

**Q1:**

Watermarking is a versatile technique employed across various industries to embed hidden information into media. Three real world examples of watermarking are seen in the following fields: audio, sustainability, and commercial printing.

In the realm of audio, watermarking is utilized to embed inaudible data within soundtracks, enabling advanced content recognition and interactive experiences. For instance, Amazon has developed an audio watermarking algorithm to address the "second-screen" phenomenon, where viewers engage with additional content on a secondary device while watching TV. This technology allows Alexa-enabled devices to recognize the audio from a primary source and synchronize supplementary information or interactive features in real-time, enhancing user engagement.

Watermarking plays a pivotal role in advancing sustainability efforts, particularly in plastic recycling. The Digital Watermarks Initiative "HolyGrail 2.0," spearheaded by the Alliance to End Plastic Waste and involving companies like Procter & Gamble, Henkel, and PepsiCo, aims to revolutionize waste sorting processes. By embedding imperceptible watermarks into plastic packaging, this technology enables more accurate identification and sorting of plastics at recycling facilities, thereby improving the quality and quantity of recycled materials.

In the commercial print sector, digital watermarking is employed to transform packaging into interactive platforms. Companies like Wipak have integrated Digimarc's digital watermarks into their printed films, allowing packaging to carry embedded data that can be scanned by smartphones or retail scanners. This innovation not only aids in product identification and

inventory management but also offers consumers access to additional product information, promotions, or recycling instructions, thereby enhancing the overall customer experience.

**Q2:**

In my opinion, Digital Rights Management (DRM) is the most effective way to prevent copyright infringement. DRM employs technologies that control access to digital content, aiming to protect the rights of copyright holders by preventing unauthorized distribution and modification.

Watermarking can be an effective method for copyright protection, but it can easily be removed or altered by someone with the right tools, making it less reliable for long-term security. For instance, in the case of images or videos, a watermark can be cropped or blurred, allowing the content to be shared without the original owner's consent. DRM, however, offers a more robust solution by controlling access and usage through features such as setting expiration dates, limiting the number of views, or restricting editing and sharing. DRM technologies can even lock content to specific devices or locations, making it much harder to bypass.

Platforms like Netflix use DRM technology to protect their content more effectively by restricting users from downloading, sharing, or redistributing movies and TV shows. They enforce strict controls, such as limiting the number of devices that can access an account, setting expiration dates for content availability, and blocking attempts to take screenshots or screen recordings. These measures ensure that even if a user shares their account details, the content remains secure and cannot be freely redistributed or modified.

Kindle also employs DRM to protect e-books from unauthorized distribution. When users purchase an e-book from Amazon, the content is encrypted with DRM, restricting it to

authorized Kindle devices or apps. This ensures that even if someone were to share the e-book file, it cannot be read on a device that doesn't have authorization. The DRM also prevents copying, printing, or sharing of the e-book's content, ensuring that the copyright holder's rights are maintained. This use of DRM ensures that authors and publishers can protect their digital content and preserve the integrity of their work.

However, it's important to note that while DRM is highly effective, it's not without its drawbacks. DRM can sometimes limit legitimate users, restricting their ability to use content in ways they might expect, such as making backups or transferring content between devices. These restrictions can frustrate users who are simply trying to enjoy content they've purchased or rented. Furthermore, managing DRM across different devices and platforms can sometimes add complexity to the content distribution process. Despite these potential inconveniences, DRM remains the most reliable and secure method for protecting digital content, especially when compared to watermarking, which can often be circumvented.

In this way, DRM offers a more secure and reliable method for copyright protection, ensuring that content is safeguarded against unauthorized distribution and modification, while watermarking remains a less effective option.

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