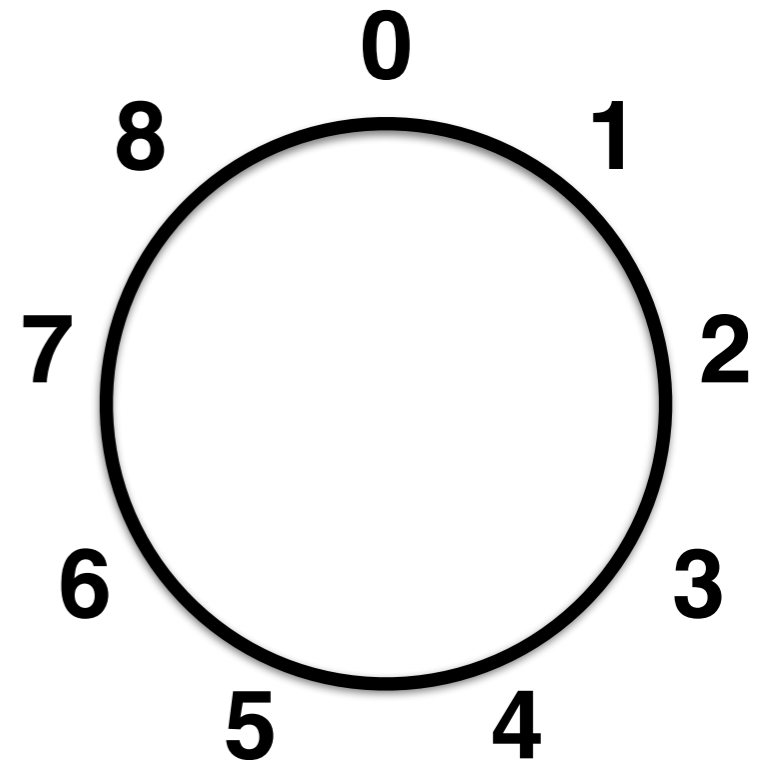
$$16 \bmod 9 = 7$$

$$17 \bmod 9 = 8$$



Modulus 9

$18 \bmod 9 = 0$	$27 \bmod 9 = 0$
$19 \bmod 9 = 1$	$28 \bmod 9 = 1$
$20 \bmod 9 = 2$	$29 \bmod 9 = 2$
$21 \bmod 9 = 3$	$30 \bmod 9 = 3$
$22 \bmod 9 = 4$	$31 \bmod 9 = 4$
$23 \bmod 9 = 5$	$32 \bmod 9 = 5$
$24 \bmod 9 = 6$	$33 \bmod 9 = 6$
$25 \bmod 9 = 7$	$34 \bmod 9 = 7$
$26 \bmod 9 = 8$	$35 \bmod 9 = 8$



Modulus 9

$$\mathbf{-9 \bmod 9 = 0}$$

$$\mathbf{-8 \bmod 9 = 1}$$

$$\mathbf{-7 \bmod 9 = 2}$$

$$\mathbf{-6 \bmod 9 = 3}$$

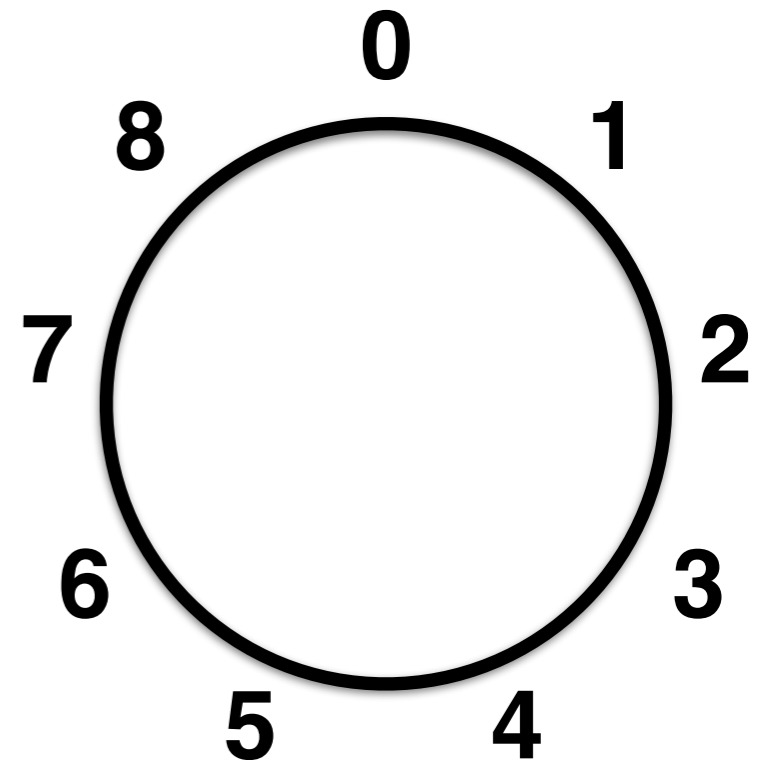
$$\mathbf{-5 \bmod 9 = 4}$$

$$\mathbf{-4 \bmod 9 = 5}$$

$$\mathbf{-3 \bmod 9 = 6}$$

$$\mathbf{-2 \bmod 9 = 7}$$

$$\mathbf{-1 \bmod 9 = 8}$$



Modulus 9

$$(0 + 1) \bmod 9 = 1$$

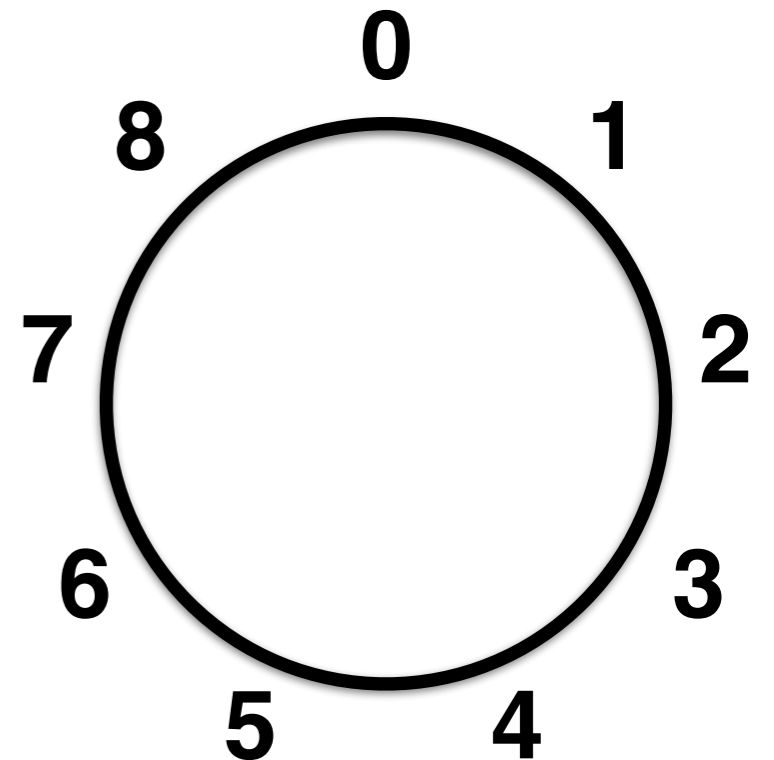
$$(1 + 5) \bmod 9 = 6$$

$$(8 + 3) \bmod 9 = 11 \bmod 9 = 2$$

$$(15 + 13) \bmod 9 = 28 \bmod 9 = 1$$

$$= 15 \bmod 9 + 13 \bmod 9$$

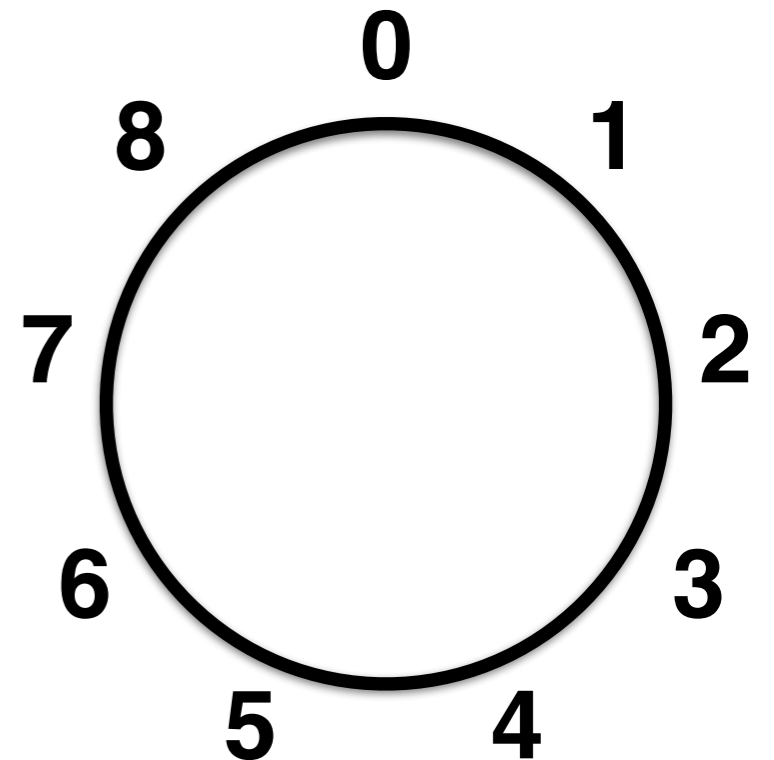
$$= (6 + 4) \bmod 9 = 10 \bmod 9 = 1$$



Modulus 9

$$(7 - 2) \bmod 9 = 5$$

$$\begin{aligned} (16 - 5) \bmod 9 &= 11 \bmod 9 = 2 \\ &= 16 \bmod 9 - 5 \bmod 9 \\ &= (7 - 5) \bmod 9 = 2 \end{aligned}$$



Modulus 4

$$0 \bmod 4 = 0$$

$$1 \bmod 4 = 1$$

$$2 \bmod 4 = 2$$

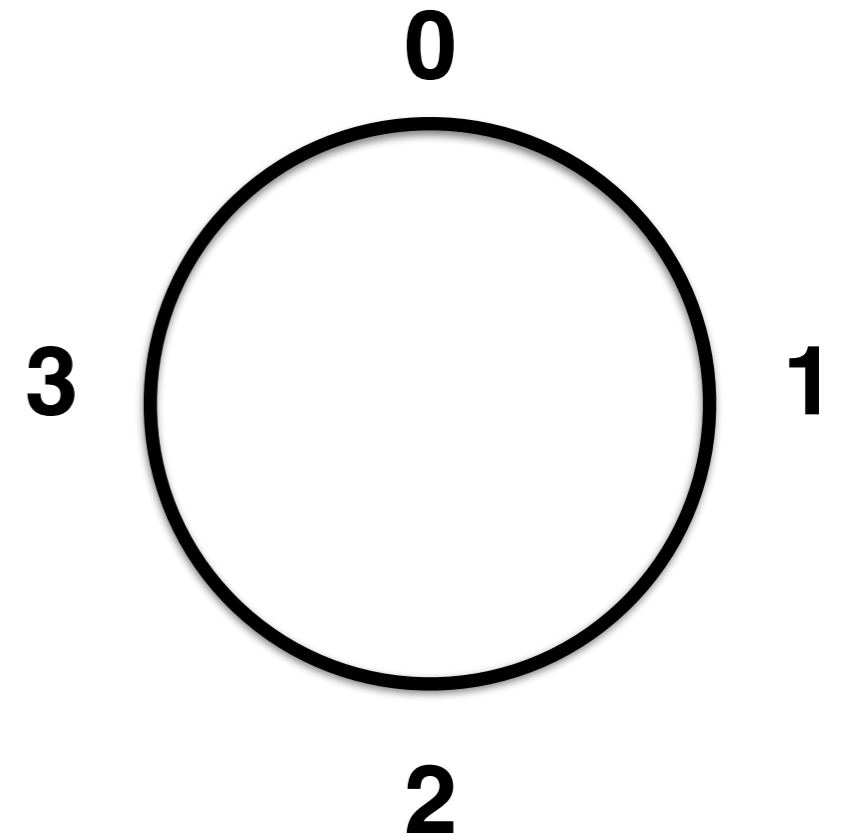
$$3 \bmod 4 = 3$$

$$4 \bmod 4 = 0$$

$$5 \bmod 4 = 1$$

$$12 \bmod 4 = 0$$

$$13 \bmod 4 = 1$$



Modulus 6

$$0 \bmod 6 = 0$$

$$1 \bmod 6 = 1$$

$$2 \bmod 6 = 2$$

$$3 \bmod 6 = 3$$

$$4 \bmod 6 = 4$$

$$5 \bmod 6 = 5$$

$$6 \bmod 6 = 0$$

$$7 \bmod 6 = 1$$

$$8 \bmod 6 = 2$$

