

Feedback Loops

For each example, graph the general behavior of the system over time & determine if it's an example of a positive feedback loop, negative feedback loop, or if it is not an example of a feedback loop:

- The price of tickets for sports games is related to the number of people demanding tickets. As the number of people wanting tickets increases, teams increase the price of tickets. This in turn reduces the number of people demanding tickets. In response to falling demand, teams lower their prices – and these lower prices cause more people to become interested in attending games again, so teams raise their prices.

 - Graph the behavior of this system, showing how ticket prices change over time.
 - Determine if this system is exhibiting a positive feedback loop, a negative feedback loop, or no feedback loop. Justify your answer.
- When an invasive species enters a new area, the first few members of the species have tremendous success at obtaining food and reproducing. They produce many offspring, each of which also produces many offspring. As the population grows, so do the number of opportunities for reproduction. As time goes on, the rate of population growth increases. Population increases exponentially.

 - Graph the behavior of the system, showing how population changes over time.
 - Determine if this system is exhibiting a positive feedback loop, a negative feedback loop, or no feedback loop. Justify your answer.
- The number of times a gene is present in a species' collective gene pool changes over time. Consider a population of birds in which roughly 75% have genes to be Large (L) and 25% of the birds have genes to be Small (S). Normally, predators prefer to go after Large birds. However, when the percentage of Large birds declines, the predators switch to hunting Small birds. This allows the number of Large birds to increase again (as Small ones are being hunted). But the increasing percentage of Large birds eventually leads predators to switch back over to hunting Large birds, again decreasing their number... and this cycle repeats...

 - Graph the behavior of this system, showing how the percentage of the population with Small genes changes over time.
 - Determine if this system is exhibiting a positive feedback loop, a negative feedback loop, or no feedback loop. Justify your answer.
- When a nightclub opens, it is empty. As time goes on, more people arrive than leave at any given time for the rest of the night. Eventually, the capacity of the club is reached and people must wait outside in a line. However, this does not affect the behavior of people arriving at the club.

 - Graph the behavior of this system, showing how the number of people at the club changes over time.
 - Determine if this system is exhibiting a positive feedback loop, a negative feedback loop, or no feedback loop. Justify your answer.

5. The speed of drivers on a freeway depends on the speed of the cars around them. When a driver slows down, other drivers behind them slow down even more to be cautious. This produces more slowing behind these drivers, and further slowing all the way back through traffic until cars come to a stop.
 - a. Graph the behavior of this system, showing how driver speed changes over time.
 - b. Determine if this system is exhibiting a positive feedback loop, a negative feedback loop, or no feedback loop. Justify your answer.

6. Many feedbacks are involved in global warming. **For each of the following, determine whether it is a positive feedback loop or a negative feedback loop affecting the temperature of the planet and justify your answer.**
 - a. Ice reflects sunlight energy, and ocean water absorbs sunlight energy. As the average temperature of the planet increases, more ice melts. This increases the amount of solar energy absorbed by the planet, which increases the average surface temperature further.
 - b. Increasing surface temperatures increase the rate of evaporation. As evaporation rises, the skies get cloudier (on average). These clouds reflect solar energy back to space that would otherwise be absorbed, which cools the planet.
 - c. Increasing surface temperatures cause semi-frozen soil called permafrost to thaw. The warmer it gets, the more it thaws. This permafrost often contains Methane molecules locked up within its ice in a form known as Methane Clathrates. As the permafrost thaws, these molecules of Methane escape to the atmosphere, where they act as a powerful greenhouse gas.
 - d. Increasing surface temperatures increase the rate of evaporation. As the rate of evaporation increases, the rate of rainfall increases as well. When it rains, greenhouse gases such as CO_2 are removed from the atmosphere
 - e. The ocean absorbs CO_2 from the atmosphere via diffusion. As concentrations of CO_2 in the atmosphere rise, the rate at which CO_2 diffuses in to the ocean increases, removing CO_2 from the atmosphere at a faster rate.