

## LESSON 4

- MORE ABOUT LETTERS
  - Variables
  - Roman Numerals
  - Nondecimal Bases
- OTHER ALPHABETS
- ENCLOSED LISTS
- MORE ABOUT ENGLISH LETTERS
- MORE ABOUT ABBREVIATIONS
- CODE SWITCHING, cont.

### *Format*

- Keep Together—Abbreviation
- Keep Together—Enclosed List

### *Answers to Practice Material*

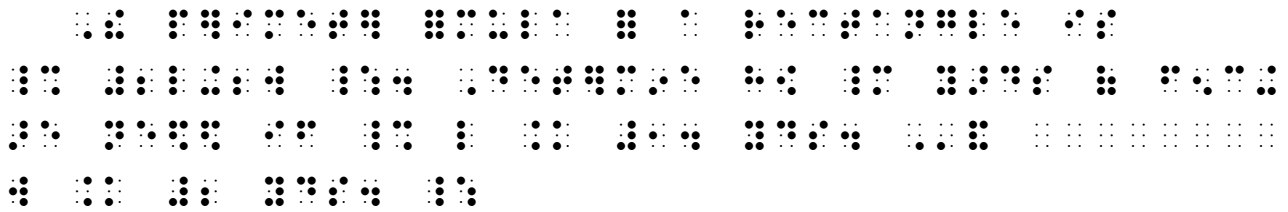
## LESSON PREVIEW

A closer look at letters used as variables. How to tell if a letter is a variable or an abbreviation. Treatment of Roman numerals. Treatment of other mathematical letter combinations as well as sequences of unspaced letters. How to handle letters used as numerals in nondecimal bases. German, Greek, Hebrew, and Russian letters used in mathematical notation. A look at mathematical constants. Rules regarding the "enclosed list". More rules about English letters and about abbreviations. Code switching considerations with headings.



*Example 4-3*

The perimeter formula for a rectangle is  $2l + 2w$ . Determine how many yards of fencing are needed if  $l = 14$  yds. and  $w = 2$  yds.



*l and w are variables.*

---

**PRACTICE 4A**

1. Express  $y$  in terms of  $x$  if  $2x - 3y = 12$ .
2. If  $A = l \times l$ , what is the length ( $l$ ) of a side in inches if the area ( $A$ ) of a square is 7.3 sq.ft.?
3. It is much easier to remember  $A = lw$  (Area = length  $\times$  width) than it is to remember  $B = jt$  when trying to figure out how much carpet to buy for the living room.
4. Determine the area  $A$  of trapezoid T with upper base  $a = 3$  in., lower base  $b = 6$  in., and height  $h = 13$  in.

---

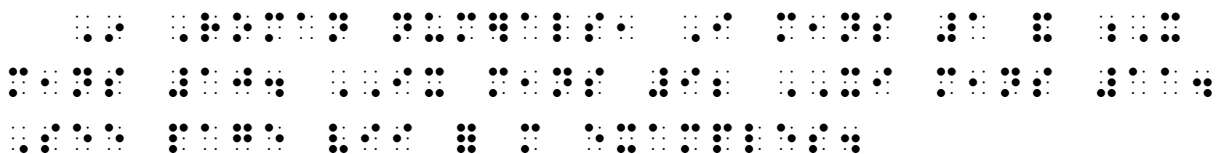
***Roman Numerals***

**4.2 Code Switching with Roman Numerals**

The rules you have learned about freestanding, unmodified mathematical numbers also apply to Roman numerals. Specifically, freestanding, unmodified Roman numerals within the narrative may be transcribed in UEB, but inside the switches they follow Nemeth rules. A Roman numeral used as an identifier may be transcribed in either code. Use context clues to decide whether or not to switch, just as you do with Arabic numerals.

*Example 4-4*

In Roman numerals, I means 1 and X means 10. IX means 9; XI means 11. See page vii for more examples.









Example 4-10

What does DC denote in the following statement?

$\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{1}{5} \times \frac{1}{6} \times \frac{1}{7} \times \frac{1}{8} \times \frac{1}{9} \times \frac{1}{10} \times \frac{1}{11} \times \frac{1}{12}$

*Out of context, it is not clear whether "DC" means the Roman numeral "600" or if it is referring to a line segment. Therefore, the letters are transcribed as a mathematical letter sequence. A switch to Nemeth Code is required.*

Example 4-11

div has special meaning.

$\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{1}{5} \times \frac{1}{6} \times \frac{1}{7} \times \frac{1}{8} \times \frac{1}{9} \times \frac{1}{10} \times \frac{1}{11} \times \frac{1}{12}$

*Out of context, it is not clear whether "div" means the Roman numeral "504" or if it is a special mathematical term. Therefore, the letters are transcribed as a mathematical letter sequence. A switch to Nemeth Code is required.*

**Review: Nonuse of the English-letter Indicator**

In Nemeth, the English-letter indicator is not used with a Roman numeral in the following circumstances.

- i. When a Roman numeral consists of two or more unspaced capitalized letters in regular type, no English-letter indicator is used.

$\gg \text{ II III VIII XV } \dots \dots \dots$

- ii. When a Roman numeral immediately precedes or follows a sign of comparison, no English-letter indicator is used.

$\gg X = 10 \dots \dots$

$\gg 1000 = M \dots \dots$

- iii. When a Roman numeral is in an expression consisting of a sequence of unspaced mathematical symbols, no English-letter indicator is used.

$\gg ix - v = iv \dots \dots$

- iv. When a Roman numeral is entirely enclosed between grouping signs, no English-letter indicator is used.

$\gg (ii) \dots \dots$

- v. When a Roman numeral is modified, no English-letter indicator is used.

» I'    ⋮⋮⋮

*Roman numerals starting with 5,000 include a line over the numeral in print.  
This notation will be discussed in Lesson 12.*

---

#### **PRACTICE 4B**

- i. Triangle ABC in Quadrant IV is reflected in Quadrant III as Triangle A'B'C'.
- ii.  $iv + vi = x$
- iii.  $X = 10$ ,  $L = 50$ ,  $C = 100$ , and  $D = 500$ .
- iv. Review items v and vi.
- v. Explain why  $MC = 1100$ , but  $CM = 900$ .
- vi. Use Formulas I' and III' to prove the statement.
-







## *OTHER ALPHABETS*

### **4.10 Alphabetic Indicators**

The language of mathematics uses letters from more than just the English alphabet. Specific provision is made in the Nemeth Code for the transcription of the letters of the German, Greek, Hebrew, and Russian (Cyrillic) alphabets. Each alphabet has a unique alphabetic indicator.

**4.10.1 Code Switching and Use of Letter Indicators.** Recall that switching to Nemeth to transcribe an English letter is not always required, and that the Nemeth English-letter indicator may be omitted in certain circumstances. In contrast, an alphabetic indicator is always required to identify a letter from the German, Greek, Hebrew, or Russian alphabets and a switch to Nemeth is always required for such letters even if UEB has a symbol for the letter.

**4.10.2 Capitalization and Punctuation.** When a letter from any alphabet is capitalized in Nemeth Code, the capitalization indicator (dot 6) is placed between the alphabetic indicator and the letter. Letters are individually capitalized—the effect of the capitalization indicator extends only to the letter which follows it. In a Nemeth transcription, letters from the German, Greek, Hebrew, and Russian alphabets are mathematical symbols and so are punctuated mathematically when the punctuation falls within the Nemeth switches.

Certain letters have unique mathematical applications. If you are unsure of a letter, find an expert who can identify it. Do not guess.

### **4.11 The Greek Alphabet**

Many letters from the Greek alphabet are used in mathematics and science. The following indicator identifies a letter as being from the Greek alphabet.

$\text{⋮}$ Greek-letter Indicator (standard form)
---------------------------------------------------

This symbol is read as the Greek-letter indicator only when immediately followed by a letter or by the capitalization indicator and a letter. The Nemeth Code table of Greek letters is reproduced below.







## Greek Alphabet Table

<u>Name of letter</u>	<u>Regular uncapitalized</u>	<u>Regular capitalized</u>	<u>Alternative form</u>
alpha	$\alpha$ ⠠⠠⠠	A ⠠⠠⠠⠠	$\alpha$ ⠠⠠⠠⠠
beta	$\beta$ ⠠⠠⠠	B ⠠⠠⠠⠠	$\beta$ ⠠⠠⠠⠠
gamma	$\gamma$ ⠠⠠⠠⠠	Γ ⠠⠠⠠⠠	
delta	$\delta$ ⠠⠠⠠⠠	Δ ⠠⠠⠠⠠	
epsilon	$\epsilon$ ⠠⠠⠠	E ⠠⠠⠠⠠	
zeta	$\zeta$ ⠠⠠⠠⠠	Z ⠠⠠⠠⠠	
eta	$\eta$ ⠠⠠⠠⠠	H ⠠⠠⠠⠠	
theta	$\theta$ ⠠⠠⠠⠠	Θ ⠠⠠⠠⠠	$\vartheta$ ⠠⠠⠠⠠
iota	$\iota$ ⠠⠠⠠	I ⠠⠠⠠⠠	
kappa	$\kappa$ ⠠⠠⠠	K ⠠⠠⠠⠠	
lambda	$\lambda$ ⠠⠠⠠	Λ ⠠⠠⠠⠠	
mu	$\mu$ ⠠⠠⠠	M ⠠⠠⠠⠠	
nu	$\nu$ ⠠⠠⠠⠠	N ⠠⠠⠠⠠	
xi	$\xi$ ⠠⠠⠠⠠	Ξ ⠠⠠⠠⠠	
omicron	$o$ ⠠⠠⠠	O ⠠⠠⠠⠠	
pi	$\pi$ ⠠⠠⠠⠠	Π ⠠⠠⠠⠠	
rho	$\rho$ ⠠⠠⠠⠠	P ⠠⠠⠠⠠	
sigma	$\sigma$ ⠠⠠⠠	Σ ⠠⠠⠠⠠	$\varsigma$ ⠠⠠⠠⠠
tau	$\tau$ ⠠⠠⠠⠠	T ⠠⠠⠠⠠	
upsilon	$\upsilon$ ⠠⠠⠠	Υ ⠠⠠⠠⠠	
phi	$\phi$ ⠠⠠⠠	Φ ⠠⠠⠠⠠	$\varphi$ ⠠⠠⠠⠠
chi	$\chi$ ⠠⠠⠠⠠	X ⠠⠠⠠⠠	
psi	$\psi$ ⠠⠠⠠⠠	Ψ ⠠⠠⠠⠠	
omega	$\omega$ ⠠⠠⠠	Ω ⠠⠠⠠⠠	
sampi	Ϡ ⠠⠠⠠		
stigma	Ϛ ⠠⠠⠠		
vau	Ϝ ⠠⠠⠠		
koph (qoph)	Ϟ ⠠⠠⠠		

4.11.1 **Code Switching with Greek Letters.** Even though the uncapitalized form of the Greek letters in Nemeth is identical to the uncapitalized form in UEB, you must switch to Nemeth when a Greek letter appears in a Nemeth transcription, even within the narrative. As with English letters, lowercase Greek letters are often printed in italics uniformly throughout a technical document or

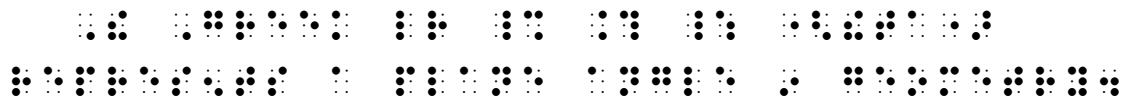
textbook. In both UEB and Nemeth, italics applied to a Greek letter are disregarded unless other circumstances require the typeface to be retained.

Greek letters used in the following examples and Practice are listed in the box below. Notice the placement of the capitalization indicator in the two capitalized letters. As stated in 4.10.2, the capitalization indicator is placed between the alphabetic indicator and the letter.

	Delta	$\Delta$
	mu	$\mu$
	pi	$\pi$
	Sigma	$\Sigma$
	tau	$\tau$
	theta	$\theta$

Example 4-15

The Greek letter  $\theta$  (theta) represents a plane angle in geometry.



Example 4-16

$\pi < 0 < 2\pi$



Example 4-17

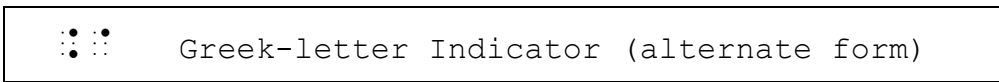
Find the button marked " $\pi$ " on your calculator.



*Greek letters are mathematical symbols and are punctuated mathematically.*

4.11.2 **Capital Greek Letters.** Several capital Greek letters look identical to capital English letters. Those Greek letters are generally not used as math symbols. You can safely assume they are English letters unless specifically identified as Greek letters in the text.

4.11.3 **Alternate Form of Greek Letters.** Some lowercase Greek letters occur in variant print forms. The Greek alphabet table in the Nemeth code book shows an alternate form for five of the Greek letters (alpha, beta, theta, sigma, and phi). The following indicator is used to identify the alternate forms.



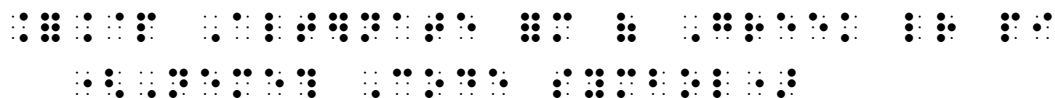
The alternative form is used in braille only when both forms—standard and alternative—appear in the same print text. If a Greek letter is represented by its alternative form *instead of its standard form throughout* the print text—that is, only one form of the letter is used throughout—the symbol for the standard form is used in braille. Include a transcriber's note at the beginning of the text to inform the reader.

Sample transcriber's note on the Transcriber's Notes page: "The alternate form of the Greek letter theta is used exclusively in print. In braille, the standard form is used."

If a text shows an alternate form of a Greek letter that does not appear in the Nemeth Code table, follow the guidelines above to determine if you should substitute the regular form or if you should use the alternate Greek-letter indicator. If the alternate form is used in the braille transcription, list the symbol on the Special Symbols page, identifying it as a Nemeth symbol as you do for the Nemeth Code terminator and the single-word switch indicator.

Example 4-18

(Special Symbols page)



If the letter's identity is not clear from context, consult an expert in the field in order to determine its designation.

**PRACTICE 4D**

Although the handwritten form of phi ( $\varphi$ ) may be found in source materials, only the standard form ( $\phi$ ) is used in this book.

Another circle constant, the Greek letter tau,  $\tau$ , equals  $2\pi$ , or approximately 6.28.

The symbol  $\Sigma$  indicates summation.  $\Delta$  signifies change.

In statistics,  $\mu$  denotes the population mean; in engineering,  $\mu$  is the coefficient of friction. In number theory,  $\mu$  represents the Möbius function whereas, in particle physics,  $\mu$  is the symbol for the muon.

## 4.12 The German Alphabet

German letters used in mathematics are derived from the Gothic or "Fraktur" calligraphic style of the Latin alphabet. It is a dark font, but is not considered to be bold. These letters must be transcribed in Nemeth. The following indicator is used to identify a letter as being from the German alphabet.

⠒⠑	German-letter Indicator
----	-------------------------

The three German Fraktur letters most commonly encountered in specialized fields of mathematics and science are shown below.

⠒⠑⠒	tseh	c
⠒⠑⠒	gheh	g
⠒⠑⠒⠑	Fao	℔

If other Fraktur letters are encountered in a text, refer to the alphabet list in Rule 6 of the Nemeth code book. The German letter may be associated with the same letter from the English alphabet, which may help you identify it.

### Example 4-19

Capital German ℔ looks like the English letter "B" but in fact it is a "V"!

The image shows the Nemeth code for the sentence: "Capital German ℔ looks like the English letter B but in fact it is a V!". The German letter ℔ is represented by its Fraktur equivalent 'V' in the Nemeth code.

### Example 4-20

In set theory, the continuum (denoted by c), is an infinite cardinal number.

The image shows the Nemeth code for the sentence: "In set theory, the continuum (denoted by c), is an infinite cardinal number.". The letter 'c' is represented by its Fraktur equivalent 'c' in the Nemeth code.

*German letters may be encountered in the study of set theory.*

### Example 4-21


$g = \text{Lie}(G)$

The image shows the Nemeth code for the equation  $g = \text{Lie}(G)$ . The letter 'g' is represented by its Fraktur equivalent 'g' in the Nemeth code.

*German letters may be encountered in the study of Lie algebra.*


### 4.13 The Hebrew Alphabet

Hebrew letters used as mathematical symbols must be transcribed in Nemeth. The following indicator is used to identify a letter as being from the Hebrew alphabet.

 Hebrew-letter Indicator
-----------------------------------------------------------------------------------------------------------

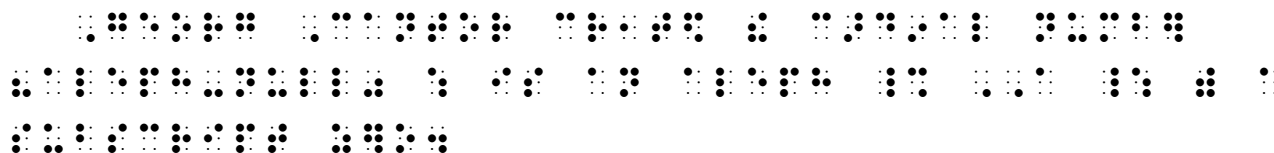
The Hebrew alphabet has no capitalized form. The letter most commonly encountered in technical material is the aleph: א The aleph is usually written with a subscript, which will be discussed in Lesson 6.

A complete list of the Hebrew letters and their braille equivalents can be found in *World Braille Usage*, which is available for download at Perkins.org.

 aleph א
-------------------------------------------------------------------------------------------


#### *Example 4-22*

Georg Cantor created the cardinal number "aleph-null" which is an aleph א with a subscript zero.






### 4.14 The Russian Alphabet

Russian (Cyrillic) letters used as mathematical symbols must be transcribed in Nemeth. The following indicator is used to identify a letter as being from the Russian alphabet.

 Russian-letter (Cyrillic) Indicator
-------------------------------------------------------------------------------------------------------------------------

Two Cyrillic letters in common usage are Sha which is used in number theory and Ell (also the lowercase ell) which is used in hyperbolic (Lobachevskian) geometry. The Sha usually keeps company with bold and barred letters, and so will be further discussed in Lesson 7. Note the similarity between the Cyrillic letter ell and the Greek letter pi. If the letter's identity is not clear from context, consult an expert in the field in order to determine its designation.

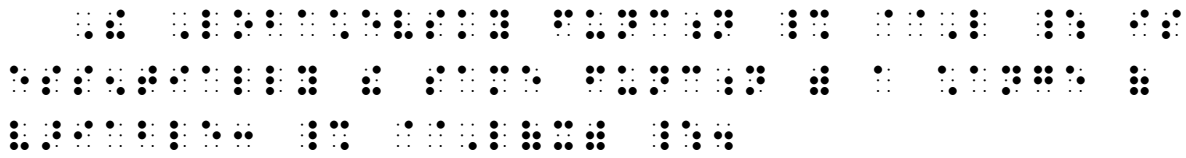
A complete list of the Russian letters and their braille equivalents can be found in *World Braille Usage*, which is available for download at Perkins.org.

 ell	π
 Ell	Π
 Sha	Ш



Example 4-23

The Lobachevsky function  $\mathcal{L}$  is essentially the same function with a change of variable:  $\mathcal{L}(x)$ .



---

*Note:* The Russian alphabet table in *World Braille Usage* shows how to transcribe the Cyrillic letters in sentence 2: dots 1, 12, 2456, 1245, 145, 15, 245, 1356, 24, and 13.

**PRACTICE 4E**

- 1) Be sure to differentiate between the Cyrillic letters "ell" Л and "Ell" Л and the Greek letters "pi" π and "Pi" Π.
- 2) The first ten uncapitalized Cyrillic letters are: ah а, beh б, veh в, gheh г, deh д, yeh е, zheh ж, zeh з, ee и, and kah к.

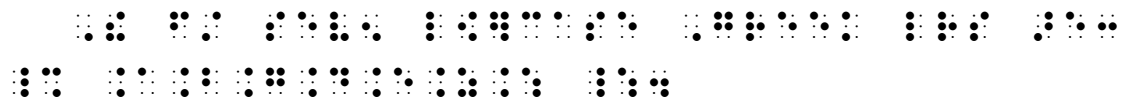
---

**4.15 A Sequence of Unspaced Letters**

- a. **Non-English Letters.** The effect of an alphabetic indicator extends only to the letter which follows it. Thus, in a sequence of unspaced letters from non-English-letter alphabets, the appropriate alphabetic indicator is used before each letter.

Example 4-24

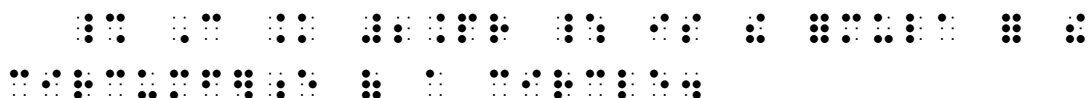
The first seven lowercase Greek letters are:  $\alpha\beta\gamma\delta\epsilon\zeta\eta$ .



- b. **English Letters.** An English letter in regular type which appears in an unspaced sequence of terms does not require a letter indicator. Recall that mathematical letters which are consistently *printed* in italics are transcribed in regular type.

Example 4-25

$C = 2\pi r$  is the formula for the circumference of a circle.



Example 4-26

The "change in  $y$ " is denoted as " $\Delta y$ ".

$$\Delta y$$

4.15.1 **Derivatives.** The English letter combinations "dx", "dy", etc. often used in differential notation are usually spaced away from surrounding characters in print in order to enhance recognition. The space is omitted in braille unless another Nemeth rule requires a space. Print may show the letter d in italics or in regular type. Either way, the letter is not italicized in braille.

Example 4-27

$$(x + y) dx dy = \_\_\_$$

$$(x + y) dx dy = \_\_\_$$

*In print, there is a space before each "d".*

**4.16 Mathematical Constant**

A mathematical constant is a special number whose value is nonvarying ("constant") and is represented by a certain alphabetic character. Two common examples are the Greek lowercase pi  $\pi$  and the English letter  $i$ . Constants are usually printed in italics uniformly throughout a document. In both UEB and Nemeth, constants are transcribed as regular type unless other circumstances require the typeface to be retained.

Example 4-28

$$i(a + bi) = -b + ai$$

$$i(a + bi) = -b + ai$$

Example 4-29

$$C = 2\pi r + \pi \Delta r$$

$$C = 2\pi r + \pi \Delta r$$

---

Linage and judicious placement of code switches is the challenge in this practice. After transcribing each sentence, write down your reasons for switching where you did. Then compare your decisions to the answer key and commentary at the end of the lesson.

### PRACTICE 4F

1. Variables  $a$  and  $b$  are inversely related.
2. There exists a constant  $N$  such that no bit of  $\Omega$  after the  $N$ th can be proven to be 1 or 0.
3. Randall replied, " $12 - n, 11 - n, 10 - n \dots$  which is correct?"
4. " $12 - n, 11 - n, 10 - n, \dots$ "
5. Which is correct: " $4x + 3y$ ," " $3x + 4y$ ," or " $4x + 4y$ "?
6. What is the remainder when 101 is divided by 3? ( $101 \div 3$ )
7. The result is  $(ax + by)(cx + dy)$ , where all components are real.
8.  $\Delta x$  means "the change in  $x$ " and  $\Delta y$  means "the change in  $y$ ". When  $x$  increases by  $\Delta x$ ,  $y$  increases by  $\Delta y$  as expressed in the equation  $y = \Delta y = f(x + \Delta x)$ .
9. ( $4x + 3y$  is the denominator.)

---

### ENCLOSED LISTS

#### 4.17 Special Case—Definition of an "Enclosed List"

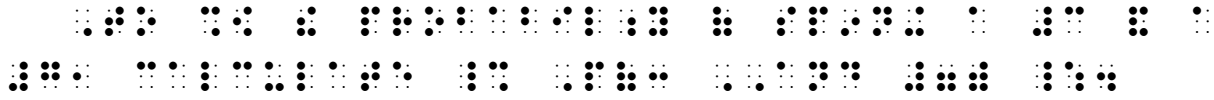
Special provision is made for the transcription of a sequence of mathematical items enclosed within grouping signs. All of the following must be true in order to apply this rule.

- i. The sequence must begin and end with a sign of grouping. The grouping signs do not have to be of the same kind.
- ii. The list must have at least two items and the items must be separated by commas.
- iii. An item of the list may be any sign used for omission – for example, an ellipsis or a long dash.
- iv. The list cannot contain any punctuation mark other than the separating commas. (The omission ellipsis or long dash are not considered to be punctuation.)
- v. The list cannot contain any words, abbreviations, ordinal endings, or plural endings. (An exception applies when a word is an element in set notation. See [4.17.3.b.](#))
- vi. The list cannot contain a sign of comparison.



Example 4-35

To show the probability of spinning a 3 and a 7, calculate P(3 AND 7).



*This is not an enclosed list because there are no commas and because it contains a word. A numeric indicator is required before the numeral 7. The word AND has mathematical significance and is transcribed in Nemeth without contractions. (The words AND, OR, and NOT may be used as mathematical operators in the fields of probability and logic.)*

**4.17.2 Nonuse of the English-letter Indicator in an Enclosed List.** In an enclosed list, the English-letter indicator is not used with any English letter or combination of English letters in regular type. This rule includes Roman numerals. (Note that a letter from a non-English alphabet must retain its appropriate alphabetic indicator.)

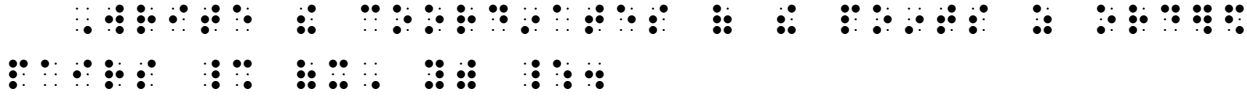
Example 4-36

(a, 2x, ..., b, ab)



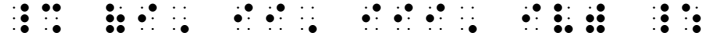
Example 4-37

Write the coordinates of the points as ordered pairs (x, y).



Example 4-38

(i, ii, iii, iv)



Example 4-39

( $\alpha$ , a,  $\beta$ , b)



*The Greek letters alpha and beta are in this enclosed list. The Greek-letter indicator is required.*

Situations which require a numeric indicator or an English-letter indicator in an enclosed list will be discussed in later lessons.

4.17.3 **Format—Keep Together.** Items in an enclosed list must not be divided between braille lines if the entire list will fit on a single braille line.

*Example 4-40*

Fill in the missing numerals. (1, 3, ?, ?, 9)

⠠⠑ ⠠⠒ ⠠⠓ ⠠⠔ ⠠⠕ ⠠⠖ ⠠⠗ ⠠⠘ ⠠⠙  
 ⠠⠑ ⠠⠓ ⠠⠔ ⠠⠕ ⠠⠖ ⠠⠗ ⠠⠘ ⠠⠙

*Example 4-41*

The replacement set is  $\{m, n, o, p, q, r, s, t, u, v, w\}$ .

⠠⠎ ⠠⠏ ⠠⠑ ⠠⠒ ⠠⠓ ⠠⠔ ⠠⠕ ⠠⠖ ⠠⠗  
 ⠠⠎ ⠠⠏ ⠠⠑ ⠠⠒ ⠠⠓ ⠠⠔ ⠠⠕ ⠠⠖ ⠠⠗ ⠠⠘ ⠠⠙

- a. **Division Between Lines.** If the enclosed list will not fit on a single braille line, use as much of the current line as possible and begin a runaway line after a comma. When the items in an enclosed list must be divided between braille lines, neither the numeric indicator nor the English-letter indicator is used before the runaway on the new line.

*Example 4-42*

Does  $\{\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \dots\}$  represent a set of integers?

⠠⠠⠨ ⠠⠠⠓ ⠠⠠⠔ ⠠⠠⠕  
 ⠠⠠⠖ ⠠⠠⠗ ⠠⠠⠘ ⠠⠠⠙  
 ⠠⠠⠑ ⠠⠠⠒ ⠠⠠⠓ ⠠⠠⠔ ⠠⠠⠕ ⠠⠠⠖ ⠠⠠⠗ ⠠⠠⠘ ⠠⠠⠙

Remember, if a math expression will fit on one line, do not divide it. See how this rule applies in an itemized format.

*Example 4-43*

Now we will discuss these three sets.

1.  $\{25, 50, 75, 100, 125, \dots\}$
2.  $\{100, 150, 200, 250, 300, 350, \dots\}$
3.  $\{100, 200, 300, 400, 500, 600, 700, \dots\}$

*Item 1 requires no division.*  
*Item 2: When the enclosed list is brought down to the next line (starting in the runover cell, cell 3) no division is needed. This keeps the enclosed list together on one line.*  
*In item 3, division is unavoidable.*

**b. Set Notation Containing Words.** Braces are used to identify the elements of a set. A switch to Nemeth is required in order to transcribe a set. When a word is an element of a set, the expression is transcribed following the rules of an enclosed list. The word is transcribed without contractions. A single-word switch indicator is not used.

*Example 4-44*

Now we must find the domain and range of the following relation.  
 {(Ford, -9), (Nixon, -5), (Taft, -11), (Polk, -23)}

*The set enclosed between braces will not fit on one line. It is divided after a comma. Note that, even though "(Polk," will fit on line 3, the pair enclosed in parentheses "(Polk, -23)" is kept together on one braille line.*

When a word (or words) appearing within set notation is not one of the elements of the set, it is still transcribed in Nemeth, but the grouped expression is no longer considered to be an "enclosed list". The word is transcribed without contractions and without the use of the single-word switch indicator.

*Example 4-45*

The replacement set is {1, 3, 5, 7, and 9}.

*This set does not meet the requirements of an "enclosed list" because it contains a word that is not an element of the set. Numeric indicators are required before each number that is preceded by a space.*

---

*Instructions:* First determine if each item is or is not an enclosed list. Write YES if the item is an enclosed list and NO if it is not. Then transcribe the YES items in Nemeth.

### PRACTICE 4G

1.  $\{a, b, c, d\}$
  2.  $(-1, -2, -3)$
  3.  $(h \text{ ft}, k \text{ in})$
  4.  $(ab, cd, ef)$
  5.  $1, i, -1, -i$
  6.  $(1, i, 2, ii)$
  7.  $(1\text{st}, 2\text{nd}, 3\text{rd})$
  8.  $(A, A', B, B', C)$
  9.  $\{\_, .13, .15, .17, \_\}$
  10.  $(1 + h, 2 + k, 0)$
  11.  $(x = 1, 2, \dots, 10)$
  12.  $(a, b]$
  13.  $(1 \ 2 \ 3)$
  14.  $[0, 1]$
  15.  $(u, v; x, y)$
  16.  $\{(Denver, 19), (Utah, 27), (Minnesota, 24), (San Antonio, 28)\}$
  17.  $(a, b, \dots)$
  18.  $(x + 1, x + 2, ?, ?, x + 5)$
  19.  $\langle -1, 0]$
  20.  $(2, 4, 6, \_, 10)$
  21.  $(0, a, 1, b, 2)$
  22.  $\{1\text{'s}, 2\text{'s}, 3\text{'s}\}$
  23.  $\{1, 2, \text{and } 3\}$
-



## MORE ABOUT ENGLISH LETTERS

### 4.18 An English Letter Touching Only One Grouping Symbol

In Lesson 3, you learned that the English-letter indicator is not needed when a "single letter" is enclosed between mathematical grouping symbols.

However, when a "single letter" is in direct contact with only one grouping sign, and the letter is not an item in an enclosed list as defined above, rules regarding the English-letter indicator are applied as though the grouping sign was not present.

Example 4-46

$(k = 1, 2, \dots, n)$ .

*Without the left parenthesis, the letter  $k$  would not need an English-letter indicator because it is followed by an equals sign. Without the right parenthesis, the letter  $n$  would need an English-letter indicator because it is preceded by a space and followed by punctuation.*

Example 4-47

Consider the set  $\{m \text{ and } n\}$ .

*Set notation is mathematical and so a switch to Nemeth Code is required. Without the left brace, the letter  $m$  would need an English-letter indicator because it is preceded and followed by a space. Without the right brace, the letter  $n$  would need an English-letter indicator because it is preceded by a space and followed by punctuation.*

Example 4-48

If two events are mutually exclusive we write  $P(A \text{ AND } B) = 0$  where  $P(A \text{ AND } B)$  means "the probability of  $A$  and  $B$  occurring at the same time".

1            
  
2 
  
3 
  
4

*Line 2: Without the left parenthesis, the letter  $A$  would not need an English-letter indicator because it immediately follows the letter  $P$ . Without the right parenthesis, the letter  $B$  would not need an English-letter indicator because it is followed by a comparison sign.*

Line 3: Without the left parenthesis, the letter A would not need an English-letter indicator because it immediately follows the letter P. Without the right parenthesis, the letter B would need an English-letter indicator because it is preceded and followed by a space.  
 Line 4: Letters A and B follow the rules of UEB in the narrative.

- a. **Roman Numerals.** The same rule applies to a Roman numeral that is in direct contact with only an opening or closing grouping sign. The English-letter indicator is used or is not used as though the grouping sign was absent. The following example illustrates Roman numerals used as identifiers, assuming uninterrupted mathematical context.

➤ i)    ⠠⠠⠠⠠  
 ➤ iv)   ⠠⠠⠠⠠⠠  
 ➤ v)    ⠠⠠⠠

- b. **Modified Grouping Sign.** If the grouping sign includes a prime or other modifying symbol, the English-letter indicator is not used with the single English letter that touches the grouping symbol.

➤ t]'    ⠠⠠⠠⠠⠠

Example 4-49

t]' and v] have unique meaning.

⠠⠠ ⠠⠠⠠⠠⠠ ⠠⠠⠠⠠ ⠠⠠⠠⠠⠠ ⠠⠠ ⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠

**4.19 English Letters with Plural, Possessive, or Ordinal Endings**

When a "single letter" has a plural, possessive, or ordinal ending, in mathematical context the English-letter indicator rules of the Nemeth Code are applied as though such endings were not present. The following examples illustrate proper use of the English-letter indicator, assuming mathematical context. Note that the expressions are punctuated mathematically. The presence of a plural, possessive, or ordinal ending does not change the fact that the punctuation mode is mathematical.

- a. Plural

➤ ps, qs, rs    ⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠

*Think: p, q, r – English-letter indicator is required*

➤ Xs, Ys, Zs    ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠

*Think: X, Y, Z – English-letter indicator is required*

b. Possessive

*Reminders:* A punctuation indicator is required before an apostrophe; otherwise dot 3 is read as a prime sign.

➤  $p's, q's, r's$      ⠠⠏⠛⠨⠎ ⠠⠒⠛⠨⠎ ⠠⠕⠛⠨⠎

*Think:*  $p, q, r$  – English-letter indicator is required

➤  $X's, Y's, Z's$      ⠠⠭⠛⠨⠎ ⠠⠶⠛⠨⠎ ⠠⠵⠛⠨⠎

*Think:*  $X, Y, Z$  – English-letter indicator is required

c. Ordinal

➤  $nth, 2nth$      ⠠⠨⠎ ⠠⠒⠨⠎

*Think:*  $n$  – English-letter indicator is required;  $2n$  – English-letter indicator is not required

d. Letter Combinations

*Reminder:* Letter combinations require a switch to Nemeth Code, but no English-letter indicator is needed. Capital letters are individually capitalized.

➤  $ABs$  and  $GHs$      ⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠

➤  $AB's$  and  $GH's$      ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

➤  $ab's$  and  $gh's$      ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠

➤  $abth$  and  $jkth$      ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠

*Instructions:* Stay in Nemeth Code to transcribe items C) and E).

**PRACTICE 4H**

A) Find all  $ABs$ ,  $CDs$ , and  $EFs$ ; draw  $XYZs$ .

B) Find all  $AB's$ ,  $CD's$ , and  $EF's$ ; draw  $XYZ's$ .

C) (1st, 2nd, ...  $nth$ , ... 49th)

D) Does  $|a| \times |b| = |ab|$ ?

E) If  $Q$ , then  $\{\text{[NOT-}P\text{]} \text{ OR } P\}$ .

## ***MORE ABOUT ABBREVIATIONS***

### Abbreviation Reminders

- Abbreviations are not mathematical expressions although they may be part of a mathematical expression.
- A space comes between an abbreviation and its related value, even if no space is shown in print.
- An abbreviation and its related value must not be divided between braille lines.
- Between a two-word abbreviation, follow the same spacing as used in print. Do not divide the abbreviation between lines.
- Abbreviations are punctuated in literary mode, even in mathematical context.

### **4.20 More Spacing Rules**

**4.20.1 Spacing of Abbreviations with Operation Signs.** Spacing between an abbreviation and an operation symbol depends upon whether the abbreviation has a related value.

- a. A space is required between an abbreviation and a sign of operation when the abbreviation has a related value.

*Example 4-50*

7 in. + 9 in. = 16 in. or 1 ft. 4 in.

The Braille representation of the text '7 in. + 9 in. = 16 in. or 1 ft. 4 in.' is shown on two lines. The first line contains the Braille for '7 in. + 9 in. = 16 in. or 1 ft. 4 in.' and the second line contains the Braille for '7 in. + 9 in. = 16 in. or 1 ft. 4 in.'.

- b. No space comes between an abbreviation and a multiplication dot when the second abbreviation has no related value. No space comes between an abbreviation and a slash which applies to the abbreviation.

*Example 4-51*

Momentum is expressed in kg·m/s.

The Braille representation of the text 'Momentum is expressed in kg·m/s.' is shown on a single line.











## CODE SWITCHING, cont.

### 4.25 General Rule Regarding Blank Lines

A blank line is required before a centered, cell-5, or cell-7 heading according to *Braille Formats* guidelines. A code switch indicator standing alone on a line does not take the place of a blank line. For example, when material ends with a Nemeth Code terminator that falls alone on the line, and when a heading follows, a blank line is still required. We will now see how this rule affects the layout of itemized Nemeth material which *follows* a heading.

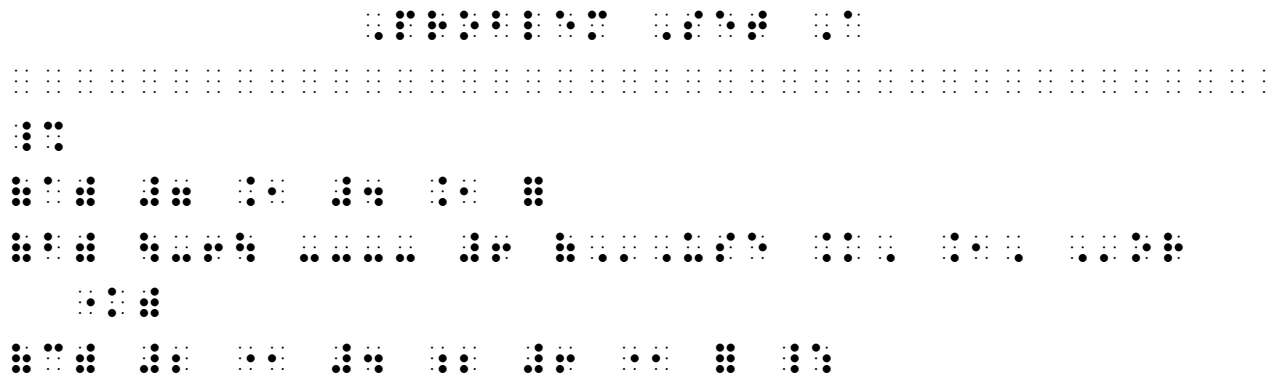
4.25.1 **Initiating Nemeth Code Before Itemized Material, Following a Heading.** As seen in Lesson 2, in order to ensure that identifiers each begin in the same cell, the opening Nemeth Code indicator is placed at the end of the text that precedes the listed items. When an itemized set of problems immediately follows a heading, the following layouts are recommended.

- a. **Centered Heading.** An opening Nemeth Code indicator cannot be placed at the end of a centered heading. When itemized material immediately follows a centered heading, place the opening Nemeth Code indicator alone on the line immediately before the first identifier. A switch indicator alone on a line does not replace a necessary blank line.

*Example 4-64*

### Problem Set A

- (a)  $7 > 4 > -?$   
 (b)  $|-6| \_ 6$  (Use =, >, or <)  
 (c)  $2 : 4 :: 6 : ?$



*Line 2 is the blank line which is required following a centered heading.*

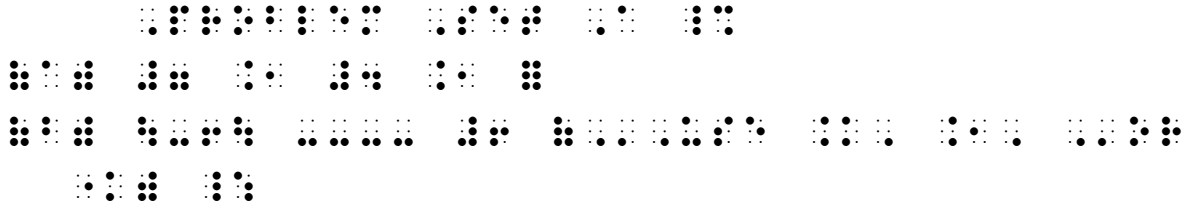
- b. **Cell-5 and Cell-7 Heading.** An opening Nemeth Code indicator may be placed at the end of a cell-5 or cell-7 heading. If the indicator does not fit on the line with the heading, it may be placed on the next line in the runover position. This is especially useful when itemized math material immediately follows the heading. The first identifier will then be transcribed in Nemeth.

Example 4-65

**Problem Set A**

(a)  $7 > 4 > ?$

(b)  $|-6| \_ 6$  (Use =, >, or <)



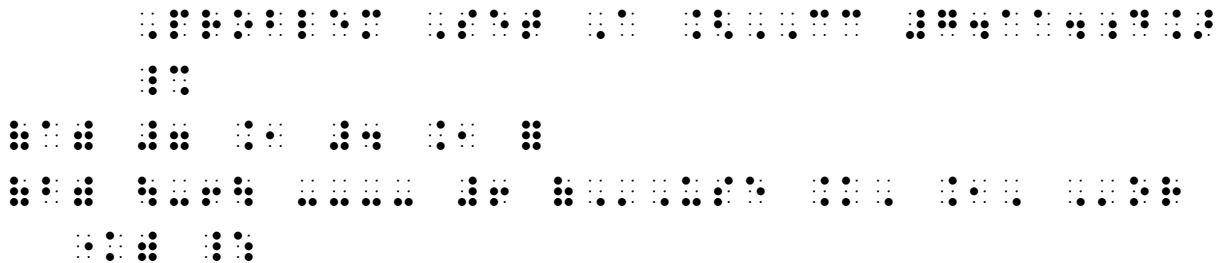
*The opening Nemeth Code indicator is transcribed after the last word in the cell-5 heading.*

Example 4-66

**Problem Set A [CC 7.11.d]**

(a)  $7 > 4 > ?$

(b)  $|-6| \_ 6$  (Use =, >, or <)



*This opening Nemeth Code indicator is transcribed in cell 5, the runover position of the cell-5 heading.*

**4.26 Transcriber's Notes**

Transcriber's note indicators are UEB symbols and therefore must be transcribed outside of the Nemeth switches. When the note itself contains mathematical material, code switching occurs within the note. Nemeth Code must be terminated before the closing transcriber's note indicator is transcribed. If mathematical material follows the transcriber's note, the opening Nemeth Code indicator may be placed following the closing transcriber's note indicator only if it fits on the same line. If it does not fit, follow established directives regarding placement of the opening switch.

**4.27 Embedded Identifiers**

Identifiers which are embedded within the narrative follow similar code-switching guidelines to identifiers aligned at the margin discussed in Lesson 2. Note that an embedded identifier may fall at the end of a line; it does not need to be placed on the same line as the material with which it is associated.





ANSWERS TO PRACTICE MATERIAL

PRACTICE 4A

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15











Practice 4G, continued

- 11. NO (this list contains a sign of comparison)
- 12. YES  $\{ \{ \{ \{ \{ \{ \{ \{ \} \} \} \} \} \} \} \}$
- 13. NO (the items are not separated by commas)
- 14. YES  $\{ \{ \{ \{ \{ \{ \} \} \} \} \} \}$
- 15. NO (there is a semicolon)
- 16. YES (See [4.17.3.b.](#) regarding set notation containing words.)  
 $\{ \{ \{ \{ \{ \{ \{ \{ \{ \} \} \} \} \} \} \} \}$   
 $\{ \{ \{ \{ \{ \{ \{ \{ \{ \} \} \} \} \} \} \}$
- 17. YES  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \} \}$
- 18. YES  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 19. YES  $\{ \{ \{ \{ \{ \{ \} \} \} \}$
- 20. YES  $\{ \{ \{ \{ \{ \{ \} \} \} \}$
- 21. YES  $\{ \{ \{ \{ \{ \{ \} \} \} \}$
- 22. NO (there are plural endings)
- 23. NO (the word is not an element of the set so this is not an enclosed list)

PRACTICE 4H

- 1  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \} \}$
- 2  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 3  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 4  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 5  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 6  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$
- 7  $\{ \{ \{ \{ \{ \{ \} \} \} \}$
- 8  $\{ \{ \{ \{ \{ \{ \{ \} \} \} \}$

# PRACTICE 4I

1     ⠠⠠

2     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

3     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

4     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

5     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

6     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

7     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

8     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

9     ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

10    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

11    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

12    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

13    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

14    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

15    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

16    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

17    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

18    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

19    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

20    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

21    ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

Line 7: The identifier fits on this line. See 4.27.