# C++ Programming

# Modulus Operator

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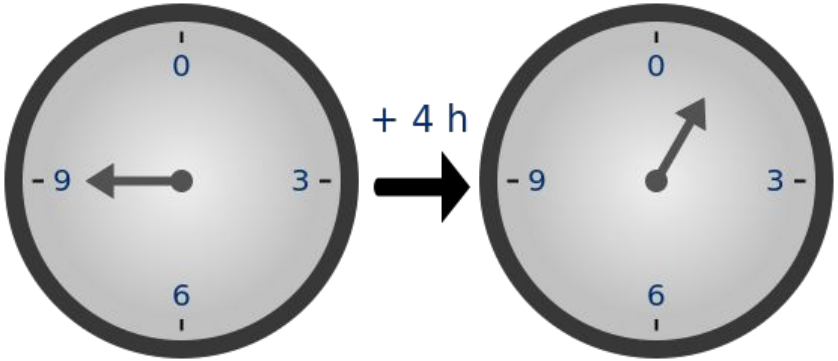
# Modulus operation




- Let’s use **12-hour Clock Cycle**
- If it is 9 now, what time:
- after 12 h? Still 9
- after 4 h? 1
- after 16 (4 + 12) h? 1
- after 17 (5 + 12) h? 2
- after 29 (5 + 2*12) h? 2
- before 24 (2*12) h? 9
- before 25 (1+2*12) h? 8
- **Every multiple of 12 is useless**

# Modulus operation

- a modulus n = a % n = finds the remainder after division by n:
- let a = 27, n = 12, then r = a % n?
- 27 / 12 = (2*12 + 3)/12 = 2 + **3**/12 = 2.25
  - 2 = Integer division part = called the quotient
    - Means we have maximum 2 multiples of 12 (2*12 = 24 <= 27)
  - 0.25 = fractional part
  - 3 (remainder) of division = 27 - 24
- 27 % 12 = 3 ⇒ Remainder of division  (must be < 12)

# Modulus operation

- 25 / 5 = 25/5 + 0/5 = 5
- 26 / 5 = 25/5 + ⅕ = 5.2
- 27 / 5 = 25/5 + ⅖ = 5.4
- 28 / 5 = 25/5 + ⅗ = 5.6
- 29 / 5 = 25/5 + ⅘ = 5.8
- 30 / 5 = 30/5 + 0/5 = 6

- 25 % 5 = 0
- 26 % 5 = 1
- 27 % 5 = 2
- 28 % 5 = 3
- 29 % 5 = 4
- 30 % 5 = 0
- Answer must be < 5

# Modulus operation

- let a = 27, n = 7, then r = 27 % 7?
- 27 / 7 = (3*7 + 6)/7 = 3 + **6**/7 = 3.85714285714
  - 3 = Integer division part
    - Means we have maximum 3 multiples of 7 (3*7 = 21)
  - 0.85714285714 = fractional part
  - 6 (remainder) of division = 27 - 21

# Modulus %2 and %10

- 100 % 2 = (50*2 + 0) ⇒ 0
- 101 % 2 = (50*2 + 1) ⇒ 1
- 108 % 2 = (54*2 + 0) ⇒ 0
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- 1000 % 10 = (100*10 + 0) ⇒ 0
- 1001 % 10 = (100*10 + 1) ⇒ 1
- 1008 % 10 = (100*10 + 8) ⇒ 8
- 1000 % 100 = (10*100 + 0) ⇒ 0
- 1234 % 100 = (100*12 + 34) ⇒ 34
- 1234 % 1000 = (1000*1 + 234) ⇒ 234
- 1234 % 10000 = (10000*0 + 1234) ⇒ 1234

- **Observations**
- Number % 2
  - 0 if number is even
    - Even number is divisible by 2
  - 1 for odd
- Number % 10 = last 1 digit
- Number % 100 = last 2 digits
- Number % 1000 = last 3 digits
- Number % 10000 = last 4 digits

# Summary

- Num % 2 ⇒ can tell us if number is even or odd
- Num % 10 ⇒ gives us the last digit of num
- Num / 10 ⇒ removes the last digit of num (integer division)
- r = n%k  [r must be < k]

"Acquire knowledge and impart it to the people."

"Seek knowledge from the Cradle to the Grave."