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Technical English, Lecture 6: Technical writing

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Numbers

Numbers are important in technical documents.

- Be accurate.
  - "The forward bias voltage of a diode is *small*." (How small is small? Should it be the voltage across the diode?)
  - "Digital disks are *better* than the analog ones." (In what? By how much?)
- Compare the same dimensions.

  "The value of R is twice that of C."
- Use a *small* space to separate groups of three digits in a number: 123 456 and not a comma 123,456. (Note the difference between 123,456 and 123, 456. The latter is two numbers separated by a comma.)
- Insert a '0' before the fractional point for numbers between -1 and 1: 0.53 not .53.

Objects, properties, and values

Watch out for the difference between

a resistor	and	a resistance,
a capacitor	and	a capacitance.

A resistor is soldered,

a resistance is measured, and

the value of the resistance is 470 ohms.

Additions

Parallel work adds in one sense but not the other. Two students working together on a project for a week

- produce more work than another student working alone for the same week,

  but
- each gets a work experience of one week not two!

Zero and infinity

In calculations, engineers often neglect some terms if they are much smaller than other terms. These are "zeros" while very large terms are "infinities".

- Remember that in reality these are not the mathematical zero or infinity.
- In a lab measurement or in a simulation, you will never have a zero or infinity.
- If you report a result below or above the range of your measuring instrument, you may write "v_{out} is less than 0.2 mV" but do not say that it is zero.

How do we write numbers?

In general, single digit numbers (zero through nine) are spelled out, while numbers of two or more digits (10, 20th Century, ...) use figures. Exceptions:

1. Use figures for all numbers when there are numbers of two or more digits for related quantities in the same sentence , such as "6 of 23 physicians recommend".
2. Use figures when a unit of measurement follows: "5 A".
3. Spell approximate values and do not abbreviate the unit (if any): about five years, two orders of magnitude, about four times larger, several kilovolts, and a few tens of megahertz.
4. Use figures when mathematical operations are implied: factor of 2 and 3 $\times$ 3 matrix.
5. Spell a number at the beginning of a sentence otherwise rewrite the sentence.

Watch your units

- All values that have dimensions must have their units specified.
- When written out (not abbreviated), all units start with a small letter: ohm, volt, and hertz.
- When abbreviated, units after the name of a person have a capital first letter: Hz, V, A.
- Only multiplier prefixes of 10^6 or more have a capital letter. Watch out for the difference between $M = 10^{+6}$ and $m = 10^{-3}$.
- A *nonbreakable* space is required between the value and the unit. Write 5 kHz and not 5kHz.
- Table heading or graphs should be labeled as kV or mV but not volts$\times 10^{-3}$.
- The 'M' and 'G' in computer memories and drives are currently ambiguous. Specify what you mean.

a or an?

The rule is simple: Use a if the first letter of the following word begins with a consonant when pronounced. Use an if the first letter of the following word begins with a vowel sound (a, e, i, o, u) when pronounced.

What do you use for the following?

UPS	RS-232	hour
1 $k\Omega$ resistance	8 V potential difference	illogical rule

Not and or

1. no drinking or no eating
2. drinking and eating prohibited
3. no drinking and no eating
4. drinking or eating prohibited
5. You may not eat or drink in this library.
6. Neither eating nor drinking is permitted.

⇒ Attempt to use expressions that are logically correct and difficult to misunderstand.

Pronouns

In English, the pronouns he and his are not neutral. Most native speakers will prefer

> "Engineers represent their profession at all times."

over

> "An engineer represents his profession at all times."

Hyphens

Notice that compound words as in

> "high-voltage supply" and
>
> "low-voltage system"

have hyphens when they are adjectives. They do not have a hyphen when used as nouns such as in

> "There was high voltage on the wires that were supposed to carry low voltage."

There are many other rules regarding hyphens in the booklet.

Verb tense and voice

As we discussed before, attempt to write using

- the present tense and
- the active voice.

Dates

What does 10/12/06 mean?

- Tenth of December 1906.
- Tenth of December 2006.
- Twelfth of October 2006.
- Sixth of December 2010.

It is much better to write 10 December 2006. This method

conveys the correct meaning clearly and

has a logical order (days then months then years).

Equations

The power, P, dissipated in any two-terminal device is given by

$$P = IV \tag{1}$$

where I is the current in the device and V is the voltage across the device. For the special case of a resistor, the relation between voltage and current can be used to express the power as a function of only voltage:

$$P = \frac{V^2}{R}. \tag{2}$$

Equations should be

- punctuated,
- numbered, and
- fitted within a single line if possible.

Examples from the TEXbook: punctuation

- A comma within a formula is different from that within the regular text. The equation $x = f(a, b)$ must not be broken after the comma but in $x = a$, b, or c we can put '$x = a$,' on one line and 'b,' on the following.
- Notice the difference between

  for $x = a, b$, or c (wrong)

  and

  for $x = a$, b, or c (right)

  in the spacing around the first comma.

  (Use a nonbreakable space for 'or c'.)

Examples from the TEXbook: spacing

- Within the text of a paragraph, formulas should be separated by words not just by commas.

  Define Fibonacci's numbers by $F_n = F_{n-1} + F_{n-2}$, for $n \geq 2$ not by $F_n = F_{n-1} + F_{n-2}, n \geq 2$.

- Side conditions in displayed equations must have extra spaces.

$$\text{(wrong)} \quad F_n = F_{n-1} + F_{n-2}, n \geq 2. \tag{3}$$

$$\text{(right)} \quad F_n = F_{n-1} + F_{n-2}, \qquad n \geq 2. \tag{4}$$

- Notice the difference between unary operators as in '$-a$' and binary operators as in '$-\,a$'. This is important when you need to break a long formula into multiple lines.

Examples from the TEXbook: ellipses

It is generally correct to produce formulas like

$$x_1 + \cdots + x_n \qquad \text{and} \qquad (x_1, \ldots, x_n),$$

but wrong to produce formulas like

$$x_1 + \ldots + x_n \qquad \text{and} \qquad (x_1, \cdots, x_n).$$

In general, the vertically centered dots appear between operators or relations while the low dots appear between commas and when things are juxtaposed with no signs between them at all.

Examples from the TEXbook: challenges

Try to write $I(\lambda) = \iint_D g(x,y)e^{i\lambda h(x,y)}\,dx\,dy$. Notice the spacing between the integral signs. Then, try the following displays.

$$\prod_{j\geq 0}\Bigl(\sum_{k\geq 0} a_{jk}z^k\Bigr) = \sum_{n\geq 0} z^n \Bigl(\sum_{\substack{k_0,k_1,\ldots\geq 0\\ k_0+k_1+\cdots=n}} a_{0k_0}a_{1k_1}\ldots\Bigr).$$

$$\sum_{x\in A}{}' f(x) \stackrel{\text{def}}{=} \sum_{\substack{x\in A\\ x\neq 0}} f(x).$$

$$\{\overbrace{a,\ldots,a}^{k\ a\text{'s}},\overbrace{b,\ldots,b}^{l\ b\text{'s}}\}.$$

$$2\uparrow\uparrow k \stackrel{\text{def}}{=} 2^{2^{\cdot^{\cdot^{\cdot^{2}}}}}\Bigr\}k.$$

Summary

There are many rules but they all guide you to

- write logically correct sentences,
- write grammatically correct sentences, and
- write sentences that are difficult to misunderstand.