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Digital Signal Processing

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Homework II Grad

**Problem 1)** For each of the following cases of signals in the time-domain, describe the characteristics you expect of its spectrum. Mention if the spectrum is discrete or continuous, periodic or aperiodic, and describe an example where you could encounter such a signal in the real world:

1. A continuous and aperiodic signal:

A **continuous aperiodic** signal is going to have a **continuous aperiodic** spectrum.

**Example:** Signal propagated by AM radio station or FM radio station.

1. A continuous and periodic signal:

A **continuous** **periodic** signal is going to have a **discrete aperiodic** spectrum

**Example:** Voltage signal coming out of a wall socket

1. A discrete and aperiodic signal of infinite duration:

A **discrete aperiodic** signal is going to have a **continuous periodic** spectrum.

**Example:** I believe there’s basically no real life examples of an **infinite** signal that we could measure. There might be theoretical answers however.

1. A discrete and periodic signal of infinite duration:

A **discrete periodic** signal is going to have a **discrete periodic** spectrum.

**Example:** Again, I believe there’s basically no real life examples of an **infinite** signal that we could measure.

1. A discrete and aperiodic signal of finite duration:

A **discrete aperiodic** signal is going to have a **continuous periodic** spectrum.

**Example:** The total distance traveled by the robotic arm is recorded just once in each hour, so this is a discrete-time signal. Over a 24-hour period there will be 24 discrete values recorded. The values of the traveled distance is not going to be necessarily periodic as it might vary every time. Therefore, this is a aperiodic discrete signal.

1. A discrete and periodic signal of finite duration:

A **discrete periodic** signal is going to have a **discrete periodic** spectrum.

**Example:** The repetitive beeping noise that you hear when you’re calling someone on the phone. The beep has the same intensity value and frequency and its repeating on a fixed amount of time. Therefore the “beeps” are periodic and discrete.