INTRODUCTION TO PYTHON ALGORITHMS USING PYTHON

CHARIS CODING CLUB

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COURSE OUTLINE

- LESSON1: INTRODUCTION TO ALGORITHMS, REFRESHER, GIT
- LESSON2: TACKLING ALGORITHMIC PROBLEMS
- LESSON3: CHALLENGES 1 AND 2
- LESSON4: NEW PYTHON METHODS FOR SCRIPTING
- LESSON5: CHALLENGE 3 AND 4
- LESSON6: FUNCTIONS AND CLASSES
- LESSON7: CHALLENGE 5 AND 6
- LESSON8: SIMPLE GAME
- LESSON9: PROJECT PART 1
- LESSON10: PROJECT PART 2

LESSON 2:
TACKLING ALGORITHMIC PROBLEMS

OBJECTIVES:

LEARN HOW TO APPROACH ALGORITHM PROBLEMS

UNDERSTAND HO TO DECIDE THE REQUIREMENTS

WRITE SOLUTIONS TO THE PROBLEMS

FROM THE LAST CLASS

- FROM THE LAST CLASS, WE LEARNED THAT IN ORDER TO TACKLE PROBLEMS, THE FOLLOWING, WE MUST:

  - UNDERSTAND THE REQUIREMENTS
  - FLESH OUT A SOLUTION
  - WRITE OUT A PROBLEM
  - IMPROVE YOUR SOLUTION.

SOLVING AN ALGORITHM PROBLEM

PRACTICAL CLASSWORK

- NOW, LET'S LOOK AT A PRACTICAL EXAMPLE OF HOW TO SOLVE AN ALGORITHM PROBLEM.

AFTER WALKING YOU THROUGH THE PROBLEM AND REQUIREMENTS, YOU WILL COME UP WITH A SOLUTION by YOURSELF.

Rest assured, since you already have all the tools you need to tackle the problem from beginners' class.

READY? LET'S GO!

BEFORE WE BEGIN

- WHAT IS AREA OF A SURFACE?
- WHAT IS THE VOLUME OF AN OBJECT?
- WHAT IS THE DENSITY OF AN OBJECT?

CAN YOU ANSWER THESE QUESTIONS…?

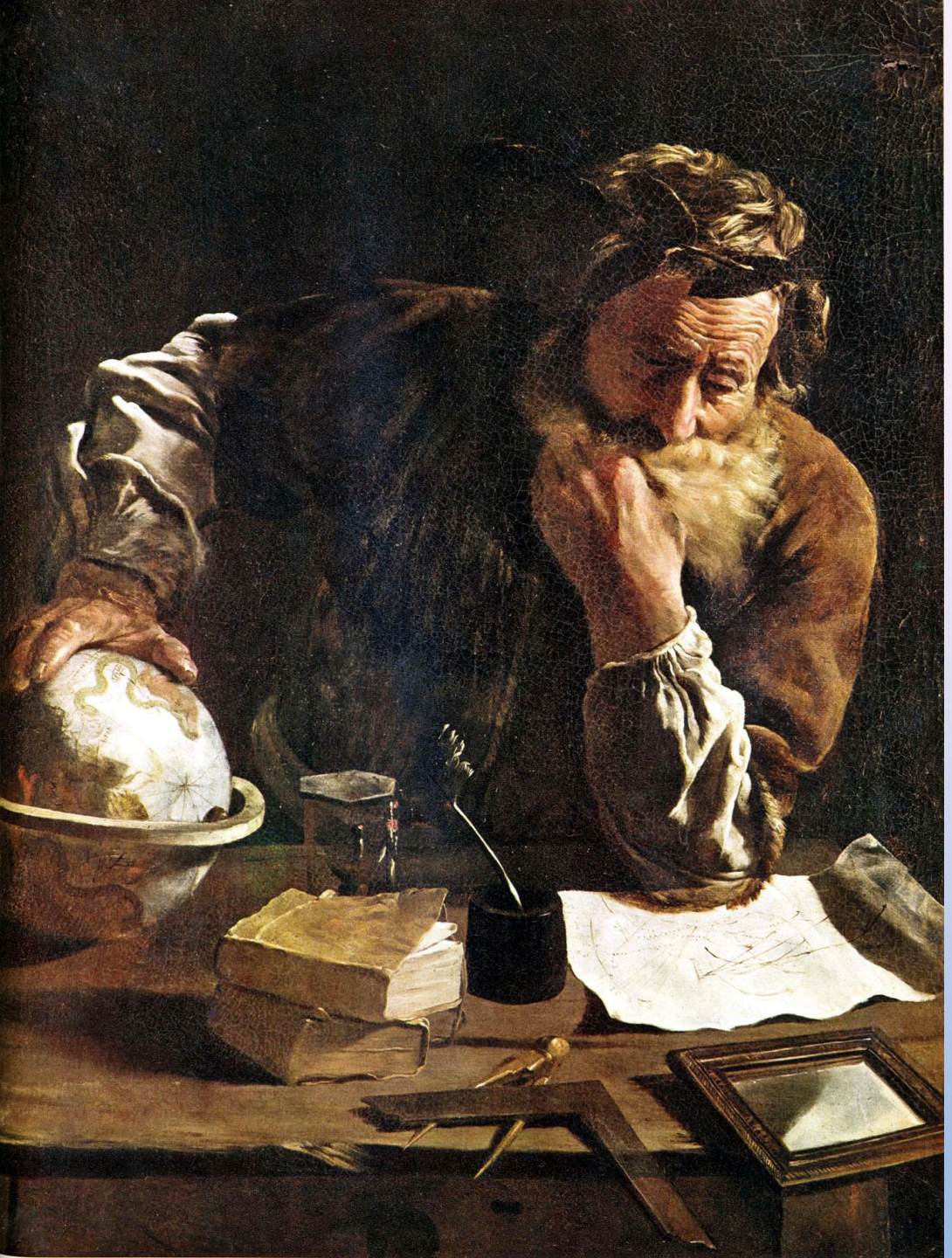
We will need them for this challenge.

SIDE STORY

HOW ARCHIMEDES LEARNED TO FIND DENSITY OF AND IRREGULAR OBJECT

Once upon a time, in ancient Greece…

There was a man called ARCHIMEDES



EUREKA! I HAVE FOUND IT!

WHAT ARCHIMEDES FIND OUT…?

Archimedes is one of the most famous physicist, mathematician, astronomer and inventor of the classical age: He lived in Syracuse on the island of Sicily in the third century B.C. Many of his inventions and theories are still being used today.

This Python challenge will be based on Archimedes' most famous "Eureka!" moment:

Courtesy 101computing

THE GOLDEN CROWN

At the time, Hiero, The King of Syracuse (Sicily, Italy), had given his goldsmith some pure gold and asked him to make a crown out of this gold. On reception of the crown, Hiero suspected he had been cheated by the goldsmith. He believe the goldsmith had replaced some of the pure gold with the same weight of silver. However Hiero needed to be able to prove that his suspicion was correct and that the crown was not made of pure gold.

DENSITY = MASS/VOLUME

Knowing the weight/mass of the crown was not enough to confirm whether the crown was made of pure gold (as opposed to a mix of gold and silver). However if Archimedes knew that if he could accurately measure the volume of the crown, he could work out its density. (Density = mass / volume). He could then compare this density with the density of pure gold to see if they are the same. If not, this would be the proof that the crown is not just made of pure gold which would confirm Hiero's suspicion. The issue was that, though it was easy at the time to precisely measure the mass of an object, there was no method for working out the exact volume of an irregular object (such as a crown!).

EUREKA! I HAVE IT!

It's while stepping into a bath that Archimedes noticed that the water level rose: he immediately deducted that the volume of water displaced must be equal to the volume of the part of his body he had submerged. He then realised that the volume of irregular objects could be measured with precision using this submersion approach. He is said to have been so eager to share his discovery that he leapt out of his bathtub and ran naked through the streets of Syracuse shouting Eureka! Eureka! (Greek for "I have it!").

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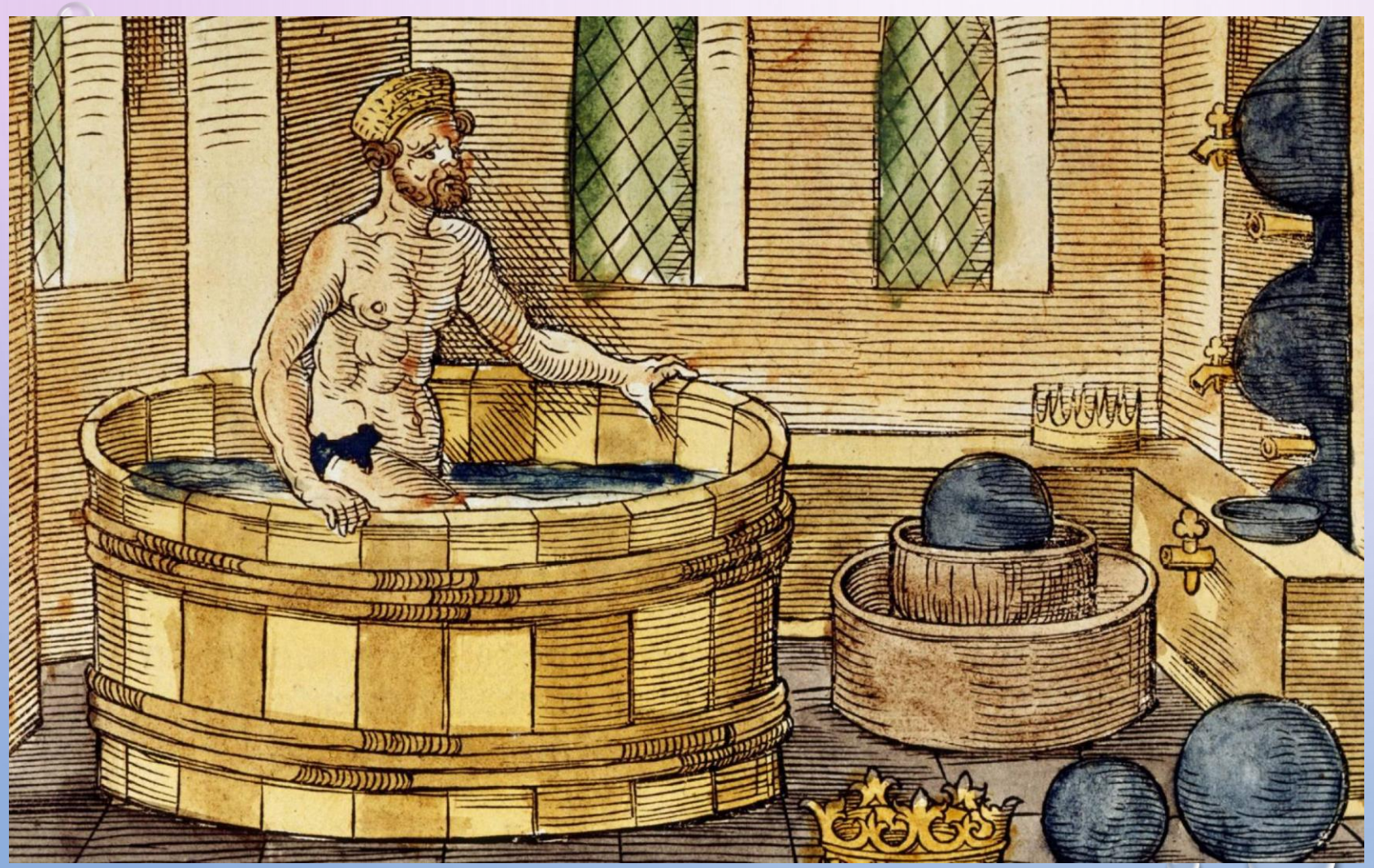
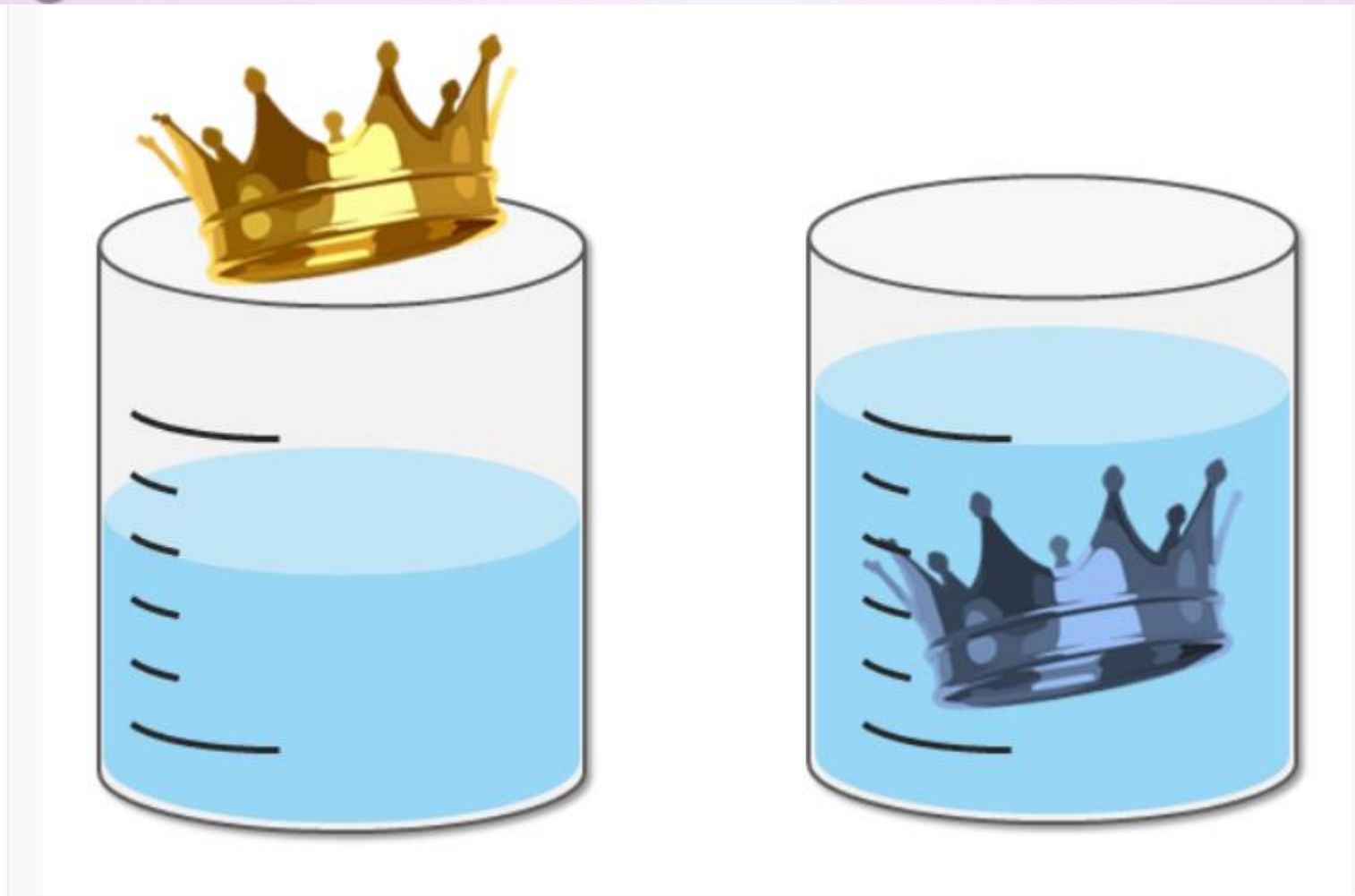
ARCHIMEDES' DISCOVERY



An irregular object when immersed in water displaces a volume of water equal to its own.

GOLD VERIFICATION PROBLEM SOLVED!

By applying this approach to the golden crown, Archimedes was able to get an accurate measure of the volume of the crown and could hence calculate the density of the crown which effectively turned out to be of a lesser density than pure gold. This confirmed Hiero's suspicion that his goldsmith had stolen some of the pure gold he was given to make this crown!



The volume of an object is equal to the volume of the water displaced when this object is submerged.

PYTHON ALGORITHM CHALLENGE

In this Python challenge we will use a program to help identify the density of an object and compare with the known density of different metals such as gold, silver, bronze, etc.

Our algorithm will:

1.Ask the user to enter the mass of an object. (in Kg)

2.Ask the user to enter the volume of an object. (in m^3)

3.Calculate and output the density of this object (mass/volume)

4.Compare this density with the densities of different metals such as pure gold, silver and bronze and output the corresponding metal if there is a match.

Our algorithm will use the following data:

Metal	Density
Aluminium	Between 2400 kg/m^3 and 2700 kg/m^3
Bronze	Between 8100 kg/m^3 and 8300 kg/m^3
Silver	Between 10400 kg/m^3 and 10600 kg/m^3
Lead	Between 11200 kg/m^3 and 11400 kg/m^3
Gold	Between 17100 kg/m^3 and 17500 kg/m^3
Platinum	Between 21000 kg/m^3 and 21500 kg/m^3

YOUR CHALLENGE:

Complete the code below and use your code to work out what the following four crowns are made of:

Test #	Object	Input Values	Output
#1		Mass:0.567kg Volume: 54cm^3 = 0.000054m^3	
#2		Mass:1.213kg Volume: 70cm^3 = 0.00007m^3	
#3		Mass:0.731kg Volume: 65cm^3 = 0.000065m^3	
#4		Mass:0.585kg Volume: 71cm^3 = 0.000071m^3	

PRACTICE TIME:

- To be done in VS Code

COMPLETE THE CODE HERE TO CALCULATE THE DENSITY AND COMPARE IT WITH THE DENSITY OF A RANGE OF DIFFERENT METALS

```
#Eureka! - Archimedes and King Hiero's Crown
mass = float(input("Input the mass of the crown in kg"))
volume = float(input("Input the volume of the crown in cubic meter"))
```

SOLUTIONS

Let’s take a look at our solutions…

QUESTION AND ANSWER TIME!

- ANY QUESTION?

WELL DONE GUYS!

SEE YOU NEXT CLASS ☺