AlgoHack #2

HOW TO SOLVE PROBLEMS WITH COMPUTER PROGRAMING

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AlgoHack aims to teach Computer Science and Programing to young people, initiated by Shilpa Sayura Foundation, supported by GOOGLE RISE and Computer Society of Sri Lanka.

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What is a problem?

A problem is a challenge to find an **answer**. There are many ways to **find** an answer to a problem. Our challenge is to find the best way to get the answer.
It is like Batman finding the real criminal.

Describe problems and in everyday life.

1. Buying weekly groceries.

2. Calculating electricity used at home.

3. Charging for bus fares through season ticket.

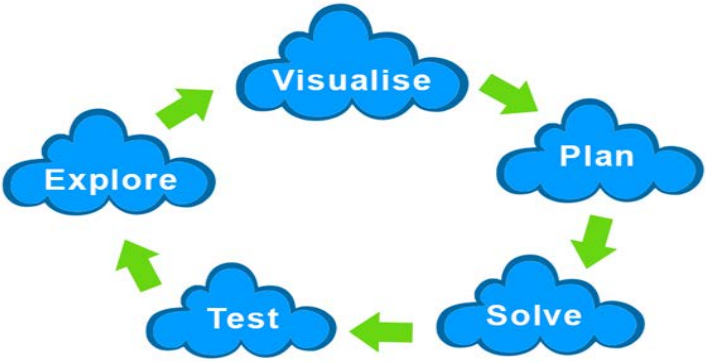
4. Marking student attendance.

Master crow bought 4 milk toffees.The first one was Rs 12, and the rest for Rs 10 each. How much did he spend?

Master crow exercise every odd day of the month. How many days in february he exercises?

So, How do we solve a problem?
Planning is a key part of solving problems.
We have to make a **problem solving plan**.

5 Steps Problem Solving Plan

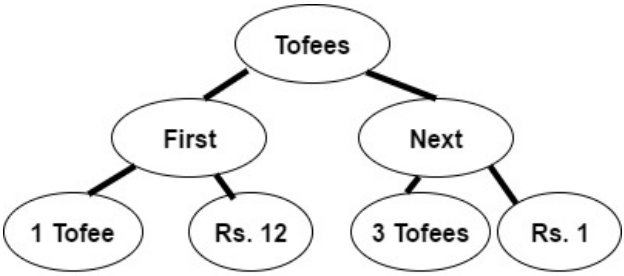


1. Explore - We are learning about the problem.
2. **Visualise** - We document and draw what we learn.
3. Plan - We find the path to solve the problem.
4. **Solve** - We handle the problem with our plan.
5. **Test** - We burden the solution using other data.

1. Explore

Master Crow **bought 4** milk toffees.
The **first one** cost **12** Rupees.
Next 3, each cost **10** Rupees.
How much did he spend?
Here We have 4 pieces of data. **4, 12, 3 , 10.**
The **question** is our **goal** to reach.

2. Visualise
Document what you learned. Note down data and their relationships given in the problem.



3. Design a plan

The question is about a total. So, it is an adding question. We can create a **Word Model** for this problem.
A word model is writing out our problem in less words.
Total Cost = 1st toffee Cost + Cost of additional toffees.

4. Solve
Total Cost = 1st toffee Cost + Cost of additional toffees
Total Cost = Rs. 10 + Rs. 3 x 8
Total Cost = Rs. 10 + Rs. 24
Total Cost = Rs 34

5. Test Your Answer with a computer program

We need a programming language to write a program.

Python is a simple programming language for beginners. You can use **python IDLE** to write programs. To start programming, download and install ***python*** from python.org.

Start **Python IDLE** to write a program to solve above problem with your problem solving plan.

Using python as a calculator.
total = 1+2
This is a **statement.**
A **statement** is a line of code. It gives an instruction for the program to do something

Look at **total=1 + 2** again

The **+** is called an **operator.**
1 and 2 are called **operands.**

Python has many operators to use with numbers.
adding (+), subtraction (-), multiplication (*) , division (/).
Type 1+2 and press enter in python IDLE

Python can work like a calculator.

Think you are given **two numbers 2 and 4**
What operator makes them become 6 ?
What operator can you use to get 2 ?
What operator can you use to get 8 ?
Is there another way to get 2?

That is how you use **operators** in calculations.

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Now we will learn how to program

We know a program takes some inputs, process them and gives an output. The process do some operation to the inputs to give outputs. When you input 1 and 2 to an adding machine the output will be 3.
Adding is the process here.

In python we can obtain inputs from the keyboard using **input ()** statement. After processing, the output is given from **print()** statement

What is a Variable ?

We use a variable to store different kinds of data,
Your Name, Age, Grade are variables in python.
Type following commands in Python. Enter your name after first command.

```
name = input()
print(name)
```

In first instruction we ask python to get an **input** and **store** it in variable **name.**

The second instruction **prints** the **value** of **name** variable stored in memory.

The parking space in front of Crow Shop is enough for one car. Sometimes it's empty. Different cars come and go. The Crows don't use cars. But the tortoises come in cars. So how many tortoises can shop at Crow Shop at a time?

A variable has an own name.
You can change the value of a variable.
A variable stays in the memory and
lost when program exists.

How to Name a Variable?
Start with a letter. age, city use letters and digits only :
Describe what is in the variable : *phone, crow3, ball6.*

Let's write a program to print full name of Miss Crow.
Click on File > New File , write program and save as fullname.py, run with F5 and enter first and last name.

```
firstname= input()
lastname= input()
fullname = firstname + lastname
print (fullname)
```

You can beautify the output by changing 4th line to add a space between two variables.

```
fullname = firstname +  " " + lastname
```

PSEUDO CODES

We use pseudo language to describe program instructions. It is like English and independent of programing language. It is a word model as we learned. This word model explains the process in statements.

INPUT OF NUMBERS

A=INPUT NUMBER
B=INPUT NUMBER

The input numbers now stored in A, B variables.
If we want to obtain sum of A and B, we can write
C = A+B
C is a another variable created using A and B.
C is now a variable in the memory like A and B.
If we want to subtract B from A
We can write D=A-B

How would you write multiplication of A and B?

Writing a **program to add any two numbers?**

A=INPUT NUMBER
B= INPUT NUMBER
C= A+B
PRINT C

This is a program to count number of students.

```
girls= input()
boys= input()
count = girls + boys
```

```
print (count)
```

When you run the program, you will get an error in count. Program does not add correctly. These kind of error is called **semantic error**. The program works but resut is wrong. We have to correct the program.

Python takes all inputs as text,
When we add, python think they are text, so joins two variables. Like 2+3=23. But it should add like 2+3=5.
To correct this problem we have to convert numbers entered as text to numbers before calculations..
Python has **int ()** function for text to number conversion..

```
girls= int(input())
boys= int(input())
count = girls + boys
print (count)
```
Do you get the addition right now?

Miss crow buys 5 buns at Rs. 10, how much she pay?
```
Buns = 5
Price = 8
Cost=Buns * Price
print (cost)
```

What if Mrs Crow buy 10 big mangos at Rs. 10 and 5 small mangos at Rupees 5? Create a word model to solve this problem.

```
BigMango=10
BigMangoPrice=10
SmallMango=5
SmallMangoPrice=5
BigMangoTotal=BigMango * BigMangoPrice
SmallMangoTotal=SmallMango * SmallMangoPrice
TotalCost=BigMangoTotal + SmallMangoTotal
Print  TotalCost
```

This is your pseudo code.
Write a program to calculate the Total cost for different inputs of number of mangos.

Syntax Errors
This happens when your code contain language errors. You have to write programs in correct **syntax.**
in python **Print (A)** is wrong. It should be **print(A)**.
Wrong Capitalization and Spelling give syntax errors.

Back to the toffee problem!
Mr. Crow bought 4 milk toffees.The first one was Rs 12, and the rest for Rs. 10. How much did he spend?
Write a python program to solve this problem.

Now modify your program to solve following problems.

Easy
What if he bought only one tofee?
What if he bought 5 toffees.

What if the 1st toffee is 10 and the each extra is 8.

Difficult
What if the 1st toffee cost any amount and each additional toffee is %10 less than 1st price?

Very difficult
What is the total cost, If 100 toffees were bought at 10 with a 1% discount for each toffee bought ?

Learning to solve these math problems will help you become a good computer programmer.

Write programs for following problems.
Follow your problem solving steps.

1) Once upon a time, there were three little crows - ages 2, 4, and 6. What is the total of their ages?

2) Each little Crow wanted to build a house. Crow #1 wanted to build a house of straw. Straw costs Rs.4 a bundle. He needs 9 bundles. How much will he spend?
1) Once upon a time, there were three little crows. They were Lady Crow, Lord Crow, and Sister Crow. Lady Crow was 5 years old. Lord Crow was 4 years old and Sister Crow was 3 years old. What was their total age?

2) One day, each little crow wanted to build a nest. Lady Crow wanted to build a nest of straw. Straw costs Rs.4 a bundle. She needs 9 bundles. How much she will spend?

3) Lord crow wanted to build a nest of twigs. Each bundle of twigs weighs 50 grams. Lord crow needs 12 bundles. How much will they weigh?

4) Sister Crow wanted to build a nest of loons. Each side of her 4-sided nest needs 50 loons. How many loons will she need?

5) Lady Crow worked creating her nest 3 hours a day for 10 days. How long did she work?

6) Lord Crow built his nest in 32 hours. He worked for 4 days. How many hours did he work each day?

7) Sister Crow worked for 60 hours. How much longer did she work than Lady Crow?

8) Lord Crow wanted an extension phone. He needs 8 meters of phone wire. How many centimeters is this? One meter is 100 centimeters.

9) What if 1 meter equals to 50 cm and to 120 cm. Design a program to input and output.

10) After all the work was done, they decided to play. They played leap hog. Lady Crow jumped 5 feet, Lord

Crow jumped 7 feet, and Sister Crow jumped 6 feet. How far did they jump together?

11) After playing, they were tired. Then Sister Crow went to bed at 8.30 p.m. The other two crows went to bed at 10.00 p.m. How much earlier did Sister Crow go to bed?

12) Lord Crow woken up at 6.00 a.m. How many hours did he sleep?

13) Sister Crow woken up and baked 4 cookies for each crow. How many cookies did Sister Crow bake?

14) Lord Crow ate 5 cookies. Sister crow ate 4 cookies. How many cookies would be there for Lady Crow.

15) Lord Crow found 36 cashew nuts. He divided them into 3 for each crows. How many cashew nuts can Sister Crow have?

16)Sister Crow walked to meet her mother. She walked 2 hours. If she walked 5 kilometers per hour, how far did she walk?

17) Sister Crow gave Mother Crow 5 cashew nuts. How many cashew nuts does Sister crow have now?

18) An eagle had followed the Sister crow. Eagle tried hurt Sister Crow and Mother Crow. Suddenly Lord crow came there and throw 16 pebbles to eagle. Lady crow

also came and throw 8 pebbles. Each pebble was 20 grams weight. How much weight are all pebbles?

19) Eagle was feared and fly out. All were very happy. Mother gave 4 liters of apple juice to drink. How many milliliters were there?

20) What if 1 liter equals to 500 milliliters and to 256 milliliters. Design a program to input and output in milliliters.

Now you know how to:

- Plan steps to solve a problem.
- Write pseudocode to find the solution.
- Write a program to solve a problem.
- How install and use python.
- Create and name variables.
- Get text and number inputs for variables.
- Do operations on variables.
- Output results

Show what you know
Write a program to calculate the area and circumference of a square.When inputs are given.

Questions to ask yourself
What is an area?
What is circumference?
How do we get the area?
How do we get the circumference?
What inputs do we need ?
How do we store the inputs ?
How do we calculate ?
How do we output results?

Write your pseudo code before writing the program
What if 1/4th of the square area is taken out?
What will happen to the circumference?

Tip : Draw and see
Can you calculate the circumference of a circle with radius R using a program.
You get an A+

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