1/16/2026 Patterns in (environmental) math Class Notes

Today: Some interesting numbers ; the number system:

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1. **Please read all the information on update page and course page.**
2. **Quiz 1 is next Friday 1/23. Details soon on update page. Please study notes on update page.**
3. **QUIZZES ARE 30% OF GRADE. IF YOU PAY ATTENTION, EASY TO GET RIGHT ANSWER.**
4. ssitaraman AT howard.edu is my email address (NOT bison.howard.edu)

Will get back to probability and statistics later.

Today: Numbers…

Number systems in use all over the world: Mayans in central America, Various African civilizations, Middle East, Europe, Asia,…

The decimal system we use today came to Europe through Arabic scholars who got it from India.

Some informative references:

"The Secret Lives of Numbers: A Hidden History of Math's Unsung Trailblazers" by Kitagawa and Revell

"Finding Zero" by Amir Aczel

"Mathematicians of African Diaspora" website maintained by Prof. Scott Williams of University of Buffalo math department.

Millions, Billions, etc.,

1 million: 1,000,000 = 1.0×10^6 in scientific notation.

i.e, one digit before decimal multiplied by a power of 10.

Population of US: 331, 893, 745 = 332 million approximately

(we round up to 332 because 893,745 > 0.5 million).

In scientific notation, we can write it as 3.31893745×10^8.

1 billion = 1000 million = 1×10^9.

$1{,}301{,}247 = 1.301247 \times 10^6$ or approximately 1.3 million.

Area of US : 3,531,905 sq.miles = 3.5 million sq. miles approximately.

Density: about 100 people per square mile.

GDP (Gross Domestic Product): $ 29.8 trillion = 2.98×10^{13}

Number of stars in the milky way galaxy : 100 billion = 10^{11} approximately.

Number of galaxies in the observable universe: Approximately 7×10^{12} = 7 trillion.

Number of stars in the whole universe: $10^{11} \times (7 \times 10^{12})$ = 7×10^{23}.

(From The Oklahoman) Number of grains of sand on earth: estimated to be $75 \times 10^{17} = 7.5 \times 10^{18}$

So there are about $10^{23}/10^{18} = 10^5$ = 100,000 stars per grain of sand on earth.

Computer storage is measured in Kilobytes (1000 bytes), Megabytes (1 million bytes), Gigabytes (1 trillion bytes) etc.,

Energy is measured in Kilowatts, Megawatts, Gigawatts, etc.,

Example: a 50 watt bulb uses 600 watts in 12 hours. In 30 days at 12 hours each it uses 1800 watts or 1.8 kilowatts or 1.8 kW.

1kW = 1000 W, 1 Megawatt = 1MW = 1000 kW,

1 GigaWatt = 1 GW = 1000 MW,

1 TeraWatt = 1000 GW.

As we saw in class, (see link on update page next to link for these notes), the world's electricity demand rose by about 600 Terawatthours or TWh (600 terawatts for an hour).

1 horsepower = 736 Watts approximately. SO one horse can produce about 3/4 of a KiloWatt in power.

Concepts learnt: Big numbers: Million, Billion, trillion, Quadrillion, …

Scientific notation

Multiplying and dividing powers.

Example problem:

1) Bacteria are about the size of a micron = 1 to 5 millionth of a meter = 0.000001 to 0.000005 meters = 0.001 to 0.005 millimeters. In scientific notation 1 micron $= 1.0 \times 10^{-6}$ meters. A human being is about 1.7 meters or 1.7 x 10^0 meters. Compare the two sizes. How much bigger than a bacteria is a human?

To compare size, we divide size of human by size of bacteria to get 1.7 x 10^6

In other words we are about 1.7 million times bigger than a bacteria.