Section 1.3: Converting from Decimal

Thursday, September 5, 2019 10:32 AM

we've been converting from other bases to decimal

but how do we go the other way, from decimal to other bases?

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background:

whole numbers: 0, 1, 2, 3, ...

integers: ..., -3, -2, -1, 0, 1, 2, 3, ...

modular arithmetic:

$\frac{7}{4}$ = $1\frac{3}{4}$ or 1.75

rational numbers

but if we stay with integers

$\frac{7}{4}$ has a Q quotient of 1 plus R 3 remainder

Q: number of times 4 divides evenly into 7

R: number left over

how do you find Q and R using a calculator?

$\frac{7}{4}$ = 1.75 on calculator

integer part 1 one → Q

0.75 decimal part

finding remainder:

method #1: $7 - 1 \times 4 = 3$ (numerator 7, denominator 4, Q = 1)

method #2: remainder = 4 × 0.75 (denominator × decimal part)

note: how do you get the decimal part quickly? subtract off the integer part

examples: Find quotient and remainder for:

a) $50 \div 4 = 12.5$

Q = 12

R = 4 × 0.5 = 2

b) $92 \div 8 = 11.5$

Q = 11

R = 4

c) $39 \div 2 = 19.5$

Q = 19

R = 1

Q = 19
R = 1

d) 133 ÷ 16 = 8.3125

Q = 8
R = 16 × 0.3125 = 5

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application: unit conversion

time: 45 days
= 6 weeks and 3 days

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digression: (will not be tested in this class)

in computing, the modulus (or modulo) function calculates the remainder left after dividing one integer by another

mod (5, 3) = 2
5 mod 3 = 2
5 % 3 = 2

and you can get the integer part from the truncation function

trunc (5, 3) = 1

(some languages allow other types of numbers,

but we'll stick with integers here - also, becomes way more confusing if either dividend (numerator) or divisor (denominator) are negative)

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recall: converting <u>from</u> octal <u>to</u> decimal:

$$152_8 = 1 \times 8^2 + 5 \times 8^1 + 2 \times 8^0$$
$$= 106_{10}$$

how do we go back the other way?

convert 106_{10} to octal

	Q	R
$106 \div 8$	13	2
$13 \div 8$	1	5
$1 \div 8$	0	1

keep dividing until Q = 0

write digits in reverse order

$$106_{10} = 152_8$$

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convert 58 to binary:

	Q	R
$58 \div 2$	29	0
$29 \div 2$	14	1
$14 \div 2$	7	0

$29 \div 2$	14	1
$14 \div 2$	7	0
$7 \div 2$	3	1
$3 \div 2$	1	1
$1 \div 2$	0	1

$58 = 111010_2$

convert 17980 to hexadecimal

	Q	R
$17980 \div 16$	1123	$12 = C$
$1123 \div 16$	70	3
$70 \div 16$	4	6
$4 \div 16$	0	4

$463C_{16}$

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convert 1792 to octal

	Q	R
$1792 \div 8$	224	0
$224 \div 8$	28	0
$28 \div 8$	3	4
$3 \div 8$	0	3

3400_8

convert 547 to base 5:

	Q	R
$547 \div 5$	109	2
$109 \div 5$	21	4
$21 \div 5$	4	1
$4 \div 5$	0	4

4142_5