

Roman numerals

Roman numerals, the numeric system of ancient Rome, uses combinations of letters from the Latin alphabet to signify values. The numbers 1 to 10 can be expressed in Roman numerals as follows:

I, II, III, IV, V, VI,
VII, VIII, IX, and X.

The Roman numeral system is decimal^[1] but not directly positional and does not include a zero. It is a cousin of the Etruscan numerals. Use of Roman numerals persisted after the decline of the Roman Empire. In the 14th century, Roman numerals were largely abandoned in favor of Arabic numerals; however, they are still in use to this day in minor applications such as numbered lists or outlines, clock faces, numbering of pages preceding the main body of a book, successive political leaders or people with identical names, chords in music, and the numbering of certain annual events.



Entrance to section LII (52) of the Colosseum, with numerals still visible

Reading Roman numerals

MMXII

"2012" as a Roman numeral

Roman numerals, as used today, are based on seven symbols:

| Symbol | Value |
|--------|-------|
| I | 1 |
| V | 5 |
| X | 10 |
| L | 50 |
| C | 100 |
| D | 500 |
| M | 1,000 |

These Roman Numbers are formed by combining symbols together and adding the values. For example, MMVI is $1000 + 1000 + 5 + 1 = 2006$. Generally, symbols are placed in order of value, starting with the largest values. When smaller values precede larger values, the smaller values are subtracted from the larger values, and the result is added to the total. For example $\text{MCMXLIV} = 1000 + (1000 - 100) + (50 - 10) + (5 - 1) = 1944$.^[2]

Below are some examples of the modern use of Roman Numerals.

- 1910 as MDCCCX (Admiralty Arch in London)

- 1954 as MCMLIV (Trailer for the movie *The Last Time I Saw Paris*)^[3]
- 1990 as MCMXC (The title of musical project Enigma's debut album MCMXC a.D., named after the year of its release.)

There has never been a universally accepted set of rules for Roman numerals.^[4] Because of this lack of standardization, there may be multiple ways of representing the same number in Roman numerals.^[4] For example, the United States National Institute of Standards and Technology could find no authority that could describe if the year 1999 should be written as MDCCCCLXXXVIII, MCMXCIX, or MIM.^[2] Despite the lack of standardization, an additional set of rules has been frequently applied for the last few hundred years^[5]:



An inscription on Admiralty Arch, London. The numeral translates to 1910; MCMX is the more common modern representation.

- A number written in Arabic numerals can be broken into digits. For example, 1903 is composed of 1, 9, 0, and 3. To write the Roman numeral, each of the non-zero digits should be treated separately. In the above example, 1,000 = M, 900 = CM, and 3 = III. Therefore, 1903 = MCMIII.^[6]
- The symbols "I", "X", "C", and "M" can be repeated three times in succession, but no more. (They may appear more than three times if they appear non-sequentially, such as XXXIX.) "D", "L", and "V" can never be repeated.^{[7][8]}
- "I" can be subtracted from "V" and "X" only. "X" can be subtracted from "L" and "C" only. "C" can be subtracted from "D" and "M" only. "V", "L", and "D" can never be subtracted^[8]
- Only one small-value symbol may be subtracted from any large-value symbol.^[9]

History

Pre-Roman/Ancient Rome

Although Roman numerals are now written with letters of the Roman alphabet, they were originally independent symbols. The Etruscans, for example, used I, Λ, X, □, 8, ⊕, for I, V, X, L, C, and M, of which only I and X happened to be letters in their alphabet. One folk etymology has it that the V represented the angle between thumb and forefinger of an open hand ("5"), and that the X was made by placing two Vs on top of each other, one inverted. However, the Etrusco-Roman numerals actually appear to derive from notches on tally sticks, which continued to be used by Italian and Dalmatian shepherds into the 19th century.^[10]

Thus, 'I' descends not from the letter 'I' but from a notch scored across the stick. Every fifth notch was double cut (i.e. Λ, V, □, □, etc.), and every tenth was cross cut (X), IIII⅁IIII⅁IIII⅁II..., much like European tally marks today. This produced a positional system: *Eight* on a counting stick was eight tallies, IIII⅁IIII, or the eighth of a longer series of tallies; either way, it could be abbreviated ΛIII (or VIII), as the existence of a Λ implies four prior notches. By extension, *eighteen* was the eighth tally after the first ten, which could be abbreviated X, and so was XΛIII. Likewise, number *four* on the stick was the I-notch that could be felt just before the cut of the Λ (V), so it could be written as either IIII or IΛ (IV). Thus the system was neither additive nor subtractive in its conception, but *ordinal*. When the tallies were transferred to writing, the marks were easily identified with the existing Roman letters I, V and X. The tenth V or X along the stick received an extra stroke. Thus 50 was written variously as N, H, K, Ψ, □, etc., but perhaps most often as a chicken-track shape like a superimposed V and I: □. This had flattened to ⊥ (an inverted T) by the time of Augustus, and soon thereafter became identified with the graphically similar letter L. Likewise, 100 was variously Ж, □, ∞, H, or as any of the symbols for 50 above plus an extra stroke. The form Ж (that is, a superimposed X and I) came to predominate. It was written variously as >I< or □IC, was then abbreviated to □ or C, with C variant finally winning out because, as a letter, it stood for *centum*, Latin for "hundred".

The hundredth V or X was marked with a box or circle. Thus 500 was like a □ superimposed on a □ or ⊥ — that is, like a P with a cross bar,— becoming Ð-or Ð by the time of Augustus, under the graphic influence of the letter D. It

was later identified *as* the letter D; an alternative symbol for "thousand" was (I) or CI↯, and half of a thousand or "five hundred" is the right half of the symbol, I) or I↯, and this may have been converted into D.^[11] This at least was the folk etymology given to it later on.

Meanwhile, 1000 was a circled or boxed X: ↻, ⊗, ⊕, and by Augustinian times was partially identified with the Greek letter Φ *phi*. Over time, the symbol changed to Ψ and ↻. The latter symbol further evolved into ∞, then ⌞, and eventually changed to M under the influence of the Latin word *mille* "thousand".

Alfred Hooper has an alternative discussion of the origin of the Roman numeral system, for small numbers.^[12] Hooper contends that the digits are related to hand signals. For example, the numbers I, II, III, IIII correspond to the number of fingers held up for another to see. V, then represents that hand upright with fingers together and thumb apart. Numbers 6–10, are represented with two hands as follows (left hand, right hand) 6=(V,I), 7=(V,II), 8=(V,III), 9=(V,IIII), 10=(V,V) and X results from either crossing of the thumbs, or holding both hands up in a cross.

In the early period of Roman history, there was no subtractive principle. Subtractive notation arose from regular Latin usage: the number 18 was *duodeviginti* or "two from twenty"; the number 19 was *undeviginti* or "one from twenty".

Middle Ages/Renaissance

| Numeral systems by culture | |
|--|----------------------|
| Hindu-Arabic numerals | |
| Western Arabic (Hindu numerals) | Burmese |
| Eastern Arabic | Khmer |
| Indian family | Lao |
| Tamil | Mongolian |
| | Thai |
| East Asian numerals | |
| Chinese | Korean |
| Japanese | Vietnamese |
| <i>Suzhou</i> | <i>Counting rods</i> |
| Alphabetic numerals | |
| Abjad | Ge'ez |
| Armenian | Greek |
| Āryabhaṭa | Georgian |
| Cyrillic | Hebrew |
| other historical systems | |
| Aegean | Kharosthi |
| Attic | Mayan |
| Babylonian | Quipu |
| Brahmi | Roman |
| Egyptian | |
| Etruscan | |
| Inuit | |
| Positional systems by base | |
| Decimal (10) | |
| 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 20, 24, 27, 30, 36, 60, 64 | |
| Balanced ternary | |
| Non-positional system | |
| Unary numeral system (Base 1) | |

| |
|--------------------------------|
| List of numeral systems |
|--------------------------------|

Minuscule (lower case) letters were developed in the Middle Ages, well after the demise of the Western Roman Empire, and lower-case versions of Roman numbers are now also commonly used: i, ii, iii, iv, *etc.* In the Middle Ages, a *j* was sometimes substituted for the final *i* of a number, such as *iiij* for 3 or *vij* for 7. This *j* was considered a swash variant of *i*. The use of a final *j* is still used in medical prescriptions to prevent tampering with or misinterpretation of a number after it is written.^{[13][14]}

A unique, more comprehensive shorthand for writing Roman numerals was developed during the Middle Ages, which today are called "medieval Roman numerals." This system used almost every other letter of the Roman alphabet to stand as abbreviations for more longhand numbers (usually those that consisted of repetitions of the same symbol). They are still listed today in most dictionaries, although through disfavor are primarily out of use.^[15]

| Modern number | Medieval abbreviation | Notes |
|---------------|-----------------------|---|
| 5 | A | Resembles an upside-down V. Also said to equal 500. |
| 6 | Ϛ | Either a ligature of VI, or the Greek letter stigma (Ϛ), having the same numerical value. ^[16] |
| 7 | S, Z | Presumed abbreviation of <i>septem</i> , Latin for 7. |
| 11 | O | Presumed abbreviation of (e.g.) <i>onze</i> , French for 11. |
| 40 | F | Presumed abbreviation of English <i>forty</i> . |
| 70 | S | Also could stand for 7, and has same etymology. |
| 80 | R | |
| 90 | N | Presumed abbreviation of <i>nonaginta</i> , Latin for 90. |
| 150 | Y | Possibly derived from the lowercase y's shape. |
| 151 | K | This unusual abbreviation's origin is unknown; it has also been said to stand for 250. ^[17] |
| 160 | T | Possibly derived from Greek <i>tetra</i> , as 4 x 40 = 160. |
| 200 | H | |
| 250 | E | |
| 300 | B | |
| 400 | P, G | |
| 500 | Q | Redundant with D, abbreviation for <i>quingenti</i> , Latin for 500. |
| 2000 | Z | |

Chronograms, messages with a numbers encoded into them, were popular during the Renaissance era. The chronogram would be a phrase containing the letters I, V, X, L, C, D, and M. By putting these letters together, the reader would obtain a number, usually indicating a particular year.

Modern usage

Roman numerals remained in common use until about the 14th century, when they were outmoded by Hindu-Arabic numerals (thought to have been introduced to Europe from al-Andalus, by way of Arab traders and arithmetic treatises, around the 11th century) in practically all mathematical and economical applications. Roman numerals are still used today in several niche contexts. A few examples of their current use include:

- Names of monarchs and Popes, e.g. Elizabeth II, Benedict XVI. These are referred to as monarchical ordinals; e.g. "II" is pronounced "the second". This tradition began in Europe sporadically in the Middle Ages, gaining widespread use in England only during the reign of Henry VIII. Previously, the monarch was not known by numeral but by an epithet such as Edward the Confessor.
- The year of production of films, television shows and other works of art within the work itself, which according to BBC News was originally done "in an attempt to disguise the age of films or television programmes."^[18] Outside reference to the work will use regular Hindu-Arabic numerals.
- Hour marks on timepieces.
- The year of construction on building faces and cornerstones.
- Page numbering of prefaces and introductions of books.
- Book volume and chapter numbers.
- Sequels of movies, video games, and other works.
- Outlines.
- A recurring grand event, such as the Olympic Games and the Super Bowl.

In astronomy, the natural satellites or "moons" of the planets are traditionally designated by capital Roman numerals.

In chemistry, Roman numerals are often used to denote the groups of the periodic table. They are also used in the IUPAC nomenclature of inorganic chemistry, for the oxidation number of cations which can take on several different positive charges. They are also used for naming phases of polymorphic crystals, such as ice.

In earthquake seismology, Roman numerals are used to designate degrees of the Mercalli intensity scale.

In music theory, the diatonic functions are identified using roman numerals. See: Roman numeral analysis.

In performance practice, individual strings of stringed instruments, such as the violin, are often denoted by Roman numerals, with higher numbers denoting lower strings.

In photography, Roman numerals (with zero) are used to denote varying levels of brightness when using the Zone System.



Roman numbers on stern of *Cutty Sark*, Greenwich, showing draft in feet.

Modern non-English-speaking usage

Capital Roman numerals are used to denote **centuries** (e.g., *XVIII* refers to the eighteenth century) in Bulgarian, Catalan, Croatian, French, Hungarian, Italian, Polish, Portuguese, Romanian, Russian, Serbian, and Spanish languages. This use has largely been replaced by Arabic numerals (e.g. *18*.) in Czech and Slovak languages.

In Central Europe, Italy, Russia, and in Bulgarian, Croatian, Portuguese, Romanian, and Serbian languages, mixed Roman and Arabic numerals are used to record **dates** (usually on tombstones, but also elsewhere, such as in formal letters and official documents). The month is written in Roman numerals while the day is in Arabic numerals: 14. VI. 1789 is 14 June 1789. This use has largely been replaced by Arabic numerals (e.g. *14.06.1789*) in Czech, Slovene, Slovak, Polish, Portuguese and Russian languages.

Boris Yeltsin's autograph, 10 November, 1988.

The month is specified by Roman numerals.

In the Baltic and Eastern Europe nations, Roman numerals are used to represent the *days of the week* in hours-of-operation signs displayed in windows or on doors of businesses. Monday is represented by *I*, which is the initial day of the week. Sunday is represented by *VII*, which is the final day of the week. The hours of operation signs are tables composed of two columns where the left column is the day of the week in Roman numerals and the right column is a range of hours of operation from starting time to closing time. The following example hours-of-operation table would be for a business whose hours of operation are 9:30 AM to 5:30 PM on Mondays, Wednesdays, and Thursdays; 9:30 AM to 7:00 PM on Tuesdays and Fridays; and 9:30 AM to 1:00 PM on Saturdays; and which is closed on Sundays.

| | |
|-----|------------|
| I | 9:30–17:30 |
| II | 9:30–19:00 |
| III | 9:30–17:30 |
| IV | 9:30–17:30 |
| V | 9:30–19:00 |
| VI | 9:30–13:00 |
| VII | — |

In Hungary, Poland, Romania, Serbia and other European countries to lesser extent, Roman numerals are used for floor numbering. Likewise, apartments in central Amsterdam are indicated as *138-III*, with both an Arabic numeral (number of the block or house) and a Roman numeral (floor number). The apartment on the ground floor is indicated as '138-huis'.

Special values

Zero

The number zero does not have its own Roman numeral, but the word *nulla* (the Latin word meaning "none") was used by medieval computists in lieu of 0. Dionysius Exiguus was known to use *nulla* alongside Roman numerals in 525.^{[19][20]} About 725, Bede or one of his colleagues used the letter N, the initial of *nulla*, in a table of epacts, all written in Roman numerals.^[21]

Fractions



A triens coin (1/3 or 4/12 of an *as*). Note the four dots •••• indicating its value.



A semis coin (1/2 or 6/12 of an *as*). Note the S indicating its value.

Though the Romans used a decimal system for whole numbers, reflecting how they counted in Latin, they used a duodecimal system for fractions, because the divisibility of twelve ($12 = 3 \times 2 \times 2$) makes it easier to handle the common fractions of $1/3$ and $1/4$ than does a system based on ten ($10 = 2 \times 5$). On coins, many of which had values that were duodecimal fractions of the unit *as*, they used a tally-like notational system based on twelfths and halves. A dot \bullet indicated an *uncia* "twelfth", the source of the English words *inch* and *ounce*; dots were repeated for fractions up to five twelfths. Six twelfths (one half) was abbreviated as the letter S for *semis* "half". *Uncia* dots were added to S for fractions from seven to eleven twelfths, just as tallies were added to V for whole numbers from six to nine.

Each of these fractions had a name, which was also the name of the corresponding coin:

| Fraction | Roman Numeral | Name (nominative and genitive) | Meaning |
|-------------|----------------|--|---|
| 1/12 | • | <i>uncia, unciae</i> | "ounce" |
| 2/12 = 1/6 | •• or : | <i>sextans, sextantis</i> | "sixth" |
| 3/12 = 1/4 | ••• or □ | <i>quadrans, quadrantis</i> | "quarter" |
| 4/12 = 1/3 | •••• or :: | <i>triens, trientis</i> | "third" |
| 5/12 | ••••• or ::: | <i>quincunx, quincuncis</i> | "five-ounce" (<i>quinque unciae</i> → <i>quincunx</i>) |
| 6/12 = 1/2 | S | <i>semis, semissis</i> | "half" |
| 7/12 | S• | <i>septunx, septuncis</i> | "seven-ounce" (<i>septem unciae</i> → <i>septunx</i>) |
| 8/12 = 2/3 | S•• or S: | <i>bes, bessis</i> | "twice" (as in "twice a third") |
| 9/12 = 3/4 | S••• or S: | <i>dodrans, dodrantis</i> or <i>nonuncium, nonuncii</i> | "less a quarter" (<i>de-quadrans</i> → <i>dodrans</i>) or "ninth ounce" (<i>nona uncia</i> → <i>nonuncium</i>) |
| 10/12 = 5/6 | S•••• or S:: | <i>dextans, dextantis</i> or <i>decunx, decuncis</i> | "less a sixth" (<i>de-sextans</i> → <i>dextans</i>) or "ten ounces" (<i>decem unciae</i> → <i>decunx</i>) |
| 11/12 | S••••• or S::: | <i>deunx, deuncis</i> | "less an ounce" (<i>de-uncia</i> → <i>deunx</i>) |
| 12/12 = 1 | I | <i>as, assis</i> | "unit" |

The arrangement of the dots was variable and not necessarily linear. Five dots arranged like $\square:::$ (as on the face of a die) are known as a quincunx from the name of the Roman fraction/coin. The Latin words *sextans* and *quadrans* are

the source of the English words sextant and quadrant.

Other Roman fractions include the following:

- $1/8$ *sexcuncia*, *sexcunciae* (from *sesqui-* + *uncia*, i.e. $1\frac{1}{2}$ uncias), represented by a sequence of the symbols for the semuncia and the uncia.
- $1/24$ *semuncia*, *semunciae* (from *semi-* + *uncia*, i.e. $\frac{1}{2}$ uncia), represented by several variant glyphs deriving from the shape of the Greek letter Sigma Σ , one variant resembling the pound sign £ without the horizontal line(s) and another resembling the Cyrillic letter Е .
- $1/36$ *binæ sextulae*, *binarum sextularum* ("two sextulas") or *duella*, *duellae*, represented by $\text{ↀ}22\text{ↀ}$, a sequence of two reversed Ss.
- $1/48$ *sicilicus*, *sicilici*, represented by $\text{ↀ}ↀↀ$, a reversed C.
- $1/72$ *sextula*, *sextulae* ($1/6$ of an uncia), represented by $\text{ↀ}2\text{ↀ}$, a reversed S.
- $1/144 = 12^{-2}$ *dimidia sextula*, *dimidia sextulae* ("half a sextula"), represented by $\text{ↀ}2\text{ↀ}$, a reversed S crossed by a horizontal line.
- $1/288$ *scripulum*, *scripuli* (a scruple), represented by the symbol $\text{ↀ}ↀↀ$.
- $1/1728 = 12^{-3}$ *siliqua*, *siliquae*, represented by a symbol resembling closing guillemets $\text{ↀ}»\text{ↀ}$.

Large numbers

In the Middle Ages, a horizontal line was used above a particular numeral to represent one thousand times that numeral, and additional vertical lines on both sides of the numeral to denote one hundred times the number, as in these examples:

- I for one thousand
- V for five thousand
- III for one hundred thousand
- IVI for five hundred thousand

The same overline was also used with a different meaning, to clarify that the characters were numerals. Sometimes both underline and overline were used, e. g. MCMLXVII, and in certain (serif) typefaces, particularly Times New Roman, the capital letters when used without spaces simulates the appearance of the under/over bar, e.g. MCMLXVII.

Sometimes 500, usually D, was written as original IO, while 1,000, usually M, was written as original CIO. This is a system of encasing numbers to denote thousands (imagine the Cs and Os as parentheses), which has its origins in Etruscan numeral usage. The D and M used to represent 500 and 1,000 were most likely derived from IO and CIO, respectively, and subsequently influenced by assumed abbreviations.

An extra O denoted 500, and multiple extra Os are used to denote 5,000, 50,000, etc. For example:



1630 on the Westerkerk in Amsterdam

Numeratio.

CCCC

CCCC

9000.

CCICCC

C.C.I.C.C

X

X

10000.

CC.I.CC

CMC

CMC

IMI

CCCCC

CCCCC

11000.

CCCCC

CCCCC

12000.

CCCCC

CCCCC

13000.

CCCCC

CCCCC

14000.

CCCCC

CCCCC

15000.

Roman numerals, 16th century

| | | | | |
|-------------|---------------|---------------|-----------------|--------------------|
| Base number | | CIC = 1,000 | CCICCC = 10,000 | CCCCICCC = 100,000 |
| 1 extra C | IC = 500 | CICCC = 1,500 | CCICCC = 10,500 | CCCCICCC = 100,500 |
| 2 extra Cs | IIC = 5,000 | | CCICCC = 15,000 | CCCCICCC = 105,000 |
| 3 extra Cs | IIIC = 50,000 | | | CCCCICCC = 150,000 |

(Sometimes $\overline{\text{CIC}}$ was reduced to $\overline{\text{CIC}}$ for 1,000. John Wallis is often credited for introducing the symbol for infinity (modern ∞), and one conjecture is that he based it on this usage, since 1,000 was hyperbolically used to represent very large numbers. Similarly, $\overline{\text{IIC}}$ for 5,000) was reduced to $\overline{\text{IIC}}$; $\overline{\text{CCIC}}$ for 10,000 to $\overline{\text{CCIC}}$; and similarly $\overline{\text{IIC}}$ and $\overline{\text{IIC}}$.)

"IIII" on clocks

Clock faces that are labeled using Roman numerals conventionally show IIII for four o'clock and IX for nine o'clock, using the subtractive principle in one case and not the other. There are many suggested explanations for this:

- Many clocks use IIII because that was the tradition established by the earliest surviving clock, the Wells Cathedral clock built between 1386 and 1392. It used IIII because that was the typical method used to denote 4 in contemporary manuscripts (as iijj or iiii). That clock had an asymmetrical 24-hour dial and used Arabic numerals for a minute dial and a moon dial, so theories depending on a symmetrical 12-hour clock face do not apply.^[22]
- Perhaps IV was avoided because IV represented the Roman god Jupiter, whose Latin name, IVPPITER, begins with IV. This suggestion has been attributed to Isaac Asimov.^[23]
- Louis XIV, king of France, who preferred IIII over IV, ordered his clockmakers to produce clocks with IIII and not IV, and thus it has remained.^[24]
- Using standard numerals, two sets of figures would be similar and therefore confusable by children and others unused to reading clockfaces: IV and VI are similar, as are IX and XI. As the first pair are upside down on the face, an additional level of confusion would be introduced—a confusion avoided by using IIII to provide a clear distinction from VI.
- The four-character form IIII creates a visual symmetry with the VIII on the other side, which the two-character IV would not.
- With IIII, the number of symbols on the clock totals twenty Is, four Vs, and four Xs,^[25] so clock makers need only a single mould with a V, five Is, and an X in order to make the correct number of numerals for their clocks: VIIIIIX. This is cast four times for each clock and the twelve required numerals are separated:

- V IIII IX
- VI II IIX
- VII III X
- VIII I IX

The IIX and one of the IXs are rotated 180° to form XI and XII. The alternative with IV uses seventeen Is, five Vs, and four Xs, requiring the clock maker to have several different patterns.

- Only the I symbol would be seen in the first four hours of the clock, the V symbol would only appear in the next four hours, and the X symbol only in the last four hours. This would add to the clock's radial symmetry.



A typical clock face with Roman numerals in Bad Salzdetfurth, Germany



The Shepherd gate clock with Roman numbers up to XXIII (and 0), in Greenwich

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External links

- Online Converter (<http://www.tinytools.nu/RomanNumeralsConverter/>) between Roman Numerals and Decimal Numerals and vice versa.
- Conversion algorithm and demonstration program (with java source code) (<http://www.moxlotus.alternatifs.eu/programmation-converter.html>) for numbers up to 3,999
- Conversion program (with javascript source code) (<http://jeankorte.ca/jk-roman-numeral-converter.html>) for numbers up to 3,999,999
- FAQ #1 Why do clocks with Roman numerals use "IIII" instead of "IV"? (<http://www.ubr.com/clocks/faq/iiii.html>)
- Minor history of the rules of Roman Numerals and an Arabic to Roman Numeral Converter (<http://www.australiannumerals.com/ArabicNumeralstoRomanNumeralsNumbersConverter.html>)
- Online Converter (<http://javascript.about.com/library/blroman.htm>) for Decimal Numerals (JavaScript, GPL)

- Roman Numeral Conversion Exercises (<http://www.psinvention.com/zoetic/romanJava.htm>) (Java)
 - Simple Roman Numeral Converter in C (<http://codeguru.earthweb.com/print.php/c4569>) (C)
 - Matlab functions for Roman numerals conversion (source code) (<http://www.ipgp.fr/~beaudu/matlab.html#roman>) (Matlab)
 - Web Based Converter - Decimal to Roman Numerals (http://www.utilitymill.com/utility/Decimal_to_Roman_Numerals)
 - Child friendly roman numerals webquest (http://www.greatmathsgames.com/roman_numerals/roman_numerals.htm)
 - French book with 841 chapters, numbered up to DCCCXLI
 - Online converter (<http://do-skoly.cz/en/courses/math/m-1/roman-arabic-numbers/calculator.aspx>) of Roman numerals into Arabic numbers with check of correct notation.
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