Barakat Ajadi

Finance

Question 1:

Introduction:

In order to measure the abundance and price of commodities different models were developed and one of it is the stock to flow model.

To understand what stock to flow model is, i need to define some terms:

Stock; Stock can be defined as the supply of an asset (e.g bitcoin) which refers to the number that has been mined. In this case, Stock is the number of bitcoin that has been mined.

Flow; this is the number of asset (e.g gold, bitcoin etc) that flows in every year (standard measurement)

What is the bitcoin Stock-to-flow model?

The Stock-to-flow model predicts the long-term trend of Bitcoin's value based on its scarcity. In this model, the stock-to-flow of gold and silver is taken as its benchmark. These commodities are referred to as "Store-of-Value" because they retain their value over long time frames due to their relative scarcity. It is difficult to significantly increase their supply i.e. the process of searching for gold and then mining it is expensive and takes time therefore causes increase in scarcity.

How is stock-flow calculated?

Stock to flow model divides the stock i.e the number of bitcoin that has been mined by the flow i.e the number of bitcoin that flows in every year.

The current S2F of bitcoin is twenty-five (25) while that of gold is sixty-two (62).

What does this S2F value mean?

The stock-to-flow value means it is the number of years it will take to restock all the assets available today. For bitcoin it will take 25 years to mine back the current bitcoins we have available right now as for gold it will take 62 years.

If the flow of bitcoin reduces, the stock will increase thereby increasing the scarcity and the S2F ratio.

Why is stock-to-flow model a bad model?

The Stock-to-flow is a bad model in my opinion because the theoretical basis for the model is based on the very strong assumption that

The USD market capitalization of a monetary asset (e.g. gold and silver) is directly derived from its new supply rate where there is no evidence or studies to support this theory. It does not seem like a model based on strong data and this model is more of assumption on other assets (gold and silver) and the same logic may not be applicable to bitcoin. Is scarcity really the cause of gold's value and can that same assumption be applied to bitcoin? I doubt. These are different assets and people keep them for different reasons and it all depends if people are interested in storing this particular asset. If i have just two (2) of my beautiful handmade mats and no one willing to buy it and i will only produce two (2) every forty (40) years this mat is scarce but no one buying it will not add any value of make the monetary value increase over the years.

N/B:

S2F = Stock-to-flow model.

USD = United state Dollar.

Question 2:

BARAKAT ABIOLA AJADI
FINANCE

To calculate Black-Scholes call price:
formular:

$$C = S_0 N(d_1) - Ke^{-rt} N(d_2)$$

where:
S_0 = Stock price
N = Cumulative standard normal distribution
K = Strike price
r = risk-free interest rate
e = exponential term
t = time until option expiration.

$S_0 = \$40$
$K = \$45$
$r = 3\%$ in decimal $r = 0.03$
$t = 4$ month in year $t = 4/12$
$d_1 = ?$
$d_2 = ?$

To find d_1: $d_1 = \dfrac{\ln(S/K) + (r + 0.5\sigma^2)t}{\sigma\sqrt{t}}$

where:
ln = natural logarithm
σ = standard deviation

$$\therefore d_1 = \frac{\ln(40/45) + (0.03 + 0.5(0.40)^2)\,4/12}{0.40\sqrt{4/12}}$$

$$d_1 = \frac{-0.1178 + (0.03 + 0.5(0.16))\,4/12}{0.40(0.3333)}$$

$$d_1 = \frac{-0.1178 + (0.03 + 0.08)\,4/12}{0.23096}$$

$$= \frac{-0.1178 + 0.03667}{0.23096}$$

$$= \frac{-0.08113}{0.23096}$$

$$d_1 = -0.3512$$

Contd

$d_2 = d_1 - \sigma\sqrt{t}$

$d_2 = -0.3512 - 0.40(\sqrt{4/12})$

$d_2 = -0.3512 - 0.40(0.5774)$

$d_2 = -0.3512 - 0.23096$

$d_2 = -0.5823$

Hence:

$d_1 = -0.3512$

$d_2 = -0.5823$

$N(d_1) = N(-0.35)$

$= 0.3632$

$N(d_2) = N(-0.58)$

$= 0.2810$

$C = S_0 N(d_1) - Ke^{-rt} N(d_2)$

$C = 40(0.3632) - 45(e^{-0.03 \times 4/12})(0.2810)$

$C = 40(0.3632) - 45(e^{-0.01})(0.2810)$

$C = 40(0.3632) - 45(0.99005)(0.2810)$

$C = 40(0.3632) - 12.519$

$C = 14.528 - 12.519$

$C = \$2.009$

$\therefore$ Black-Sholes call price = $\$2$

Computer Science:

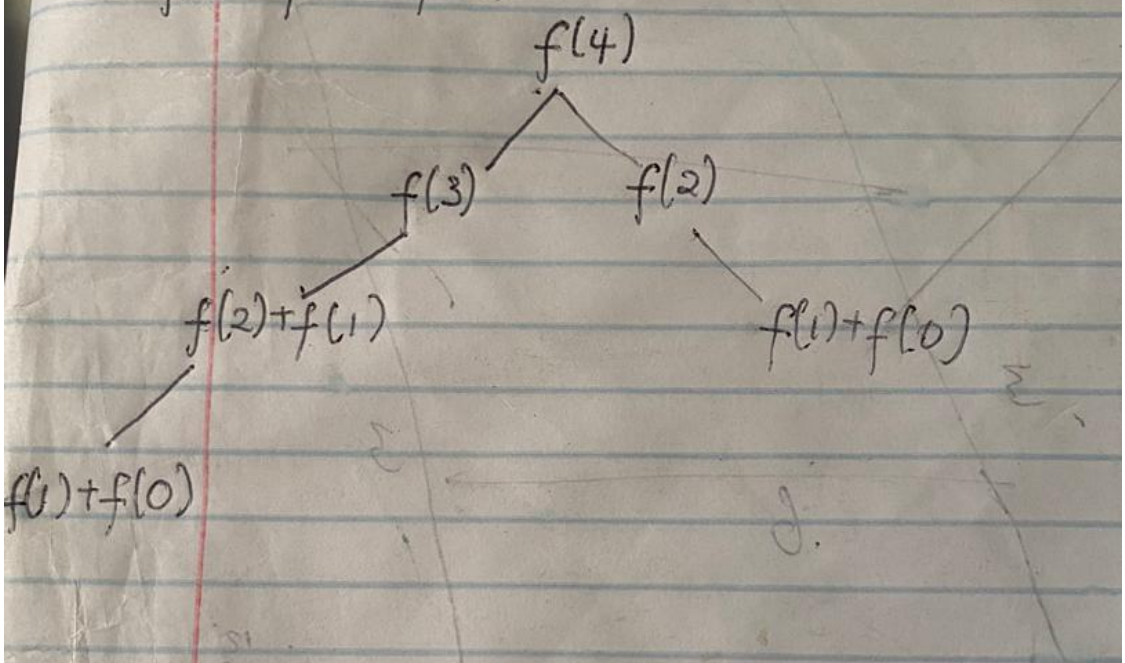
Question 1: It's a bad idea to use recursion to find the Fibonacci of a number because this will lead to solving subproblems repeatedly thereby increasing the time complexity.

$f(n) = f(n - 1) + f(n - 2)$

Take f(4) for example;

Solving via recursion would give us a tree like this, we can see that f(2) is called multiple times which can be a bottleneck. This solution will give us a time complexity of 2^n. Memoization which is saving the results of function calls in order not to repeat work can help reduce our time complexity here down to O(n).

$f(4) = f(3) + f(2)$
$f(3) = f(2) + f(1)$
$f(2) = f(1) + f(0)$

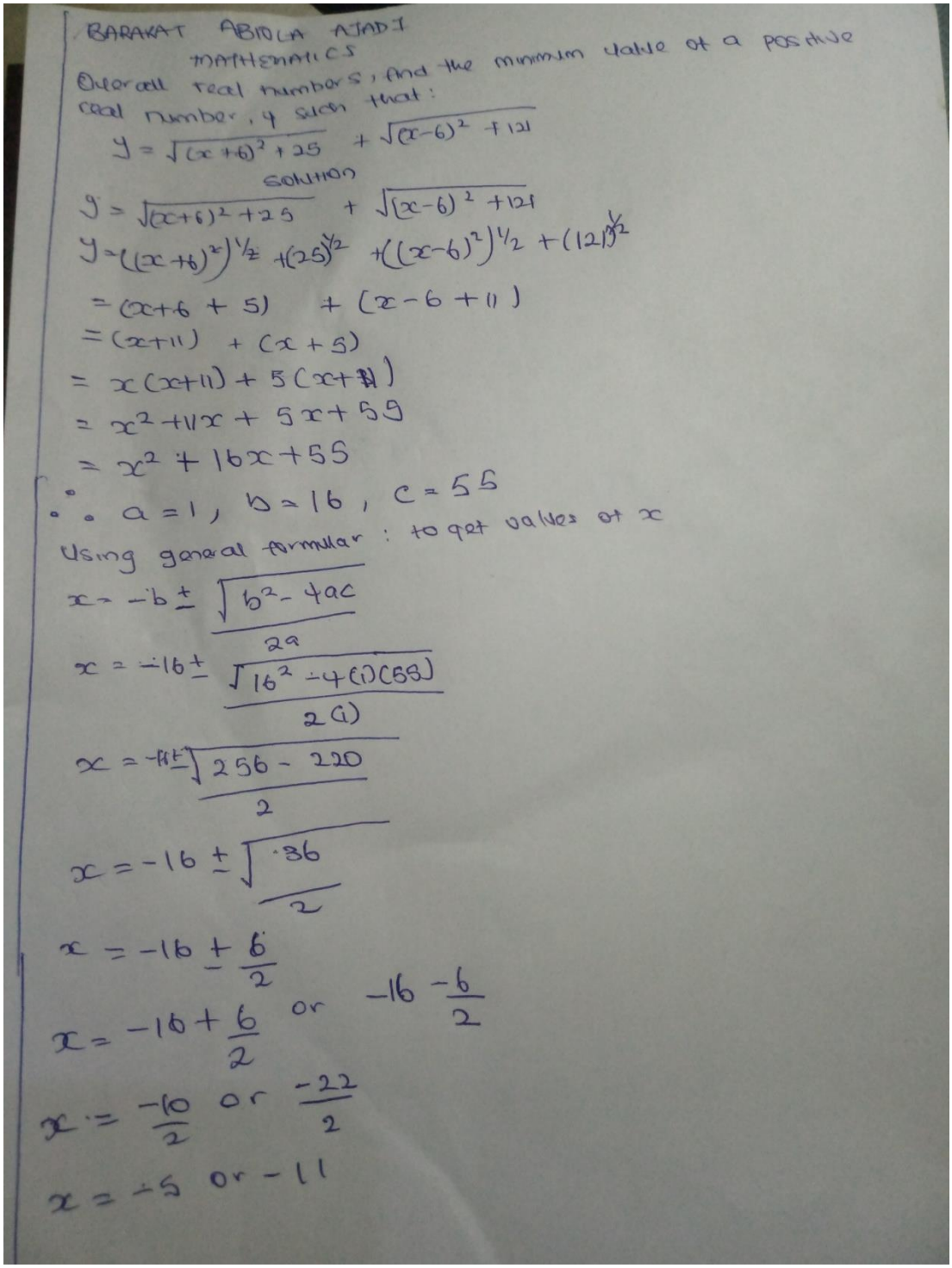


Question 2: (Using python)

```
import math



def isPrime(p):
    n = p // 2 + 1
    for a in range(1, n):
        power = (p - 1) / 2
        num = (a ** power) + 1


        if num % p == 0:
            return True


    return False



# print(isPrime(113))
```

Mathematics

Question 1:



when $x = -5$

$y = x^2 + 16x + 55$

$y = (-5)^2 + 16(-5) + 55$

$y = 25 - 80 + 55$

$y = 0$

when $x = -11$

$y = x^2 + 16x + 55$

$y = (-11)^2 + 16(-11) + 55$

$y = 121 - 176 + 55$

$y = 0$

the minimum value of y is zero (0).

(2)