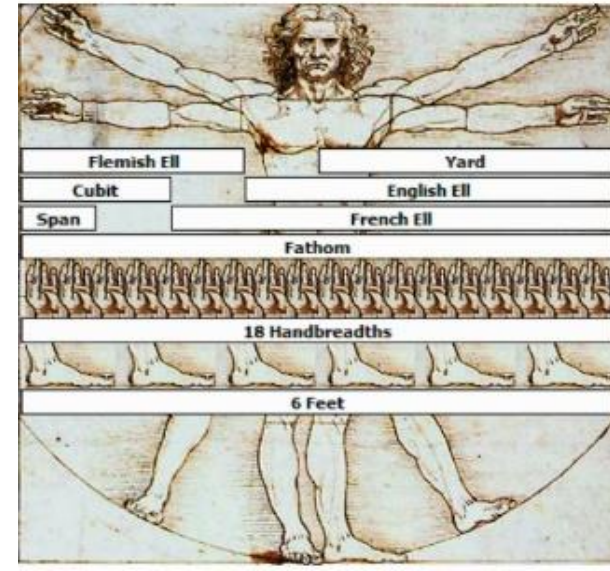


# Some Historical Units of Measurement



# Measurement

- the **assignment of numbers** to objects or events
- a type of **quantitative observation** made with a **measuring instrument**
- includes both a **number** and a **unit**
- **units** of measurement are essentially **arbitrary**: people make them up and then agree to use them

**Measuring is an important part of everyday life!**

**What** can we measure?

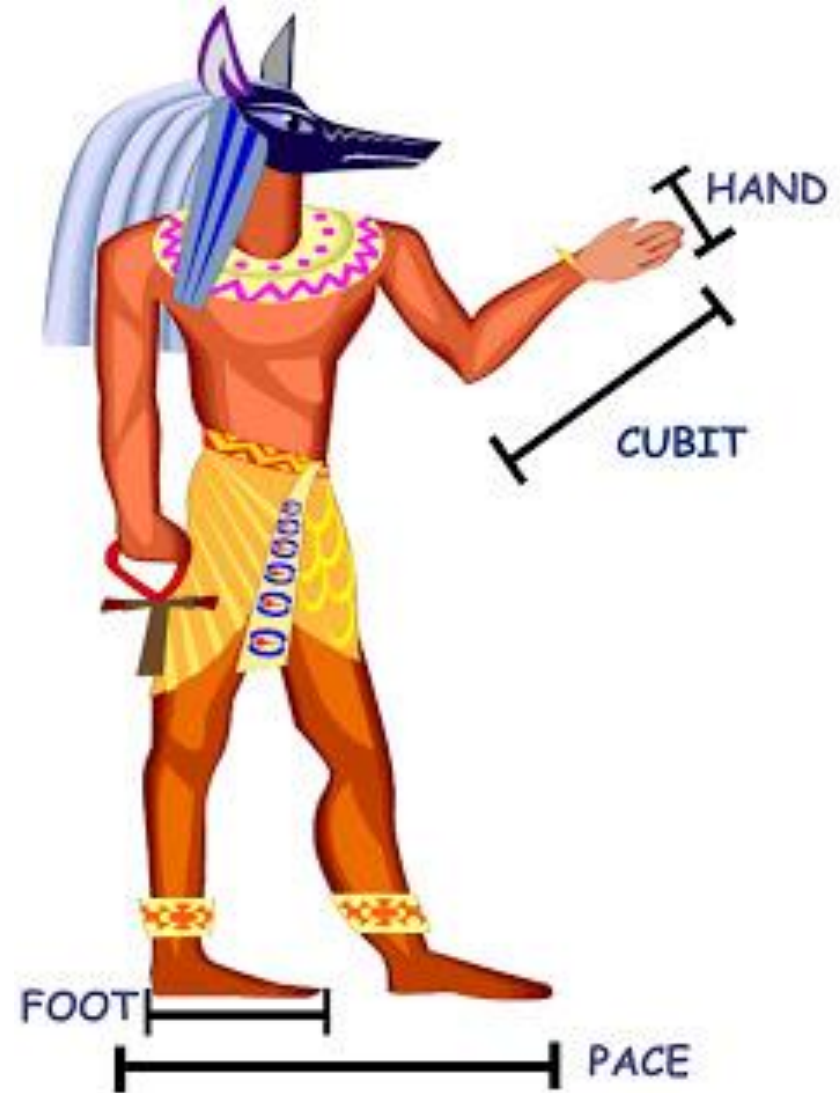
**Why** do we measure?

**How** can we measure?

**How well** can we measure?

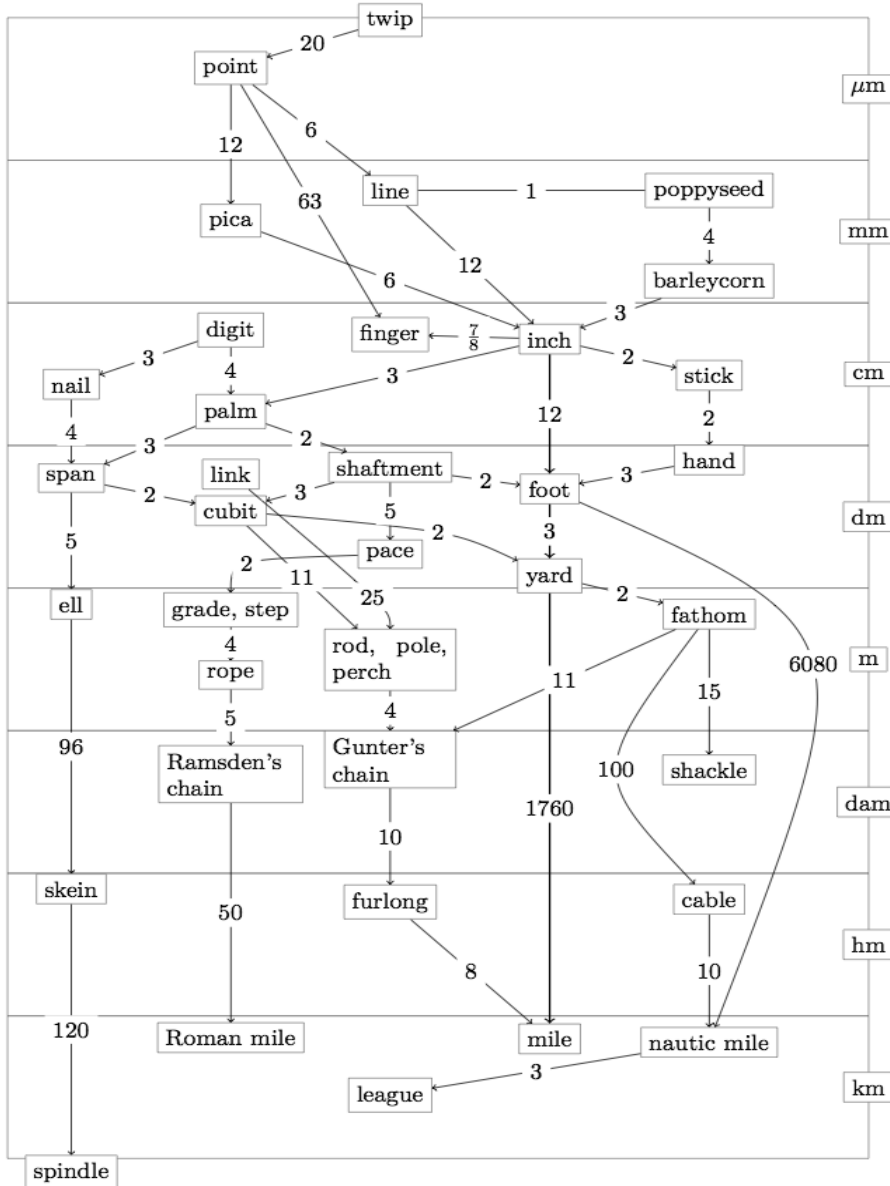
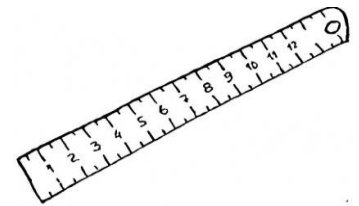
# History of Measurement

- Objects were initially measured for *convenience*, to *aid commerce* and *prevent fraud*.
- The **Egyptians** among other civilizations **were the first to begin recording measurements** around 3200 BC.
- **Early** measurement units were **based on body parts** or **common objects**.



# Historical Units of Length

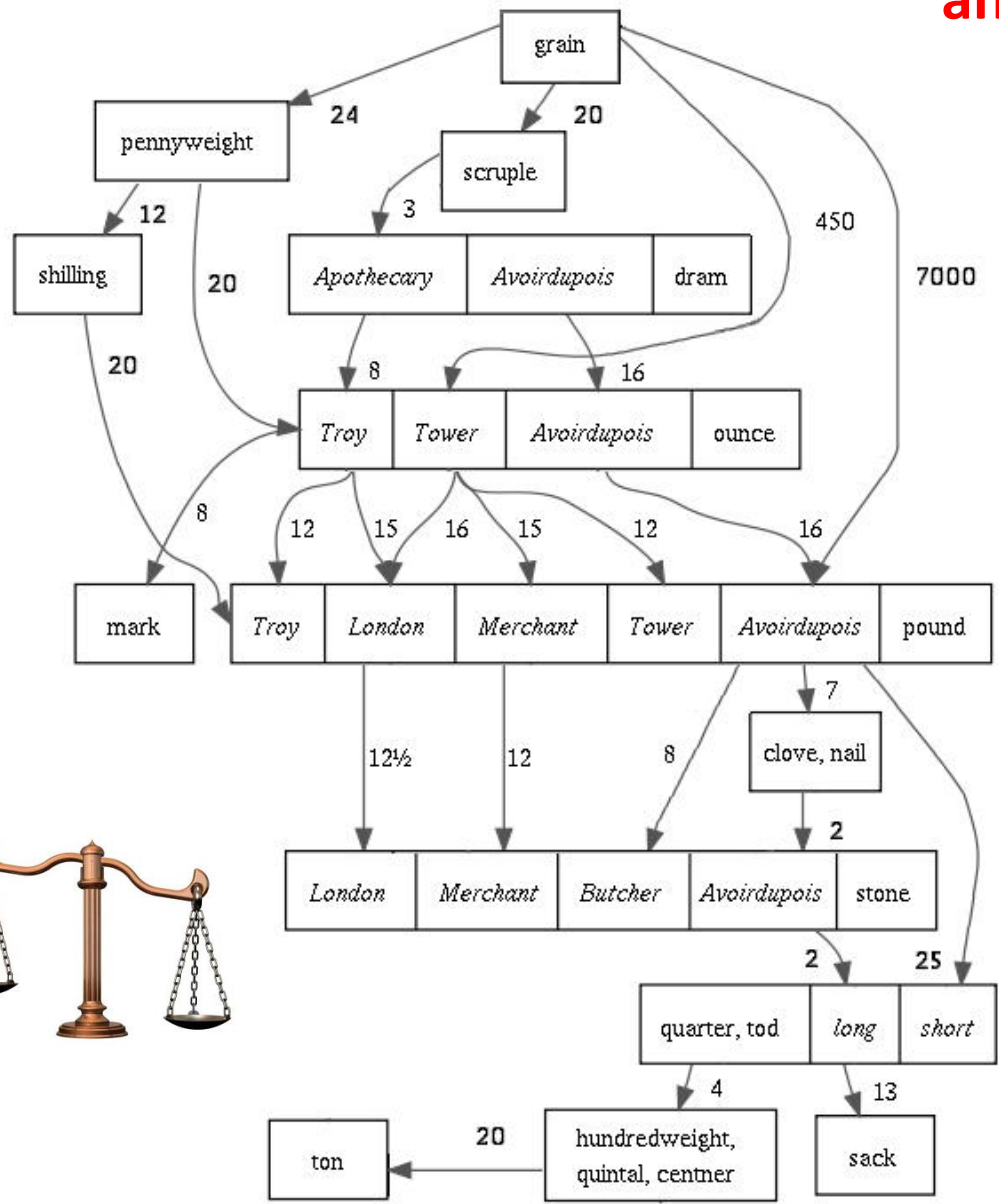
## and their equivalence chart



- **Digit**: the breadth of a finger (Egyptian)
- **Barleycorn**: the length of a barleycorn seed
- **Inch**: the width of a man's thumb or 3 barleycorns
- **Foot**: the length of a man's foot
- **Cubit**: elbow to fingertip length (Egyptian)
- **Yard**: nose to fingertip length
- **Mile**: 5000 pedes (feet, Roman)
- **League**: 7500 pedes

# Historical Units of Mass/Volume

and their equivalence chart



- **Grain:** the weight of a grain of wheat or barleycorn
- **Pound (*libra*):** ~5000 grains (Roman) or ~7000 grains (English)
- **Talent:** 100 libra
- **Stone:** 14 pounds (English/British)
- **Troy Ounce:** 1/12 of a pound
- **Carat:** weight of a carob seed

# The Cubit



The cubit is the measure from your elbow to the tip of your middle finger when your arm is extended.

The cubit was the measurement used by the Egyptians to build the pyramids.



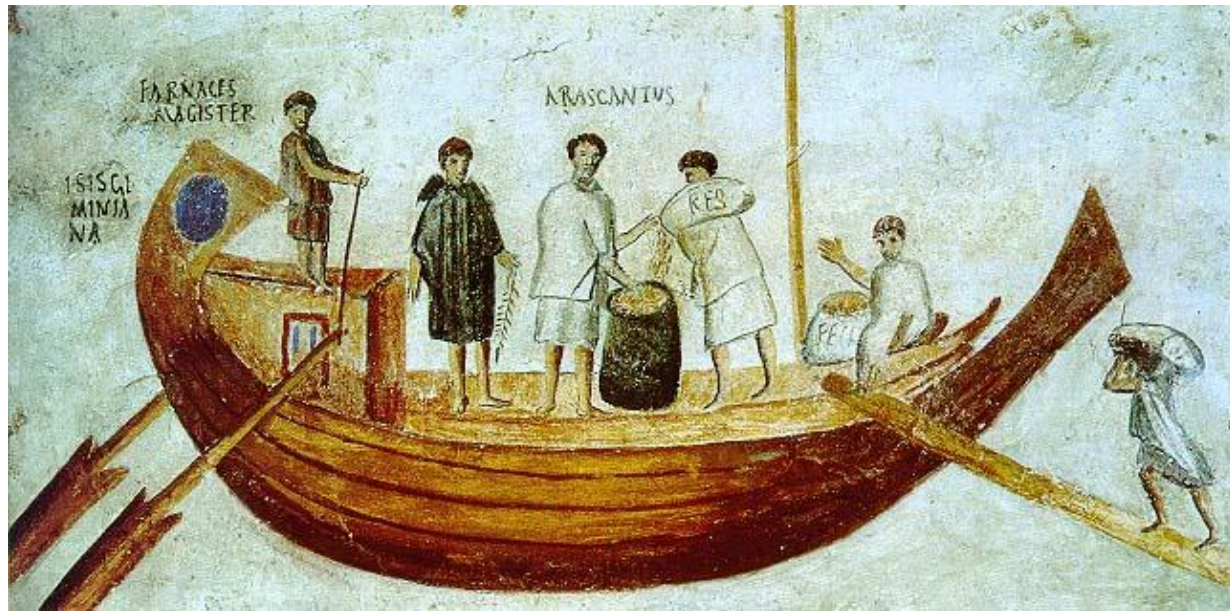
# The Palm

The palm is the *width* of your four fingers when they are placed together.

# The Fathom



The fathom is the measure from fingertip to fingertip when your arms are stretched sideways as far as they will go.



The fathom was used by sailors to measure the depth of water so that boats would not run aground.

# The Hand-span

The hand-span is the measure from the tip of your pinky to the tip of your thumb when your hand is stretched out.



Hand-span was used to measure the height of horses.

People **still describe horses** as being so many hands high.



# The Pace

The pace is the measure of distance from one step to another. This unit was used by the Roman army to judge speed.

The **term** is **still used** frequently during various types of **foot races**.



# The Foot

A measurement equal to the length of an individual's foot.



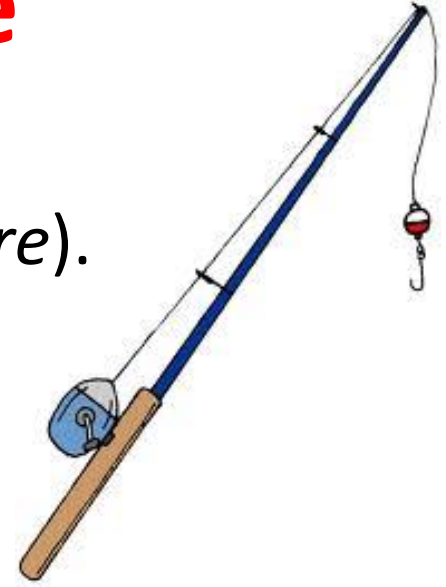
**Feet are different...**

In the 12th century, King **Henry I** of England defined a standard for this measurement:

his foot was **12 inches long**.

# The Girth or Girdle

The girth/girdle was the measurement around one's stomach (your *belt measure*).



Girth was used to measure fishing line.

The **term** (not unit) is **still used by US Post Office** and refers to package dimensions.



# The Yard

The origin of the measure is uncertain.

The word *yard* comes from the Old English *gyrd*, meaning a rod or measure.



In the 12th century, King **Henry I** of England fixed the yard as the **distance from his nose to the thumb of his out-stretched arm.**

Today it is 36 inches.



# The Acre

The acre (“field” in Saxon) was a **unit of area** equal to the size of a field that a farmer could plow in a single day.



French word for acre means “day” and the German word means “morning” or “day’s work”.

# The Grain

At least since antiquity, grains of wheat or barley were used by Mediterranean traders to define **units of mass**.



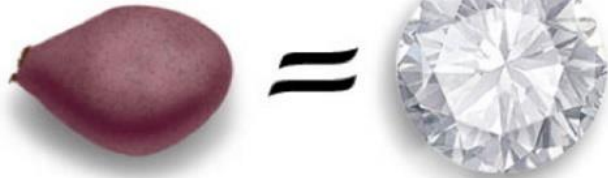
Presently, the grain is commonly used to measure the **mass of bullets** and propellants as well as to **weigh arrows** in archery.

## The Stone

The 1772 edition of the Encyclopædia Britannica defines:  
*“A stone of beef, in London, is the quantity of eight pounds; in Hertfordshire, twelve pounds; in Scotland sixteen pounds”*

# The Carat

unit of  
mass



1 Carob Seed = 1 Carat

**Carob bean seeds** have been used throughout history to measure jewelry, because it was believed that there was little variance in their mass distribution (which is not true).

45.52 carat **Hope Diamond**, worth a quarter of a billion dollars, is on display at the Smithsonian Institution National Museum of Natural History in Washington, D.C.



1,109-carat **Lesedi La Rona** diamond, largest discovered in 100 years.

# Problems with Early Measurement Units

1. People have different sized body parts, as well as there is a variety among common objects like grains...



Grain, India



Barleycorn



Wheat

2. ...so measurements are not accurate, especially when dealing with fractions and multiples...

**SOLUTION: Standard Measurement Systems!**



# English Units Based Systems

- **Imperial System of Measurement (British Empire, 1824):**
  - Distance/Length: Inch, foot, yard, mile
  - Volume: fluid ounce, pint, quart, gallon
  - Area: Acre
  - Weight/Mass (three different systems!): grain, ounce, pound, stone, ton



- **US Customary System of Measurement:**
  - Mostly *same unit names*
  - **Units are not identical!**  
(1 US gal=0.83 imp gal)
  - Different units for liquid and dry measures (liquid/dry ounce)

