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Subject Update – The Kb (1024) or Kb (1000) Dilemma

Introduction

There have been discussions around how we would reward students when they might use 1000 rather than 1024 in exam papers. It led to an interesting step back and think moment and I want to be very clear in the guidance given.

If we ask questions about disk storage we are **always** referring to the base 2 numbers, which are $k=1024$ or 2^{10} . When we are talking about transmission speeds we are **always** referring to SI units or base 10 numbers so $k=1000$ or 10^3 .

Below is the background thinking that underpins our clearly stated principle.

Capitalisation

Capital letters have nothing to do with the definition. As far as we're concerned, the candidates could write Kb, kB, kb, or KB. We would never penalise them for that. More to the point, we would never construct a question that would lead to that confusion.

There is no shortcut rule to reveal the meaning of kilo by capitalisation or not.

File size, memory size, and hard disc size

A kilobyte file is 1024 bytes in size. It is not 1000 bytes in size.
A kilogram of apples is 1000 grams heavy. It is not 1024 grams heavy.
The meaning of the prefix is clear from the context.

Therefore, when we talk about disk storage, file size, and memory size, kilobyte means 1024 bytes. That is perfectly clear from the context.

Transmission Speeds

Transmission speeds are described in kilobits per second (kbps). Now, that is not disk storage, files size, or memory size. For transmission speeds, kilobits means 1000 bits. Speed in physics is based on SI-units.



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Calculations

If a candidate uses 1000 in an arithmetic expression when 1024 is the correct value, then they would be penalised. The calculation would not produce an accurate result.

Questions

Look at some examples from the GCSE (9-1) Computer Science Sample assessment material.

- SAM 1 - Q1di Calculate how many bytes there are in three kilobytes of disc storage?
 - This question clearly defines the context of the question as disc storage. Therefore, the meaning of kilobyte should be clear. It is 1024. The correct response is 3×1024 .
- SAM 1 - Q1dii Calculate how many bits are being transmitted per second for a network described as three Mbps.
 - This question clearly defines the context of network transmission. Therefore, the meaning of 3 Mbps (megabits per second) should be clear. It is 1,000,000 bits per second. The correct response is $3 \times 1,000,000$.
- A question like, How long would it take to transmit a 2 KB (kilobyte) file at 3 Mbps (megabits per second)
 - This question would involve both of the values 1000 and 1024. The correct response would be $[2 * 1024 * 8] / [3 * 1000 * 1000]$. Replacing the values 1000 with 1024, or vice versa, or using all 1000, or using all 1024, would not generate the same value. Only one response is correct, not all four responses.

Interesting Note

When developing the [International GCSE in Computer Science](#) It was decided to adopt the more formal and more prescriptive units as defined by the International Electrotechnical Commission (IEC) which can be seen in the subject content 3.3. Data storage and compression, under 3.3.1. This adopts kibi for 2^{10} , mebi for 2^{20} etc.