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Unit 3, Assignment 1

Ex. A1.1

1. Compare the arrays' lengths.
    - If lengths are equal, continue.
    - Else return false.
2. Sort the two char arrays (create a separate method for sorting)
3. Use a for-loop to compare chars in the same position in the two arrays.
    - If the two chars are NOT equal, return false.
    - Else continue.
4. If the loop has finished without returning false, it means the arrays are anagrams => return true.

Ex. A1.7

Actually, before I saw the approach in the pre-assignment, I thought about this problem of determining whether two arrays are anagrams by first sorting them (see my Ex. A1.1 above).

Problem 3

I think this is a photo of the WW2 German Encryption Machine Enigma.

Problem 5

1.

Charles Babbage was born in London in the last decade of the eighteenth century, the son of a wealthy banker. An excellent mathematician, Babbage received a degree from Cambridge University in 1814, but his attempts to obtain university professorship were unsuccessful until 1828 when he became a professor at Cambridge. He was also a member of the Royal Society of London, the Royal Astronomical Society (of which he was one of the founders), and the American Academy of Arts and Sciences.

A man of many diverse interests, Babbage made important contributions to mathematics, statistics, economics, engineering, and theology. He also had political ambitions entering the race for a seat in Parliament twice, both times unsuccessfully. However, today he seems to be best-known for conceiving and designing machines that embodied the principles of the modern digital computer.

Babbage’s first machine, the Difference Engine, was a mechanical calculator for addition-based operations. His ambition for this machine was to produce, cheaply and reliably, log tables and other numerical tables that in his time were produced by human workers trained in performing certain calculations. Very complex, and exorbitantly expensive, this machine was never fully finished. However, the part that Babbage did manage to get built performed calculations efficiently and effectively. In the 1990s, using Babbage’s drawings and notes engineers, succeeded in building the Difference Engine to the engineering specifications of the nineteenth century. This fully functional model proved that Babbage’s design and technical details were correct.

Babbage’s other invention was even more grandiose. His Analytical Engine was supposed to be what is described today as a mechanical digital programmable computer. In this massive mechanism, or rather an ensemble of mechanical systems, Babbage envisioned a “store” (memory), a “mill” (CPU), cards (for loading programs), a steam engine (for driving the machine), and a printing mechanism. In other words, Babbage devised the full architecture of the modern general-purpose computer. This machine functions including arithmetic operations, conditional branching, looping, retrieving information from memory, and storing information in memory. Very importantly, this design also included output functions to print out the calculations automatically, thus avoiding human errors plaguing the mathematical tables of Babbage’s time.

Although never built in full physical form, Babbage’s designs inspired his contemporaries. Among his admirers was Ada Lovelace. Born in 1815, she was the daughter of the famous poet Byron. Her mother ensured Ada’s excellent education in various disciplines, including, atypically for the women of that era, math. Ada met Babbage at a royal ball. He told her of his work and showed her the partially complete Difference Engine. Greatly inspired by his ideas and inventions, Ada corresponded with Babbage and later helped him publicize the Analytical Engine in Britain. Having an excellent understanding of the principles and capabilities of this projected machine, she also developed ideas for possible applications of the Analytical Engine beyond mathematical calculations, hypothesizing that it could be used for composing music. This conception was prescient of the potential of the computer that we have seen blossom in the twentieth and twenty-first century. Ada Lovelace also designed algorithms for various calculations that the Analytical Engine was supposed to be capable of performing. Thus today she is credited to be the first computer programmer. The computer language Ada was named after Ada Lovelace.

2.

The terms “analog” and “digital” describe two types of signal that devices, including computers, can receive, process, and output. Analog signals represent data as “continuously variable physical quantities.” For example, continuously variable pitches of sound waves are translated through an analog microphone into continuously variable voltages, which in turn are reproduced as continuously variable sound waves by the speakers of a stereo system. The “louder” the input, the “louder” the output. In other words, the output information is represented analogously with the input information.

Digital devices process input information by translating it into discrete units. I wonder whether this discreteness is suggested by the original meaning of the word “digit” – finger. All starting out from the palm, fingers diverge and become discrete. Similarly continuous physical signals may be presented as discrete bits of information. For example, continuously variable pitches of sound waves are translated into discrete predefined measurable units, such as 0s and 1s. The collection of these units is stored (for example, on a digital laser-read compact disk), and then when needed, it is output by re-translating the units into sound waves or other kinds of signals. Thus, unlike analog systems, digital systems rely on signals that are not analogous with the physical quantities that human senses perceive as information.

3.

The literature describes Babbage’s Difference Engine and Analytical Engine as digital devices. Here is what the website of the Computer History Museum states: “Babbage's calculating engines are decimal digital machines. They are decimal in that they use the familiar ten numbers '0' to '9' and they are digital in the sense that only whole numbers are recognized as valid” (https://www.computerhistory.org/babbage/engines/). These machines’ reliance on integers, rather than real numbers, is what allows characterizing them as digital. The numerous cogs keeping track of these machines’ calculations have pins that in their discreteness are not unlike digits/fingers.

Sources:

- “Digital computers”: https://www.britannica.com/technology/digital-computer
- “Analog computers” : https://www.britannica.com/technology/analog-computer
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