Date: 8 October 1999 L2/99-244R

To: Unicode Technical Committee
ISO/IEC JTC1/SC2/WG2

From: STIX Project of the STIPUB Consortium (a consortium of scientific societies and scientific/technical publishers)

Subject: Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646 (supersedes L2/99-159

References: L2/98-405, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646
L2/98-406, Proposal to encode mathematical variant tags
L2/99-045, Proposal to encode mathematical alphanumeric symbols
L2/99-049, Addendum to L2/98-405: Request for assignment of codes to mathematical and technical symbols L2/99-159, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646 (revised)
L2/99-160, Proposal to encode mathematical variant tags
L2/99-195, Proposal to encode mathematical alphanumeric symbols
L2/99-199, Mathematical Alphabets (for L2/99-195)

This document is a complete revision of the similarly titled version of 1 June 1999 (L2/99-159). It reinstates material authorized by decisions of the June UTC meeting, and as well incorporates new material from (1) the Proposal to add the ISO Standard Z character set to Unicode/ISO-IEC 10646, transmitted by the UTC chair, and (2) an additional source that had been intended for inclusion in the original proposal but was missed owing to miscommunication among some STIX participants.

Rationale

Scientific communication and publication via the Web are currently hindered by the absence of both suitable symbol fonts and recognized methods of indicating particular symbols and their relationships to one another. The font problems of ordinary text, which are considerable irrespective of language, have so far been addressed essentially only by the introduction of the ISO 10646/Unicode standard. The special problems of handling technical texts have been examined by the W3C Math Working Group, and their MathML proposal, which is interdependent with this request, was accepted as a W3C Recommendation on 7 April 1998 [see http://www.w3c.org/Math]. The work of the HTML-Math WG is also related to the work of the OpenMath consortium.

The present proposal is the work of the STIX Project (scientific and technical information exchange), a working group reporting to STIPUB, a consortium of publishers of mathematical, scientific, and technical books and journals. The ultimate product of the STIX group will be the creation of one comprehensive set of fonts for scientific and technical publishing. This set

of fonts should be adopted and supported by all major STM publishers, and will also be made available for general use under license but free of charge, with the explicit aim to ease and foster the uninhibited flow, exchange, and linking of scientific information. The symbol complement of the STIX font set will be based on the symbols in this proposal along with many already in Unicode, as well as variant forms not included here (because they are required by publishing house styles without different meaning from symbols included above) and additional technical symbols from areas other than mathematics.

The availability of a universal font set will benefit scientific and technical publishing in several ways:

- It will eliminate certain legal problems with distributing PDF files and publishing on the World Wide Web.
- It will ease the exchange of documents from different publishers.
- It will make the re-use of archived material simpler and more robust.

The STIX group has agreed that the basis for the organization of such a font set should be ISO 10646/Unicode. Some arguments in favor of ISO 10646/Unicode are: it is the basis for XML, and therefore for MathML, and it is the character set of the programming language Java and the operating system Windows NT. In XML documents, and most importantly for use in MathML, one must be able to identify all notation, either by numerical character reference or by entity reference. But numerical character references are ISO 10646/Unicode numbers, since that is the character set underlying XML. If entity names are used, they must still be mapped to something that applications will be able to handle and render.

In the attached charts and lists, we have included only what we believe to be unique symbols. The language of mathematics is fluid, and symbols are defined in context to represent particular mathematical concepts. The tool set of an active mathematician ideally consists of several alphabets, whose members can be distinguished from one another, to represent various classes of variables and constants, and a fairly extensive collection of similarly sized shapes to represent various operations. There are of course many fully "standardized" shapes that are now used almost exclusively to represent particular operations and relations, but even these are sometimes adopted in fields where they are not already in use and redefined to have some other particular meaning. For this reason, the "definitions" accompanying the symbols listed here are in some cases not precise; where multiple varying meanings are possible, or a single precise meaning is not available, the shape is described.

Variants

Many math symbols occur in two or more variant forms, with the same or similar meanings usually, but not always, attached to both. In order to accommodate the (sometimes strong) preferences of authors and publishers, a single Math Variant Tag (MVT) is recommended, to be applied to a fixed list of symbols with predetermined results. The recommended list follows the tables of requested symbols; some symbols have been removed from the tables as a consequence of adding this MVT.

The case for alphabets

For a mathematician or other scientist, alphabets provide the symbols to represent ad hoc variables as well as a number of more well-defined concepts. Different styles of alphabets have different meanings, some of which have been formally standardized in some disciplines, but many of which follow only the strength of custom, or even current necessity.

Document L2/99-195, Proposal to encode mathematical alphanumeric symbols, catalogues the different styles of alphabets that are routinely used in mathematical and technical literature; these alphabets and digits will not be further dealt with here.

There remain, however, some individual letters from or related to these alphabets that are routinely used in a turned or inverted orientation, as well as a few symbols in the style of a particular math alphabet but not part of its normal alphabetic complement. These are considered distinct symbols, and are therefore candidates for code assignments.

Symbols

In the tables that follow, four data elements are given for each symbol:

- a reference ID indicating location in the corresponding chart
- a * if there is an existing symbol in Unicode or another symbol in this collection that appears to be similar
- a one-letter code indicating the class of the symbol:
  - N: normal or ordinary, e.g., symbol used as a variable
  - A: alphabetic; subclass of ordinary
  - D: diacritic or combining symbol
  - P: punctuation
  - B: binary operator, e.g., $a + b$
  - R: relation, e.g., $a = b$
  - L: large operator, e.g. sum, product
  - O: opening delimiter (assuming left-to-right presentation)
  - C: closing delimiter (assuming left-to-right presentation)
  - F: nondirectional delimiter (fence post)
- description of the symbol, or meaning when dominant

Arrows and harpoons, combinations, fishtails

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AX00   N GREEK SYMBOL CAPITAL THETA WITH STRAIGHT BAR
         → 0472 cyrillic capital letter fita
AX01   N GREEK SYMBOL CURLY CAPITAL UPSILON
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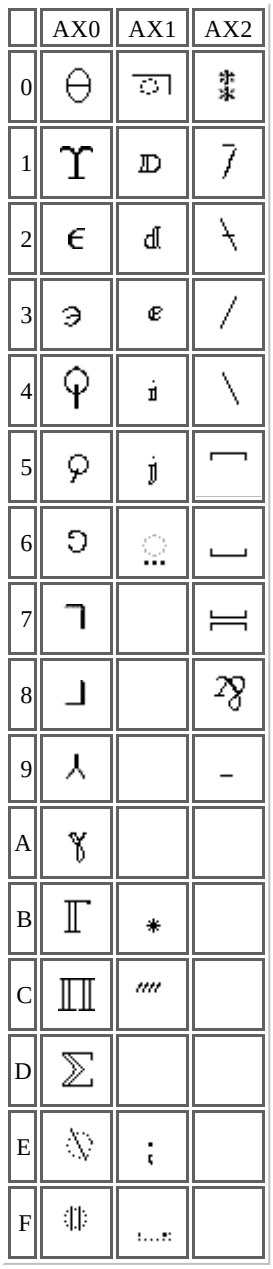
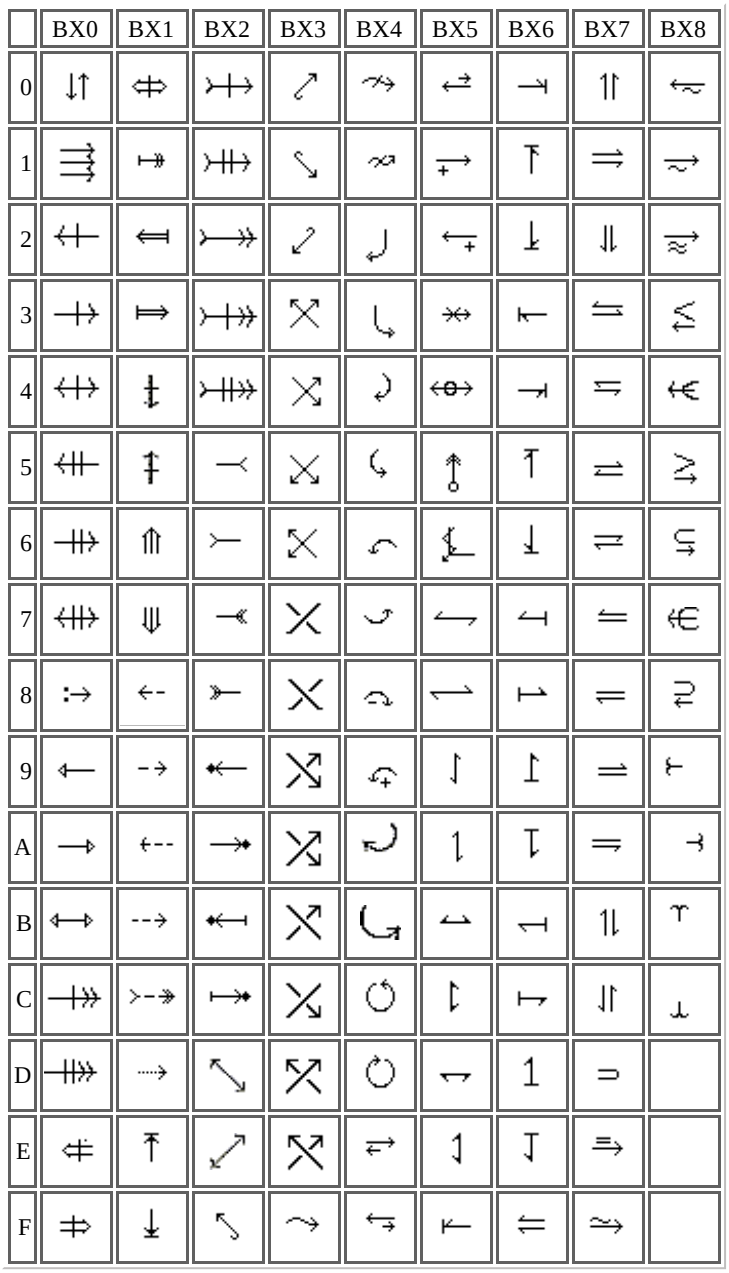
AX02 N GREEK SYMBOL STRAIGHT EPSILON
AX03 N GREEK SYMBOL REVERSED STRAIGHT EPSILON
AX04 N GREEK LETTER Q-KOPPA
AX05 N GREEK SMALL LETTER Q-KOPPA
AX06 N TURNED SANS SERIF CAPITAL G
= game
AX07 N TURNED SANS SERIF CAPITAL L
AX08 N REVERSED SANS SERIF CAPITAL L
AX09 N INVERTED SANS SERIF CAPITAL Y
AX0A N OPEN-FACE GREEK SMALL LETTER GAMMA
AX0B N OPEN-FACE GREEK CAPITAL GAMMA
AX0C N OPEN-FACE GREEK CAPITAL PI
AX0D L OPEN-FACE SUM
AX0E D COMBINING REVERSED SOLIDUS OVERLAY
AX0F D COMBINING DOUBLE VERTICAL STROKE OVERLAY
= Z NOTATION FINITE FUNCTION
AX10 D ANNUITY SYMBOL
= actuarial bend
AX11 N CAPITAL DIFFERENTIAL D
AX12 N DIFFERENTIAL D
AX13 N EXPONENTIAL E
AX14 N IMAGINARY I
AX15 N IMAGINARY J
AX16 D TRIPLE UNDERDOT
AX17 [removed]
...
AX1A [removed]
AX1B LOW ASTERISK
AX1C N QUADRUPLE PRIME
[composed: U+2032 + U+2032 + U+2032 + U+2032]
AX1D [removed]
AX1E REVERSED SEMI-COLON
AX1F P EM LEADER
AX20 N TWO ASTERISKS ALIGNED VERTICALLY
AX21 SOLIDUS OVERBAR
AX22 REVERSED SOLIDUS WITH HORIZONTAL STROKE
AX23 B BIG SOLIDUS
AX24 B BIG REVERSED SOLIDUS
= Z NOTATION SCHEMA HIDING
AX25 TOP SQUARE BRACKET
AX26 BOTTOM SQUARE BRACKET
AX27 BOTTOM ABOVE TOP SQUARE BRACKET
AX28 N TURNED AMPERSAND
AX29 [removed]
AX2A N SIGNIFICANT BLANK SYMBOL
AX2B N MEDIUM MATH SPACE
. four-eighteenths of an em
AX2C [removed: 2423]





Large operators, binary operators; relational operators

BX00 R DOWNWARDS ARROW LEFTWARDS OF UPWARDS ARROW
BX01 R THREE RIGHTWARDS ARROWS
BX02 R LEFTWARDS ARROW WITH VERTICAL STROKE
BX03 R RIGHTWARDS ARROW WITH VERTICAL STROKE
= Z NOTATION PARTIAL FUNCTION
BX04 R LEFT RIGHT ARROW WITH VERTICAL STROKE
= Z NOTATION PARTIAL RELATION
BX05 R LEFTWARDS ARROW WITH DOUBLE VERTICAL STROKE

BX06 R RIGHTWARDS ARROW WITH DOUBLE VERTICAL STROKE
= Z NOTATION FINITE FUNCTION
BX07 R LEFT RIGHT ARROW WITH DOUBLE VERTICAL STROKE
= Z NOTATION FINITE RELATION
BX08 RULE-DELAYED
= colon right arrow
BX09 R LEFTWARDS OPEN-HEADED ARROW
BX0A R RIGHTWARDS OPEN-HEADED ARROW
BX0B R LEFT RIGHT OPEN-HEADED ARROW
BX0C R RIGHTWARDS TWO-HEADED ARROW WITH VERTICAL STROKE
= Z NOTATION PARTIAL SURJECTION
BX0D R RIGHTWARDS TWO-HEADED ARROW WITH DOUBLE VERTICAL STROKE
= Z NOTATION FINITE SURJECTION
BX0E R LEFTWARDS DOUBLE ARROW WITH VERTICAL STROKE
BX0F R RIGHTWARDS DOUBLE ARROW WITH VERTICAL STROKE
BX10 R LEFT RIGHT DOUBLE ARROW WITH VERTICAL STROKE
BX11 R RIGHTWARDS TWO-HEADED ARROW FROM BAR
= maps to
BX12 R LEFTWARDS DOUBLE ARROW FROM BAR
= maps from
BX13 R RIGHTWARDS DOUBLE ARROW FROM BAR
= maps to
BX14 R DOWNWARDS ARROW WITH HORIZONTAL STROKE
BX15 R UPWARDS ARROW WITH HORIZONTAL STROKE
BX16 R UPWARDS TRIPLE ARROW
BX17 R DOWNWARDS TRIPLE ARROW
BX18 R LEFTWARDS BROKEN ARROW
BX19 R RIGHTWARDS BROKEN ARROW
BX1A R LEFTWARDS DOUBLY BROKEN ARROW
BX1B R RIGHTWARDS DOUBLY BROKEN ARROW
BX1C R RIGHTWARDS TWO-HEADED BROKEN ARROW
BX1D R RIGHTWARDS ARROW WITH DOTTED STEM
BX1E R UPWARDS ARROW TO BAR
BX1F R DOWNWARDS ARROW TO BAR
BX20 R RIGHTWARDS ARROW WITH TAIL WITH VERTICAL STROKE
= Z NOTATION PARTIAL INJECTION
BX21 R RIGHTWARDS ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
= Z NOTATION FINITE INJECTION
BX22 R RIGHTWARDS TWO-HEADED ARROW WITH TAIL
= bijective mapping
BX23 R RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH VERTICAL STROKE
= Z NOTATION SURJECTIVE INJECTION
BX24 R RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
= Z NOTATION FINITE SURJECTIVE INJECTION
BX25 R LEFTWARDS ARROW-TAIL
BX26 R RIGHTWARDS ARROW-TAIL
BX27 R LEFTWARDS DOUBLE ARROW-TAIL
BX28 R RIGHTWARDS DOUBLE ARROW-TAIL
BX29 R LEFTWARDS ARROW TO FILLED SQUARE
BX2A R RIGHTWARDS ARROW TO FILLED SQUARE
BX2B R LEFTWARDS ARROW FROM BAR TO FILLED SQUARE
BX2C R RIGHTWARDS ARROW FROM BAR TO FILLED SQUARE
BX2D R NORTH WEST-SOUTH EAST ARROW
BX2E R NORTH EAST-SOUTH WEST ARROW

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BX2F   R NORTH WEST ARROW WITH HOOK
BX30   R NORTH EAST ARROW WITH HOOK
BX31   R SOUTH EAST ARROW WITH HOOK
BX32   R SOUTH WEST ARROW WITH HOOK
BX33   R NORTH WEST AND NORTH EAST ARROWS
BX34   R NORTH EAST AND SOUTH EAST ARROWS
BX35   R SOUTH EAST AND SOUTH WEST ARROWS
BX36   R SOUTH WEST AND NORTH WEST ARROWS
BX37   N RISING DIAGONAL CROSSING FALLING DIAGONAL
BX38   N FALLING DIAGONAL CROSSING RISING DIAGONAL
BX39   N SOUTH EAST ARROW CROSSING NORTH EAST ARROW
BX3A   N NORTH EAST ARROW CROSSING SOUTH EAST ARROW
BX3B   N FALLING DIAGONAL CROSSING NORTH EAST ARROW
BX3C   N RISING DIAGONAL CROSSING SOUTH EAST ARROW
BX3D   N NORTH EAST ARROW CROSSING NORTH WEST ARROW
BX3E   N NORTH WEST ARROW CROSSING NORTH EAST ARROW
BX3F * R RIGHTWARDS ARROW-CURVED
BX40   R NOT RIGHTWARDS ARROW-CURVED
         [composed:   BX3F + U+0338]
BX41   R NOT RIGHTWARDS ARROW-WAVY
         [composed: U+219D + U+0338]
BX42 * R ARROW POINTING DOWNWARDS THEN CURVING LEFTWARDS
BX43 * R ARROW POINTING DOWNWARDS THEN CURVING RIGHTWARDS
BX44   R RIGHT-SIDE ARC CLOCKWISE ARROW
BX45   R LEFT-SIDE ARC ANTICLOCKWISE ARROW
BX46   R TOP ARC ANTICLOCKWISE ARROW
BX47   R BOTTOM ARC ANTICLOCKWISE ARROW
BX48   R TOP ARC CLOCKWISE ARROW WITH MINUS
BX49   R TOP ARC ANTICLOCKWISE ARROW WITH PLUS
BX4A   R LOWER RIGHT SEMICIRCULAR CLOCKWISE ARROW
BX4B   R LOWER LEFT SEMICIRCULAR ANTICLOCKWISE ARROW
BX4C * R ANTICLOCKWISE CLOSED CIRCLE ARROW
BX4D * R CLOCKWISE CLOSED CIRCLE ARROW
BX4E   R RIGHTWARDS ARROW ABOVE SHORT LEFTWARDS ARROW
BX4F   R LEFTWARDS ARROW ABOVE SHORT RIGHTWARDS ARROW
BX50   R SHORT RIGHTWARDS ARROW ABOVE LEFTWARDS ARROW
BX51   R RIGHTWARDS ARROW WITH PLUS BELOW
BX52   R LEFTWARDS ARROW WITH PLUS BELOW
BX53   R RIGHTWARDS ARROW THROUGH X
BX54   R SMALL CIRCLE WITH SUPERIMPOSED LEFT RIGHT ARROW
BX55   R UPWARDS TWO-HEADED ARROW FROM SMALL CIRCLE
BX56     RIGHT ANGLE WITH DOWNWARDS ZIG-ZAG ARROW
BX57   R LEFT-UP-RIGHT-DOWN HARPOON
BX58   R LEFT-DOWN-RIGHT-UP HARPOON
BX59   R UP-RIGHT-DOWN-LEFT HARPOON
BX5A   R UP-LEFT-DOWN-RIGHT HARPOON
BX5B   R LEFT-UP-RIGHT-UP HARPOON
BX5C   R UP-RIGHT-DOWN-RIGHT HARPOON
BX5D   R LEFT-DOWN-RIGHT-DOWN HARPOON
BX5E   R UP-LEFT-DOWN-LEFT HARPOON
BX5F   R LEFTWARDS HARPOON-UP TO BAR
BX60   R RIGHTWARDS HARPOON-UP TO BAR
BX61   R UPWARDS HARPOON-RIGHT TO BAR
BX62   R DOWNWARDS HARPOON-RIGHT TO BAR
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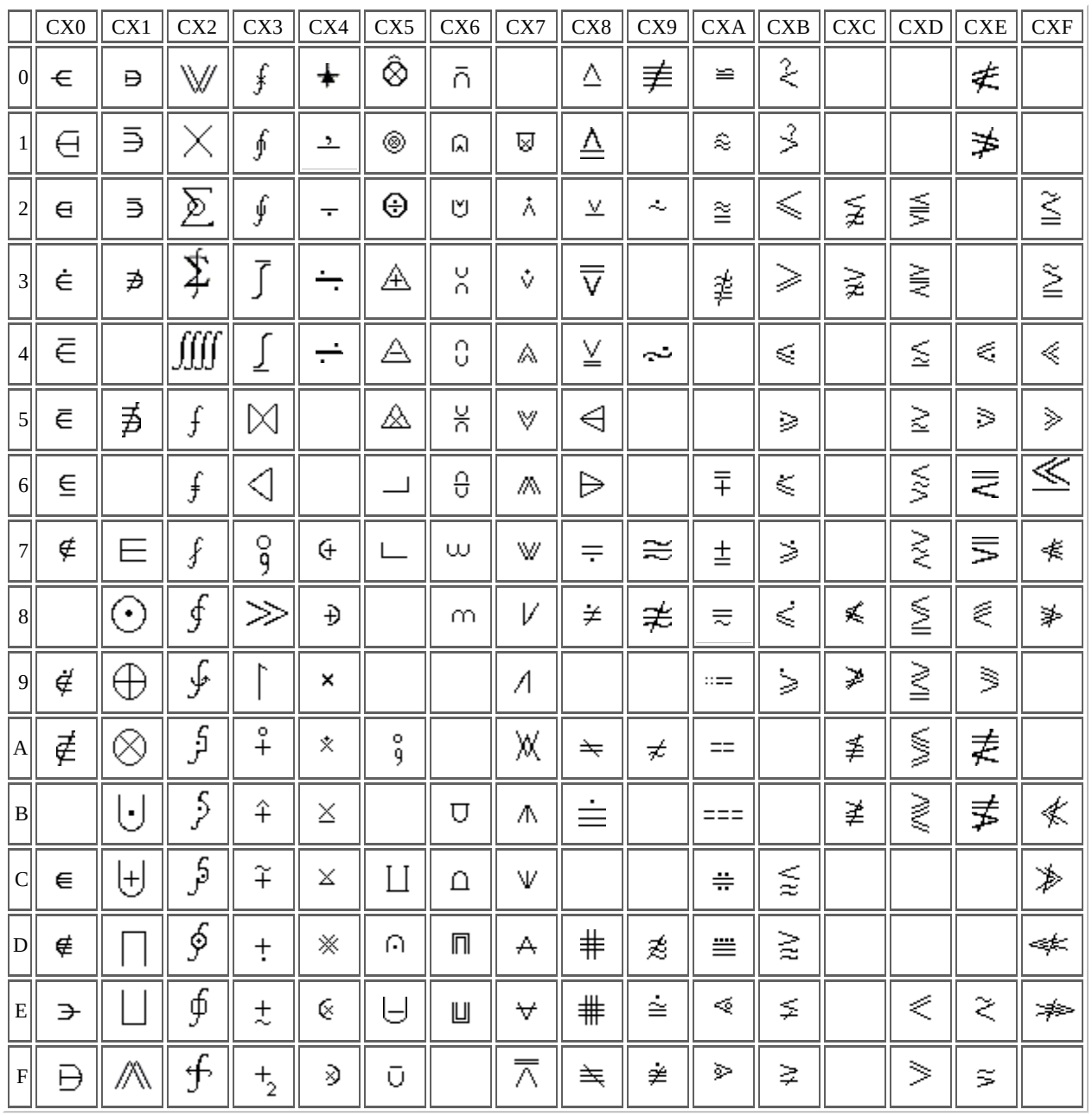
BX63 R LEFTWARDS HARPOON-DOWN TO BAR
BX64 R RIGHTWARDS HARPOON-DOWN TO BAR
BX65 R UPWARDS HARPOON-LEFT TO BAR
BX66 R DOWNWARDS HARPOON-LEFT TO BAR
BX67 R LEFTWARDS HARPOON-UP FROM BAR
BX68 R RIGHTWARDS HARPOON-UP FROM BAR
BX69 R UPWARDS HARPOON-RIGHT FROM BAR
BX6A R DOWNWARDS HARPOON-RIGHT FROM BAR
BX6B R LEFTWARDS HARPOON-DOWN FROM BAR
BX6C R RIGHTWARDS HARPOON-DOWN FROM BAR
BX6D R UPWARDS HARPOON-LEFT FROM BAR
BX6E R DOWNWARDS HARPOON-LEFT FROM BAR
BX6F R LEFTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-DOWN
BX70 R UPWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
BX71 R RIGHTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-DOWN
BX72 R DOWNWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
BX73 R LEFTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-UP
BX74 R LEFTWARDS HARPOON-DOWN ABOVE RIGHTWARDS HARPOON-DOWN
BX75 R RIGHTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-UP
BX76 R RIGHTWARDS HARPOON-DOWN ABOVE LEFTWARDS HARPOON-DOWN
BX77 R LEFTWARDS HARPOON-UP ABOVE LONG DASH
BX78 R LEFTWARDS HARPOON-DOWN BELOW LONG DASH
BX79 R RIGHTWARDS HARPOON-UP ABOVE LONG DASH
BX7A R RIGHTWARDS HARPOON-DOWN BELOW LONG DASH
BX7B R UPWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
BX7C R DOWNWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
BX7D R RIGHT DOUBLE ARROW WITH ROUNDED HEAD
. looks like thin superset
BX7E R EQUAL ABOVE RIGHTWARDS ARROW
BX7F R TILDE OPERATOR ABOVE RIGHTWARDS ARROW
BX80 R LEFTWARDS ARROW ABOVE TILDE OPERATOR
BX81 R RIGHTWARDS ARROW ABOVE TILDE OPERATOR
BX82 R RIGHTWARDS ARROW ABOVE DOUBLE TILDE OPERATOR
BX83 R LESS THAN ABOVE LEFTWARDS ARROW
BX84 R LEFTWARDS ARROW THROUGH LESS-THAN
BX85 R GREATER-THAN ABOVE RIGHTWARDS ARROW
BX86 R SUBSET ABOVE RIGHTWARDS ARROW
BX87 R LEFTWARDS ARROW THROUGH SUBSET
BX88 R SUPERSET ABOVE LEFTWARDS ARROW
BX89 * R LEFT FISH TAIL
BX8A * R RIGHT FISH TAIL
BX8B R UP FISH TAIL
BX8C R DOWN FISH TAIL



More relations

CX00 R ELEMENT OF WITH LONG HORIZONTAL STROKE
CX01 R ELEMENT OF WITH VERTICAL BAR ON HORIZONTAL STROKE
CX02 R SMALL ELEMENT OF WITH VERTICAL BAR ON HORIZONTAL STROKE
CX03 R ELEMENT OF WITH DOT ABOVE
CX04 R ELEMENT OF WITH OVERBAR
CX05 R SMALL ELEMENT OF WITH OVERBAR
CX06 R ELEMENT OF WITH UNDERBAR

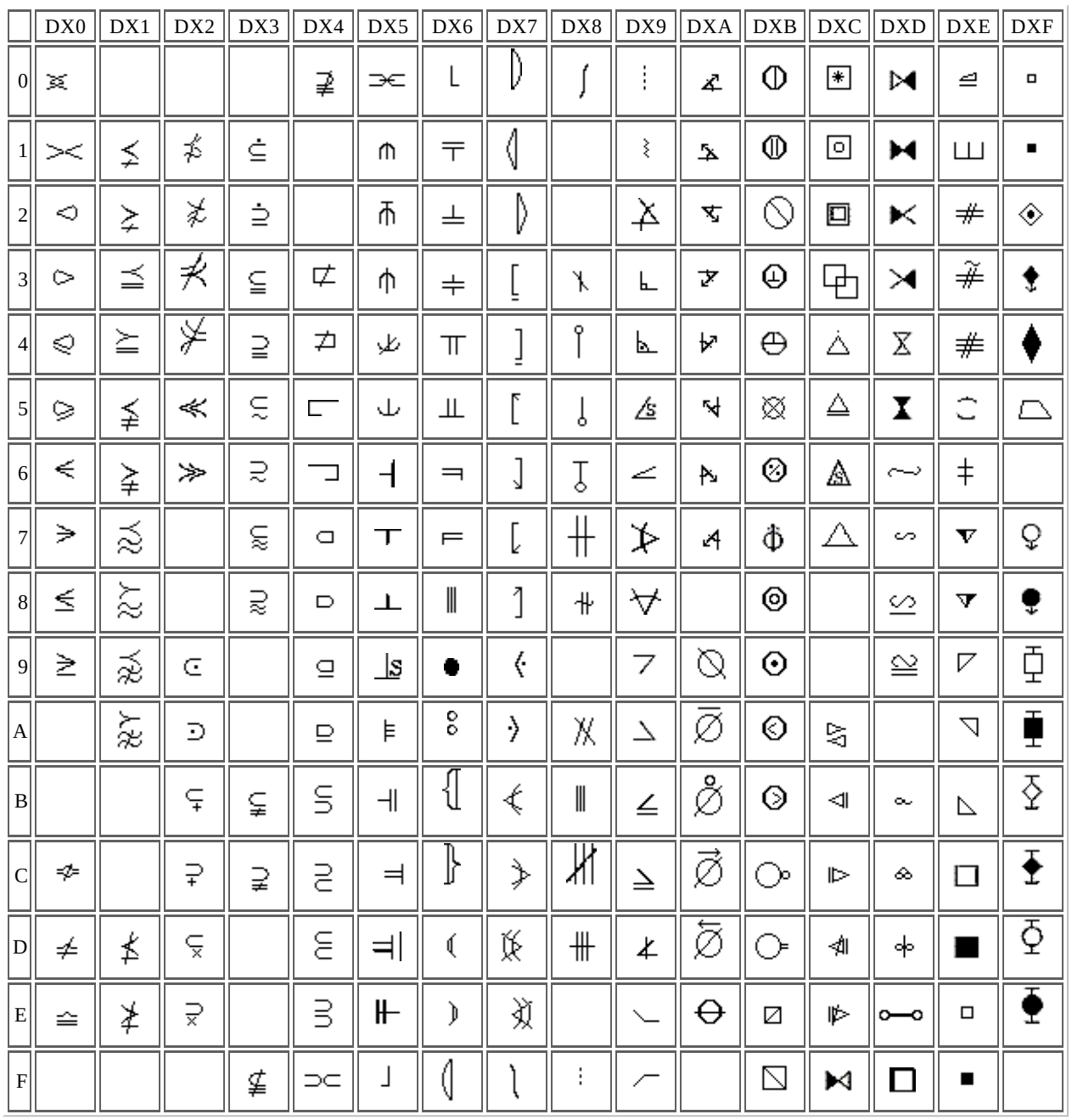
CX07 R SMALL ELEMENT OF WITH SLASH
[composed: U+220A + U+0338]
CX09 R NEGATED ELEMENT OF WITH DOT ABOVE
[composed: CX03 + U+0338]
CX0A R NEGATED ELEMENT OF WITH OVERBAR
[composed: CX04 + U+0338]
CX0C R ELEMENT OF WITH TWO HORIZONTAL STROKES
CX0D R NEGATED ELEMENT OF WITH TWO HORIZONTAL STROKES
[composed: CX0C + U+0338]
CX0E R CONTAINS WITH LONG HORIZONTAL STROKE
CX0F R CONTAINS WITH VERTICAL BAR ON HORIZONTAL STROKE
CX10 R SMALL CONTAINS WITH VERTICAL BAR ON HORIZONTAL STROKE
CX11 R CONTAINS WITH OVERBAR
CX12 R SMALL CONTAINS WITH OVERBAR
CX13 * R SMALL CONTAINS WITH SLASH
[composed: U+220D + U+0338]
CX15 R NEGATED CONTAINS WITH OVERBAR
[composed: CX11 + U+0338]
CX17 R Z NOTATION BAG MEMBERSHIP
CX18 * L N-ARY CIRCLED DOT OPERATOR
CX19 * L N-ARY CIRCLED PLUS OPERATOR
CX1A * L N-ARY CIRCLED TIMES OPERATOR
CX1B L N-ARY UNION OPERATOR WITH DOT
CX1C * L N-ARY UNION OPERATOR WITH PLUS
CX1D * L N-ARY SQUARE INTERSECTION OPERATOR
CX1E * L N-ARY SQUARE UNION OPERATOR
CX1F * L TWO LOGICAL AND OPERATOR
CX20 * L TWO LOGICAL OR OPERATOR
CX21 L N-ARY TIMES OPERATOR
CX22 L MODULO TWO SUM
CX23 L SUMMATION WITH INTEGRAL
CX24 L QUADRUPLE INTEGRAL OPERATOR
[composed: U+222B + U+222B + U+222B + U+222B]
CX25 * L FINITE PART INTEGRAL
CX26 L INTEGRAL WITH DOUBLE STROKE
CX27 L INTEGRAL AVERAGE WITH SLASH
CX28 * L CIRCULATION FUNCTION
CX29 L ANTICLOCKWISE INTEGRATION
CX2A L LINE INTEGRATION WITH RECTANGULAR PATH AROUND POLE
CX2B L LINE INTEGRATION WITH SEMICIRCULAR PATH AROUND POLE
CX2C L LINE INTEGRATION NOT INCLUDING THE POLE
CX2D L INTEGRAL AROUND A POINT OPERATOR
CX2E L QUATERNION INTEGRAL OPERATOR
CX2F L INTEGRAL OVERPRINTED WITH LEFTWARDS ARROW WITH HOOK
CX30 L INTEGRAL OVERPRINTED WITH TIMES SIGN
CX31 L INTEGRAL OVERPRINTED WITH CAP
CX32 L INTEGRAL OVERPRINTED WITH CUP
CX33 L UPPER INTEGRAL WITH OVERBAR
CX34 L LOWER INTEGRAL WITH UNDERBAR
CX35 L JOIN
= large bowtie (relational database theory)
CX36 L LARGE LEFT TRIANGLE OPERATOR
. relational database theory
CX37 L Z NOTATION SCHEMA COMPOSITION

CX38 L Z NOTATION SCHEMA PIPING
CX39 L Z NOTATION SCHEMA PROJECTION
CX3A B PLUS SIGN WITH SMALL CIRCLE ABOVE
CX3B B PLUS SIGN WITH CIRCUMFLEX ACCENT ABOVE
CX3C B PLUS SIGN WITH TILDE ABOVE
CX3D B PLUS SIGN WITH DOT BELOW
CX3E B PLUS SIGN WITH TILDE BELOW
CX3F B PLUS SIGN WITH SUBSCRIPT TWO
= nim-addition
CX40 B FILLED TRIANGLE WITH PLUS
CX41 B MINUS SIGN WITH COMMA ABOVE
CX42 B MINUS SIGN WITH DOT BELOW
CX43 B FALLING DOTS MINUS
CX44 B RISING DOTS MINUS
CX47 B PLUS SIGN IN LEFT HALF CIRCLE
CX48 B PLUS SIGN IN RIGHT HALF CIRCLE
CX49 B SMALL BOLD TIMES
CX4A B MULTIPLICATION SIGN WITH DOT ABOVE
CX4B B MULTIPLICATION SIGN WITH UNDERBAR
CX4C B SEMIDIRECT PRODUCT TIMES SIGN WITH BOTTOM CLOSED
CX4D B SMASH PRODUCT
CX4E B MULTIPLICATION SIGN IN LEFT HALF CIRCLE
CX4F B MULTIPLICATION SIGN IN RIGHT HALF CIRCLE
CX50 B CIRCLED MULTIPLICATION SIGN WITH CIRCUMFLEX ACCENT
CX51 B MULTIPLICATION SIGN IN DOUBLE CIRCLE
CX52 * B CIRCLED DIVISION SIGN
CX53 B PLUS IN TRIANGLE
CX54 B MINUS IN TRIANGLE
CX55 B MULTIPLY IN TRIANGLE
CX56 * B INTERIOR PRODUCT
CX57 * B RIGHTHAND INTERIOR PRODUCT
CX5A B Z NOTATION RELATIONAL COMPOSITION
CX5B [removed: 2040]
CX5C * B AMALGAMATION OR COPRODUCT
CX5D B INTERSECTION WITH DOT
CX5E B UNION WITH MINUS
= Z NOTATION BAG SUBTRACTION
CX5F B UNION WITH OVERBAR
CX60 B INTERSECTION WITH OVERBAR
CX61 B INTERSECTION WITH LOGICAL AND
CX62 B UNION WITH LOGICAL OR
CX63 B UNION ABOVE INTERSECTION
CX64 B INTERSECTION ABOVE UNION
CX65 B UNION ABOVE BAR ABOVE INTERSECTION
CX66 B INTERSECTION ABOVE BAR ABOVE UNION
CX67 B UNION BESIDE AND JOINED WITH UNION
CX68 B INTERSECTION BESIDE AND JOINED WITH INTERSECTION
CX6B B CLOSED UNION WITH SERIFS
CX6C B CLOSED INTERSECTION WITH SERIFS
CX6D B DOUBLE SQUARE INTERSECTION
CX6E B DOUBLE SQUARE UNION
CX71 B CLOSED UNION WITH SERIFS AND SMASH PRODUCT
CX72 B LOGICAL AND WITH DOT ABOVE
CX73 B LOGICAL OR WITH DOT ABOVE

CX74 * B DOUBLE LOGICAL AND
CX75 * B DOUBLE LOGICAL OR
CX76 * B TWO INTERSECTING LOGICAL AND
CX77 * B TWO INTERSECTING LOGICAL OR
CX78   B SLOPING LARGE OR
CX79   B SLOPING LARGE AND
CX7A   R LOGICAL OR OVERLAPPING LOGICAL AND
CX7B   B LOGICAL AND WITH MIDDLE STEM
CX7C   B LOGICAL OR WITH MIDDLE STEM
CX7D   B LOGICAL AND WITH HORIZONTAL DASH
CX7E   B LOGICAL OR WITH HORIZONTAL DASH
CX7F * B LOGICAL AND WITH DOUBLE OVERBAR
CX80 * B LOGICAL AND WITH UNDERBAR
CX81   B LOGICAL AND WITH DOUBLE UNDERBAR
CX82   B SMALL VEE WITH UNDERBAR
CX83   B LOGICAL OR WITH DOUBLE OVERBAR
CX84 * B LOGICAL OR WITH DOUBLE UNDERBAR
CX85   B Z NOTATION DOMAIN ANTIRESTRICTION
CX86   B Z NOTATION RANGE ANTIRESTRICTION
CX87   R EQUAL SIGN WITH DOT BELOW
CX88   R NOT EQUAL TO WITH DOT ABOVE
CX8A   R REVERSED NOT EQUAL
         [composed: U+003D + 7X0D]
CX8B   R IDENTICAL WITH DOT ABOVE
CX8D   R TRIPLE HORIZONTAL BAR WITH DOUBLE VERTICAL STROKE
         = identical and parallel to
CX8E   R TRIPLE HORIZONTAL BAR WITH TRIPLE VERTICAL STROKE
CX8F   R REVERSED NOT EQUIVALENT
CX90   R NOT STRICTLY EQUIVALENT
         [composed: U+2263 + U+0338]
CX92   R TILDE OPERATOR WITH DOT
CX94 * R TILDE OPERATOR WITH RISING DOTS
CX97   R SIMILAR MINUS SIMILAR
CX98   R NOT SIMILAR MINUS SIMILAR
         [composed: CX97 + U+0338]
CX9A * R NOT EQUAL TO OR SIMILAR
         [composed: U+2242 + U+0338]
CX9D * R NOT APPROXIMATELY IDENTICAL TO
         [composed: U+224B + U+0338]
CX9E   R CONGRUENT WITH DOT ABOVE
CX9F   R NOT CONGRUENT WITH DOT ABOVE
CXA0 * R REVERSED CONGRUENT
CXA1   R DOUBLE TILDE OPERATOR WITH CIRCUMFLEX ACCENT
CXA2   R APPROXIMATELY EQUAL OR EQUAL TO
CXA3   R NOT APPROXIMATELY EQUAL OR EQUAL TO
         [composed: CXA2 + U+0338]
CXA6   B EQUAL ABOVE PLUS
CXA7   B PLUS ABOVE EQUAL
CXA8 * R EQUAL ABOVE TILDE OPERATOR
CXA9   R DOUBLE COLON EQUAL
CXAA   R TWO CONSECUTIVE EQUAL SIGNS
CXAB   R THREE CONSECUTIVE EQUAL SIGNS
CXAC * R EQUAL SIGN WITH TWO DOTS ABOVE AND TWO DOTS BELOW
CXAD   R EQUIVALENT WITH FOUR DOTS ABOVE

CXAE R LESS-THAN WITH CIRCLE INSIDE
CXAF R GREATER-THAN WITH CIRCLE INSIDE
CXB0 R LESS-THAN WITH QUESTION MARK ABOVE
CXB1 R GREATER-THAN WITH QUESTION MARK ABOVE
CXB2 * R LESS-THAN OR SLANTED EQUAL TO
CXB3 * R GREATER-THAN OR SLANTED EQUAL TO
CXB4 R LESS-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
CXB5 R GREATER-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
CXB6 R LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
CXB7 R GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
CXB8 R LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE RIGHT
CXB9 R GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE LEFT
CXBC * R LESS-THAN OR APPROXIMATE
CXBD * R GREATER-THAN OR APPROXIMATE
CXBE * R LESS-THAN AND NOT ONE-LINE EQUAL TO
CXBF * R GREATER-THAN AND NOT ONE-LINE EQUAL TO
CXC2 * R LESS-THAN AND NOT APPROXIMATE
CXC3 * R GREATER-THAN AND NOT APPROXIMATE
CXC8 * R NOT LESS-THAN OR SLANTED EQUAL TO
CXC9 * R NOT GREATER-THAN OR SLANTED EQUAL TO
CXCA * R NOT LESS-THAN OR TWO-LINE EQUAL TO
[composed: U+2266 + U+0338]
CXCB * R NOT GREATER-THAN OR TWO-LINE EQUAL TO
[composed: U+2267 + U+0338]
CXD2 * R LESS-THAN ABOVE TWO-LINE EQUAL ABOVE GREATER-THAN
CXD3 * R GREATER-THAN ABOVE TWO-LINE EQUAL ABOVE LESS-THAN
CXD4 R LESS-THAN ABOVE SIMILAR OR EQUAL
CXD5 R GREATER-THAN ABOVE SIMILAR OR EQUAL
CXD6 R LESS-THAN ABOVE SIMILAR ABOVE GREATER-THAN
CXD7 R GREATER-THAN ABOVE SIMILAR ABOVE LESS-THAN
CXD8 R LESS-THAN ABOVE GREATER-THAN ABOVE TWO-LINE EQUAL
CXD9 R GREATER-THAN ABOVE LESS-THAN ABOVE TWO-LINE EQUAL
CXDA R LESS-THAN ABOVE SLANTED EQUAL ABOVE GREATER-THAN ABOVE SLANTED EQUAL
CXDB R GREATER-THAN ABOVE SLANTED EQUAL ABOVE LESS-THAN ABOVE SLANTED EQUAL
CXDE * R SLANTED EQUAL TO OR LESS-THAN
CXDF * R SLANTED EQUAL TO OR GREATER-THAN
CXE0 R NOT SLANTED EQUAL TO OR LESS-THAN
[composed: CXDE + U+0338]
CXE1 R NOT SLANTED EQUAL TO OR GREATER-THAN
[composed: CXDF + U+0338]
CXE4 R SLANTED EQUAL TO OR LESS-THAN WITH DOT INSIDE
CXE5 R SLANTED EQUAL TO OR GREATER-THAN WITH DOT INSIDE
CXE6 R TWO-LINE EQUAL TO OR LESS-THAN
CXE7 R TWO-LINE EQUAL TO OR GREATER-THAN
CXE8 R TWO-LINE SLANTED EQUAL TO OR LESS-THAN
CXE9 R TWO-LINE SLANTED EQUAL TO OR GREATER-THAN
CXEA R NOT TWO-LINE EQUAL TO OR LESS-THAN
[composed: CXE6 + U+0338]
CXEB R NOT TWO-LINE EQUAL TO OR GREATER-THAN
[composed: CXE7 + U+0338]
CXEE * R SIMILAR OR LESS-THAN
CXEF * R SIMILAR OR GREATER-THAN
CXF2 R SIMILAR ABOVE LESS-THAN ABOVE EQUAL
CXF3 R SIMILAR ABOVE GREATER-THAN ABOVE EQUAL

CXF4 R DOUBLE NESTED LESS-THAN SIGN
= absolute continuity
CXF5 R DOUBLE NESTED GREATER-THAN SIGN
CXF6 R DOUBLE LESS-THAN WITH UNDERBAR
CXF7 * R NOT DOUBLE NESTED LESS-THAN SIGN
[composed: CXF4 + U+0338]
CXF8 * R NOT DOUBLE NESTED GREATER-THAN SIGN
[composed: CXF5 + U+0338]
CXFB R NOT MUCH LESS THAN
[composed: U+226A + U+0338]
CXFC R NOT MUCH GREATER THAN
[composed: U+226B + U+0338]
CXFD R NOT TRIPLE LESS THAN
[composed: U+22D8 + U+0338]
CXFE R NOT TRIPLE GREATER THAN
[composed: U+22D9 + U+0338]



The two white and two black squares shown as `DXEC`, `DXED`, `DXF0` and `DXF1` are meant to form a size-graded sequence with the present Unicode squares `25A0`, `25A1`, `25AA` and `25AB`. Ideally, the largest should be just a bit larger than `25A0` (but not as large as `2588`), and the smallest, just a bit smaller than `25AA` (but not quite as small as the dot operator, `22C5`). These are used ad hoc to define various operations, with different sizes often indicating the degree of conformity to a particular notion. (Several different geometric shapes are used in this manner, the most common being squares and circles.)

More relations

DX00 R GREATER-THAN OVERLAPPING LESS-THAN
DX01 R GREATER-THAN BESIDE LESS-THAN
DX02 R LESS-THAN CLOSED BY CURVE
DX03 R GREATER-THAN CLOSED BY CURVE
DX04 R LESS-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
DX05 R GREATER-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
DX06 R SMALLER THAN
DX07 R LARGER THAN
DX08 R SMALLER THAN OR EQUAL
DX09 R LARGER THAN OR EQUAL
DX0C * R NOT BUMPY EQUAL
[composed: U+224E + U+0338]
DX0D R NOT BUMPY ABOVE ONE-LINE EQUAL
[composed: U+224F + U+0338]
DX0E * R BUMPY ABOVE TWO-LINE EQUAL
DX11 R PRECEDES ABOVE NOT ONE-LINE EQUAL
DX12 R SUCCEEDS ABOVE NOT ONE-LINE EQUAL
DX13 * R PRECEDES ABOVE TWO-LINE EQUAL
DX14 * R SUCCEEDS ABOVE TWO-LINE EQUAL
DX15 * R PRECEDES ABOVE NOT TWO-LINE EQUAL
DX16 * R SUCCEEDS ABOVE NOT TWO-LINE EQUAL
DX17 * R PRECEDES ABOVE DOUBLE TILDE OPERATOR
DX18 * R SUCCEEDS ABOVE DOUBLE TILDE OPERATOR
DX19 * R PRECEDES ABOVE NOT DOUBLE TILDE OPERATOR
DX1A * R SUCCEEDS ABOVE NOT DOUBLE TILDE OPERATOR
DX1D * R NEGATED PRECEDES ABOVE ONE-LINE EQUAL
[composed: DX0F + U+0338]
DX1E * R NEGATED SUCCEEDS ABOVE ONE-LINE EQUAL
[composed: DX10 + U+0338]
DX21 * R NEGATED PRECEDES ABOVE TILDE OPERATOR
[composed: U+227E + U+0338]
DX22 * R NEGATED SUCCEEDS ABOVE TILDE OPERATOR
[composed: U+227F + U+0338]
DX23 R NEGATED EQUAL TO OR PRECEDES
DX24 R NEGATED EQUAL TO OR SUCCEEDS
DX25 R DOUBLE PRECEDES
DX26 R DOUBLE SUCCEEDS
DX29 R SUBSET WITH DOT
DX2A R SUPERSET WITH DOT
DX2B R SUBSET WITH PLUS BELOW
DX2C R SUPERSET WITH PLUS BELOW
DX2D R SUBSET WITH MULTIPLICATION SIGN BELOW
DX2E R SUPERSET WITH MULTIPLICATION SIGN BELOW
DX31 R SUBSET OF OR EQUAL TO WITH DOT ABOVE
DX32 R SUPERSET OF OR EQUAL TO WITH DOT ABOVE
DX33 * R SUBSET OF OR TWO-LINE EQUAL
DX34 * R SUPERSET OF OR TWO-LINE EQUAL
DX35 R SUBSET OF ABOVE TILDE OPERATOR
DX36 R SUPERSET OF ABOVE TILDE OPERATOR
DX37 R SUBSET OF ABOVE DOUBLE TILDE OPERATOR
DX38 R SUPERSET OF ABOVE DOUBLE TILDE OPERATOR

DX3B * R SUBSET OF OR NOT TWO-LINE EQUAL
DX3C * R SUPERSET OF OR NOT TWO-LINE EQUAL
DX3F * R NEGATED SUBSET OF OR TWO-LINE EQUAL
[composed: DX33 + U+0338]
DX40 * R NEGATED SUPERSET OF OR TWO-LINE EQUAL
[composed: DX34 + U+0338]
DX43 * R NEGATED SQUARE SUBSET
[composed: U+228F + U+0338]
DX44 * R NEGATED SQUARE SUPERSET
[composed: U+2290 + U+0338]
DX45 R SQUARE LEFT OPEN BOX OPERATOR
DX46 R SQUARE RIGHT OPEN BOX OPERATOR
DX47 R CLOSED SUBSET
DX48 R CLOSED SUPERSET
DX49 R CLOSED SUBSET OR EQUAL
DX4A R CLOSED SUPERSET OR EQUAL
DX4B R SUBSET ABOVE SUPERSET
DX4C R SUPERSET ABOVE SUBSET
DX4D R SUBSET ABOVE SUBSET
DX4E R SUPERSET ABOVE SUPERSET
DX4F R SUPERSET BESIDE SUBSET
DX50 R SUPERSET BESIDE AND JOINED BY DASH WITH SUBSET
DX51 R ELEMENT OF OPENING DOWNWARDS
DX52 R PITCHFORK WITH TEE TOP
DX53 * R TRANSVERSAL INTERSECTION
DX54 R FORKING
. symbol is slashed although positive
DX55 R NONFORKING
. negative symbol - has no slash
DX56 R SHORT LEFT TACK
DX57 R SHORT DOWN TACK
DX58 R SHORT UP TACK
DX59 R PERPENDICULAR WITH S
DX5A R VERTICAL BAR TRIPLE RIGHT TURNSTILE
= ordinarily satisfies
DX5B R DOUBLE VERTICAL BAR LEFT TURNSTILE
DX5C R VERTICAL BAR DOUBLE LEFT TURNSTILE
DX5D R DOUBLE VERTICAL BAR DOUBLE LEFT TURNSTILE
DX5E * R LONG DASH FROM LEFT MEMBER OF DOUBLE VERTICAL
DX5F R VERTICAL WITH LOW BAR TO LEFT FROM BASE
DX60 R VERTICAL WITH LOW BAR TO RIGHT FROM BASE
DX61 R SHORT DOWN TACK OVERBAR
→ 22A4 down tack
DX62 R SHORT UP TACK WITH UNDERBAR
→ 22A5 up tack
DX63 R SHORT UP TACK OVER SHORT DOWN TACK
DX64 R DOUBLE DOWN TACK
DX65 * R DOUBLE UP TACK
= independence (probability theory)
DX66 R NOT WITH TWO HORIZONTAL STROKES
DX67 R REVERSED NOT WITH TWO HORIZONTAL STROKES
DX68 F TRIPLE VERTICAL BAR DELIMITER
DX69 F Z NOTATION SPOT
. medium-sized filled circle

DX6A F Z NOTATION TYPE COLON
DX6B O LEFT WHITE BRACE
DX6C C RIGHT WHITE BRACE
DX6D * O LEFT WHITE ANGULAR BRACKET
→ 3108 left white tortoise shell bracket
DX6E * C RIGHT WHITE ANGULAR BRACKET
→ 3109 right white tortoise shell bracket
DX6F O Z NOTATION LEFT IMAGE BRACKET
DX70 C Z NOTATION RIGHT IMAGE BRACKET
DX71 O Z NOTATION LEFT BINDING BRACKET
DX72 C Z NOTATION RIGHT BINDING BRACKET
DX73 O LEFT BRACKET UNDERBAR
DX74 C RIGHT BRACKET UNDERBAR
DX75 O LEFT BRACKET WITH REVERSED SOLIDUS TOP CORNER
DX76 C RIGHT BRACKET WITH REVERSED SOLIDUS BOTTOM CORNER
DX77 O LEFT BRACKET WITH SOLIDUS BOTTOM CORNER
DX78 C RIGHT BRACKET WITH SOLIDUS TOP CORNER
DX79 O LEFT ANGLE BRACKET WITH DOT
DX7A C RIGHT ANGLE BRACKET WITH DOT
DX7B * O LEFT ARC LESS-THAN BRACKET
DX7C * C RIGHT ARC GREATER-THAN BRACKET
DX7D DOUBLE LEFT ARC GREATER-THAN BRACKET
DX7E DOUBLE RIGHT ARC LESS-THAN BRACKET
DX7F RIGHT MOUSTACHE
DX80 LEFT MOUSTACHE
DX81 [removed: AX25]
DX82 [removed: AX26]
DX83 R DOES NOT DIVIDE WITH REVERSED NEGATION SLASH
DX84 R CIRCLE WITH VERTICAL LINE BELOW
DX85 R VERTICAL LINE WITH CIRCLE BELOW
DX86 N TOP WITH CIRCLE BELOW
DX87 B PARALLEL WITH HORIZONTAL STROKE
DX88 R PARALLEL WITH OVERPRINTED TILDE OPERATOR
DX8A R NEGATED SLANTED PARALLEL
[composed: U+2225 + MVT + AX0E]
DX8B B TRIPLE VERTICAL BAR BINARY RELATION
DX8C B TRIPLE VERTICAL BAR WITH SLASH
DX8D B TRIPLE VERTICAL BAR WITH HORIZONTAL STROKE
DX8E [removed: 2506]
DX8F B TRIPLE COLON
. logic
DX90 F DOTTED FENCE
. four close dots vertical
DX91 VERTICAL ZIG-ZAG LINE
DX92 MEASURED ANGLE OPENING LEFT
DX93 RIGHT ANGLE VARIANT WITH SQUARE
DX94 MEASURED RIGHT ANGLE WITH DOT
DX95 ANGLE WITH S INSIDE
DX96 ACUTE ANGLE
DX97 SPHERICAL ANGLE OPENING LEFT
DX98 SPHERICAL ANGLE OPENING UP
DX99 TURNED ANGLE
DX9A REVERSED ANGLE
DX9B ANGLE WITH UNDERBAR

DX9C REVERSED ANGLE WITH UNDERBAR
DX9D ANGLE WITH VERTICAL STROKE
[composed: U+2220 + U+20D2]
DX9E LARGE DOWNWARDS POINTING ANGLE
DX9F LARGE UPWARDS POINTING ANGLE
DXA0 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE RIGHT
DXA1 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE LEFT
DXA2 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE RIGHT
DXA3 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE LEFT
DXA4 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND UP
DXA5 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND UP
DXA6 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND DOWN
DXA7 MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND DOWN
DXA8 [removed: 2205]
DXA9 N REVERSED EMPTY SET
[composed: U+25CB + AX0E]
DXAA N EMPTY SET OVERBAR
DXAB N EMPTY SET WITH SMALL CIRCLE ABOVE
DXAC N EMPTY SET RIGHT ARROW ABOVE
DXAD N EMPTY SET LEFT ARROW ABOVE
DXAE * CIRCLE WITH HORIZONTAL BAR
DXB0 * B CIRCLED VERTICAL BAR
DXB1 B CIRCLED PARALLEL
DXB2 B CIRCLED REVERSED SOLIDUS
DXB3 B CIRCLED PERPENDICULAR
DXB4 CIRCLE DIVIDED BY HORIZONTAL BAR AND TOP HALF DIVIDED BY VERTICAL
DXB5 CIRCLE WITH SUPERIMPOSED X
DXB6 CIRCLED ANTICLOCKWISE-ROTATED DIVISION SIGN
DXB7 UP ARROW THROUGH CIRCLE
DXB8 CIRCLED LARGE CIRCLE
→ 233E apl functional symbol circle jot
DXB9 CIRCLED FILLED CIRCLE
DXBA * CIRCLED LESS-THAN
DXBB * CIRCLED GREATER-THAN
DXBC CIRCLE WITH SMALL CIRCLE TO THE RIGHT
DXBD CIRCLE WITH TWO HORIZONTAL STROKES TO THE RIGHT
DXBE * SQUARED SOLIDUS
→ 2341 apl functional symbol quad slash
DXBF * SQUARED REVERSED SOLIDUS
→ 2342 apl functional symbol quad backslash
DXC0 SQUARED ASTERISK
DXC1 SQUARED SMALL CIRCLE
→ 233B apl functional symbol quad circle
DXC2 B SQUARED SQUARE
DXC3 TWO JOINED SQUARES
DXC4 TRIANGLE WITH DOT OVER
DXC5 * TRIANGLE WITH UNDERBAR
DXC6 S IN TRIANGLE
DXC7 B TRIANGLE WITH SERIFS AT BOTTOM
DXCA R RIGHT TRIANGLE ABOVE LEFT TRIANGLE
DXCB R LEFT TRIANGLE BESIDE VERTICAL BAR
DXCC R VERTICAL BAR BESIDE RIGHT TRIANGLE
DXCD R NEGATED LEFT TRIANGLE BESIDE VERTICAL BAR
[composed: DXCB + U+0338]

DXCE R NEGATED VERTICAL BAR BESIDE RIGHT TRIANGLE
[composed: DXCC + U+0338]
DXCF R LEFT FILLED BOWTIE
DXD0 R RIGHT FILLED BOWTIE
DXD1 R FILLED BOWTIE
DXD2 R LEFT FILLED TIMES
→ 22C9 left normal factor semidirect product
DXD3 R RIGHT FILLED TIMES
→ 22CA right normal factor semidirect product
DXD4 WHITE HOURGLASS PLUS
DXD5 FILLED HOURGLASS
DXD6 MOST POSITIVE
DXD7 CONGRUENCE SIGN - LAZY S
DXD8 REVERSED MOST POSITIVE WITH LINE BELOW
DXD9 MOST POSITIVE WITH TWO LINES BELOW
DXDA [removed: 221D]
DXDB N INFINITY SIGN WITH TOP RIGHT QUADRANT OMITTED
DXDC N TIE OVER INFINITY
DXDD N INFINITY NEGATED WITH VERTICAL BAR
DXDE R DOUBLE-ENDED MULTIMAP
DXDF N SQUARE WITH CONTOURED OUTLINE
= D'Alembertian
DXE0 R INCREASES AS
DXE1 SHUFFLE PRODUCT
DXE2 R SLANTED PARALLEL SUPERIMPOSED ON EQUAL
= homothetically congruent to
DXE3 R TILDE ABOVE SLANTED PARALLEL SUPERIMPOSED ON EQUAL
DXE4 R SLANTED PARALLEL SUPERIMPOSED ON THREE-LINE EQUAL
= congruent and parallel
DXE5 R TOP ARC OVER BOTTOM ARC
DXE6 N THERMODYNAMIC
. vertical bar crossed by two horizontals
DXE7 N DOWN-POINTING TRIANGLE WITH LEFT HALF BLACK
DXE8 N DOWN-POINTING TRIANGLE WITH RIGHT HALF BLACK
DXE9 UPPER LEFT TRIANGLE
DXEA UPPER RIGHT TRIANGLE
DXEB LOWER LEFT TRIANGLE
DXEC N WHITE MEDIUM SQUARE
DXED N BLACK MEDIUM SQUARE
DXEE [removed]
DXEF [removed]
DXF0 N WHITE VERY SMALL SQUARE
DXF1 N BLACK VERY SMALL SQUARE
DXF2 N WHITE DIAMOND WITH CENTERED DOT
DXF3 N FILLED DIAMOND WITH DOWN ARROW
DXF4 FILLED LOZENGE
DXF5 N TRAPEZIUM
DXF6 [removed: 2736]
DXF7 N CIRCLE WITH DOWN ARROW
DXF8 N FILLED CIRCLE WITH DOWN ARROW
DXF9 N ERROR-BARRED WHITE SQUARE
DXFA N ERROR-BARRED FILLED SQUARE
DXFB N ERROR-BARRED WHITE DIAMOND
DXFC N ERROR-BARRED FILLED DIAMOND

DXFD N ERROR-BARRED WHITE CIRCLE
DXFE N ERROR-BARRED FILLED CIRCLE

Symbol variants defined using a Math Variant Tag

- 2278 (≸) + MVT → ≹ not less-than or greater-than - with slash
- 2279 (≹) + MVT → ≸ not greater-than or less-than - with slash
- 2209 (∉) + MVT → ∉ negated element of - with vertical stroke
- CX0A (∉) + MVT → ∉ negated element of with overbar - with vertical stroke
- 220C (∌) + MVT → ∌ negated contains - with vertical stroke
- CX15 (∌) + MVT → ∌ negated contains with overbar - with vertical stroke
- 2260 (≠) + MVT → ≠ not equal - with vertical stroke
- 2262 (≢) + MVT → ≢ not equivalent - with vertical stroke
- CX90 (≢) + MVT → ≢ not strictly equivalent - with vertical stroke
- 2241 (≁) + MVT → ≁ not tilde operator - with vertical stroke
- 2244 (≄) + MVT → ≄ not similar or equal - with vertical stroke
- 2247 (≇) + MVT → ≇ not similar or double equal - with vertical stroke
- CX98 (≇) + MVT → ≇ not similar minus similar - with vertical stroke
- CX9A (≠) + MVT → ≠ not equal or similar - with vertical stroke
- 2249 (≉) + MVT → ≉ not approximately equal to - with vertical stroke
- CXA3 (≉) + MVT → ≉ not approximately equal or equal to - with vertical stroke
- 226D (≭) + MVT → ≭ not asympototically equal to - with vertical stroke
- 2268 (≨) + MVT → ≨ less-than and not double equal - with vertical stroke
- 2269 (≩) + MVT → ≩ greater-than and not double equal - with vertical stroke
- 226E (≮) + MVT → ≮ not less-than - with vertical stroke
- 226F (≯) + MVT → ≯ not greater-than - with vertical stroke
- 2270 (≰) + MVT → ≰ not less-than or equal to - with vertical stroke
- 2271 (≱) + MVT → ≱ not greater-than or equal to - with vertical stroke
- CXC8 (≰) + MVT → ≰ not less-than or slanted equal to - with vertical stroke
- CXC9 (≱) + MVT → ≱ not greater-than or slanted equal to - with vertical stroke
- CXCA (≰) + MVT → ≰ not less-than or double equals - with vertical stroke
- CXCB (≱) + MVT → ≱ not greater-than or double equals - with vertical stroke
- 2274 (≴) + MVT → ≴ not less-than or similar - with vertical stroke
- 2275 (≵) + MVT → ≵ not greater-than or similar - with vertical stroke
- CXE0 (≰) + MVT → ≰ not slanted equal to or less-than - with vertical stroke
- CXE1 (≱) + MVT → ≱ not slanted equal to or greater-than - with vertical stroke
- CXEA (≦) + MVT → ≦ not two-line equal to or less-than - with vertical stroke
- CXEB (≧) + MVT → ≧ not two-line equal to or greater-than - with vertical stroke
- CXF7 (≫) + MVT → ≫ not double nested less-than - with vertical stroke
- CXF8 (≪) + MVT → ≪ not double nested greater-than - with vertical stroke
- 2280 (≺) + MVT → ≺ precedes with vertical stroke

- 2281 ($\nsucc$) + MVT → $\succnsim$ succeeds with vertical stroke
- 22E0 ($\npreccurlyeq$) + MVT → $\precnsim$ does not precede above contour equals - with vertical stroke
- 22E1 ($\nsucccurlyeq$) + MVT → $\succnsim$ does not succeed above contour equals - with vertical stroke
- 2284 ($\nsubset$) + MVT → $\subsetneq$ subset with vertical stroke
- 2285 ($\nsupset$) + MVT → $\supsetneq$ superset with vertical stroke
- 2288 ($\nsubseteq$) + MVT → $\subsetneqq$ subset of or equal to with vertical stroke
- 2289 ($\nsupseteq$) + MVT → $\supsetneqq$ superset of or equal to with vertical stroke
- DX3F ($\nsubseteqq$) + MVT → $\subsetneqq$ negated subset of or two-line equals - with vertical stroke
- DX40 ($\nsupseteqq$) + MVT → $\supsetneqq$ negated superset of or two-line equals - with vertical stroke
- 22EC ($\ntriangleleft$) + MVT → $\ntriangleleft$ left triangle underbar negated by vertical stroke
- 22ED ($\ntriangleright$) + MVT → $\ntriangleright$ right triangle underbar negated by vertical stroke
- 22DC ($\eqless$) + MVT → $\leqslant$ slanted equal-or-less-than
- 22DD ($\eqgtr$) + MVT → $\geqslant$ slanted equal-or-greater-than
- 22DA ($\lesseqgtr$) + MVT → $\lesseqgtr$ less-than above slanted equal above greater-than
- 22DB ($\gtreqless$) + MVT → $\gtreqless$ greater-than above slanted equal above less-than
- 2272 ($\lesssim$) + MVT → $\lesssim$ less-than or similar - following the slant of the lower leg
- 2273 ($\gtrsim$) + MVT → $\gtrsim$ greater-than or similar - following the slant of the lower leg
- CXEE ($\precapprox$) + MVT → $\precapprox$ similar - following the slant of the upper leg - or less-than
- CXFF ($\succapprox$) + MVT → $\succapprox$ similar - following the slant of the upper leg - or greater-than
- DX08 ($\leqslant$) + MVT → $\leqslant$ smaller than or slanted equal
- DX09 ($\geqslant$) + MVT → $\geqslant$ larger than or slanted equal
- 227C ($\preccurlyeq$) + MVT → $\preccurlyeq$ precedes above single-line equals
- 227D ($\succcurlyeq$) + MVT → $\succcurlyeq$ succeeds above single-line equals
- 228A ($\subsetneq$) + MVT → $\subsetneq$ subset not equals - variant with stroke through bottom members
- 228B ($\supsetneq$) + MVT → $\supsetneq$ superset not equals - variant with stroke through bottom members
- DX3B ($\subsetneqq$) + MVT → $\subsetneqq$ subset not two-line equals - variant with stroke through bottom members
- DX3C ($\supsetneqq$) + MVT → $\supsetneqq$ superset not two-line equals - variant with stroke through bottom members
- CX56 ($\lrcorner$) + MVT → $\lrcorner$ interior product - tall variant with narrow foot
- CX57 ($\llcorner$) + MVT → $\llcorner$ righthand interior product - tall variant with narrow foot
- 2295 ($\bigoplus$) + MVT → $\oplus$ circled plus with white rim
- 2297 ($\bigotimes$) + MVT → $\otimes$ circled times with white rim
- 229C ($\circledequal$) + MVT → $\circledequal$ equal sign inside and touching a circle
- 2225 ($\parallel$) + MVT → // slanted parallel
- 222A ($\cup$) + MVT → $\cup$ union with serifs
- 2229 ($\cap$) + MVT → $\cap$ intersection with serifs
- 2293 ($\sqcap$) + MVT → $\sqcap$ square intersection with serifs
- 2294 ($\sqcup$) + MVT → $\sqcup$ square union with serifs

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