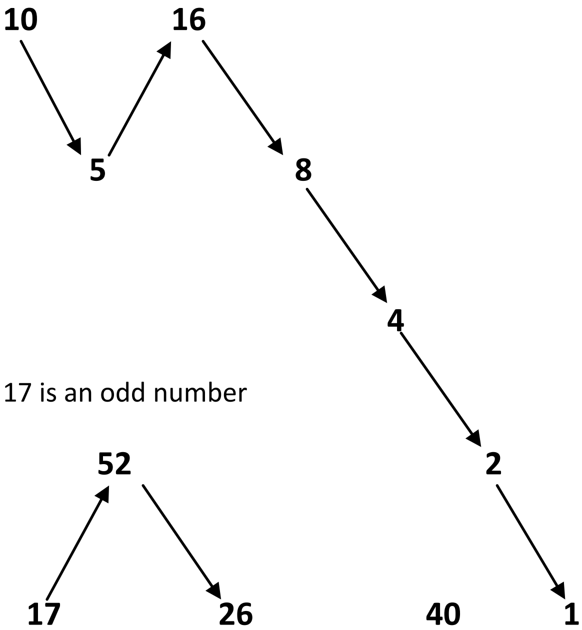
COLLATZ CONJECTURE PROOF

SIDI ABDESSALAM YASSINE THEOREM

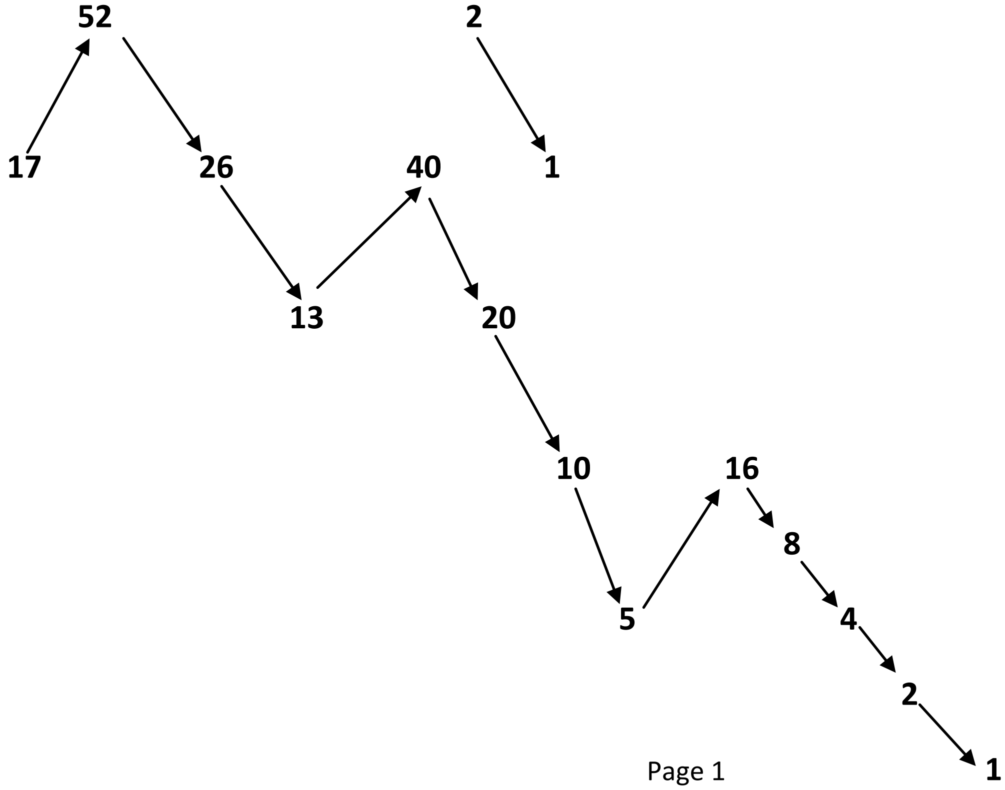
INTRODUCTION:

The **Collatz Conjecture** is one of the most famous unsolved problems in mathematics .It is named after mathematician **LOTHAR COLLATZ** who proposed it in **1937** , **Collatz Conjecture** is also known as **(3n+1 problem)** or the **(3n+1 Conjecture)**

The Collatz Conjecture states that if you take any positive integer n and apply a simple set of rules repeatedly, eventually you will always end up with the number 1.
The rules are as follows:
If n is an even number, divide it by 2
If n is an odd number, multiply it by 3 and add 1
For example:
10 is an even number



17 is an odd number



NOTION:

The natural numbers are divided in 3 groups:

Odd numbers that are written as : odd = 2n+1

Even numbers that are written as : even = 2^n .odd , hence : $n \in N^*$

Even pure numbers that are written as : even.p = 2^m , hence : $m \in N^*$

CONJECTURE PROOF FOR ODD NUMBERS ODD=2N+1:

* The Martyr Ismail Haniyeh Formula:

As we have written before that Even pure numbers are expressed as follows:

even.p = 2^m , hence : $m \in N^*$

Let $\sum_{n=1}^{\infty} even.p$ be the sum of all even pure numbers , hence :

$$\sum_{n=1}^{\infty} even.p = 2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + \ldots\ldots\ldots\ldots$$

Now , let us calculate the sum of $\sum_{n=1}^{\infty} even.p$

we have: $\sum_{n=1}^{\infty} even.p = 2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + \ldots\ldots\ldots\ldots$

*2 we are going to multiply 2 by $\sum_{n=1}^{\infty} even.p$ and we get as a result this :

$$2.\sum_{n=1}^{\infty} even.p = 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + \ldots\ldots\ldots\ldots$$

We have: $\sum_{n=1}^{\infty} even.p - 2 = 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + \ldots\ldots\ldots\ldots$

Let us replace $\sum_{n=1}^{\infty} even.p - 2$ its value and we get as a result this :

$$1= \quad 2.\sum_{n=1}^{\infty} even.p = \sum_{n=1}^{\infty} even.p - 2$$

$$1 \Longleftrightarrow 2.\sum_{n=1}^{\infty} even.p - \sum_{n=1}^{\infty} even.p = -2$$

$1 \Longleftrightarrow \sum_{n=1}^{\infty} even.p = -2$ and we call this formula: **The martyr Ismail Haniyeh Formula**

Let $\sum All\ Numbers$ be the sum of all natural numbers

And let $\sum odd$ be the sum of all odd numbers

And let $\sum Even$ be the sum of all even numbers

We have:

$$\sum All.Numbers$$ = 1+2+3+4+5+6+7+8+9+10+11+12+13+14+15+16+17+18

+19+20+21+22+23+24+25+26+27+28+29+30+31+32+33

+34+35+36+37+38+39+40+41+.................................

Let us delete all even pure numbers and all odd numbers; we will get as a result:

(1) $$\sum All.Numbers - \sum odd - \sum_{n=1}^{\infty} even.p = Rest$$

Hence Rest is a result

Rest= 6+10+12+14+18+20+22+24+26+28+30+34+36+38+40+42+44

+46+48+50+52+54+56+58+60+62+66+68+70+72+74+76+78+.................

Then:

Rest = 2*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

4*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

8*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

16*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

....

+

....

Therefore

Rest = 2^1*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

2^2*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

2^3*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

2^4*(3+5+7+9+11+13+15+17+19+21+23+...........)

+

....

+

....

Then : **Rest** = $(2^1 +2^2 +2^3 +2^4 +2^5 +......) * (3+5+7+9+11+13+15+17+19+21+23+......)$

We have $\sum odd$ = 1+3+5+7+9+11+13+15+17+........

Then : $\sum odd - 1$ = 3+5+7+9+11+13+15+17+........

Using Ismail Haniyeh Formula , we get :

$2^1 +2^2 +2^3 +2^4 +2^5 +........ = \sum_{n=1}^{\infty} even.p = -2$

Therefore: **Rest** = $\sum_{n=1}^{\infty} even.p *(\sum odd - 1)$

Then: **Rest** = $-2*(\sum odd - 1)$

Rest = 2 - 2*$\sum odd$

this formula: is one of **Sidi Mbarek Formula**

* Lalla Raqiyeh Formula:

Let us substitute this Formula in the equation 1 and we get as a result :

this formula:

(3) = $\sum All.Numbers - \sum odd - \sum_{n=1}^{\infty} even.p$ = Rest

(3) $\Longleftrightarrow \sum All.Numbers - \sum odd - \sum_{n=1}^{\infty} even.p = 2 - 2\sum odd$

(3) $\Longleftrightarrow \sum All.Numbers - \cancel{\sum odd} - \sum_{n=1}^{\infty} even.p = 2 - \cancel{\sum odd} - \sum odd$

(3) $\Longleftrightarrow \sum All.Numbers - \sum_{n=1}^{\infty} even.p = 2 - \sum odd$

We have :

$\sum All.Numbers = \sum odd + \sum Even$

Then:

(3) $\Longleftrightarrow \sum odd + \sum Even - \sum_{n=1}^{\infty} even.p = 2 - \sum odd$

(3) $\Longleftrightarrow$ **$\sum Even + 2\sum odd - 2 = \sum_{n=1}^{\infty} even.p$**

this formula is **Lalla Rqiyeh Formula**

Lalla Rqiyeh is the mother of my spiritual Father **Sidi Abdessalam Yassine** may Allah sanctify his secret

* Mohammed Ben Sellam Formula:

We have $Z(S) = 1/1^s + 1/2^s + 1/3^s + 1/4^s + 1/5^s + 1/6^s + 1/7^s + \ldots\ldots\ldots\ldots$

Let us substitute S for 0, then we get:

$Z(0) = 1/1^0 + 1/2^0 + 1/3^0 + 1/4^0 + 1/5^0 + 1/6^0 + 1/7^0 + \ldots\ldots\ldots\ldots$

$Z(0) = 1 + 1 + 1 + 1 + 1 + 1 + 1 + \ldots\ldots\ldots\ldots$

Therefore:

$Z(0) = (2-1) + (4-3) + (6-5) + (8-7) + (10-9) + (12-11) + \ldots = 1 + 1 + 1 + 1 + 1 + 1 + 1 + \ldots$

We conclude that:

$Z(0) = (2+4+6+8+10+12+\ldots\ldots) - (1+3+5+7+9+11+\ldots\ldots) = 1+1+1+1+1+\ldots\ldots$

Therefore:

$$(4) \quad = \sum Even - \sum odd = Z(0)$$

$$(4) \Longleftrightarrow \sum Even = \sum odd + Z(0)$$

$$(4) \Longleftrightarrow \sum Even = 3\sum odd - 2\sum odd + Z(0)$$

$$(4) \Longleftrightarrow \sum Even + 2\sum odd = 3\sum odd + Z(0)$$

$$(4) \Longleftrightarrow \sum Even + 2\sum odd - 1 - 1 = 3\sum odd + (Z(0) - 1 - 1)$$

$$(4) \Longleftrightarrow \sum Even + 2\sum odd - 2 = 3\sum odd + (Z(0) - 1 - 1)$$

We have:

$Z(0) = 1+1+1+1+1+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

Then: $Z(0) - 1 - 1 = (1+1+1+1+1+\ldots\ldots\ldots) - 1 - 1 = Z(0)$

Therefore:

$$(4) \Longleftrightarrow \sum Even + 2\sum odd - 2 = 3\sum odd + Z(0)$$

And we have also:

$Z(0) = 1+1+1+1+1+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

Then:

$Z(0) + 1 + 1 = (1+1+1+1+1+\ldots\ldots\ldots\ldots) + 1 + 1 = 1+1+1+1+1+\ldots = Z(0)$

Therefore:

(4) $\Longleftrightarrow \sum Even + 2\sum odd - 2 = 3\sum odd + Z(0) + 1 + 1$

As a result:

(4) $\Longleftrightarrow \boldsymbol{\sum Even + 2\sum odd - 2 = 3\sum odd + Z(0) + 2}$

this formula is **Mohammed Ben Sellam Formula**

Mohammed Ben Sellam is the father of my spiritual Father **Sidi Abdessalam Yassine** may Allah sanctify his secret .

* Lalla Nadia Yassine Formula:

Using Lalla Raqiyeh Formula

(3) $\Longleftrightarrow \sum Even + 2\sum odd - 2 = \sum_{n=1}^{\infty} even.p$

Using Mohammed Ben Sellam Formula

(4) $\Longleftrightarrow \sum Even + 2\sum odd - 2 = 3\sum odd + Z(0) + 2$

We conclude:

$$\boldsymbol{3\sum odd + Z(0) + 2 = \sum_{n=1}^{\infty} even.p}$$

this formula is **Lalla Nadia Formula**

Using Lalla Nadia Yassine Formula

$$3\sum odd + Z(0) + 2 = \sum_{n=1}^{\infty} even.p$$

$$3\sum odd + Z(0) + 2 = 2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + \ldots\ldots\ldots$$

$$\boldsymbol{3\sum odd + Z(0) = 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + \ldots\ldots\ldots}$$

$\sum odd = odd_a + (odd_e + odd_t + odd_c) + (odd_b + odd_g + odd_r + odd_n + odd_d)$

$+ (odd_h + odd_l + odd_i + odd_p + odd_j + odd_v + odd_y)$

$+ (odd_q + odd_z + odd_u + odd_s + odd_o + odd_{ff} + odd_{tty} + odd_{er} + odd_{sw})$

+(11 odd numbers chosen randomly)

+(13 odd numbers chosen randomly)

+(15 odd numbers chosen randomly)

+...

+...

+...

+(n odd numbers chosen randomly) ,hence n is an odd number

Therefore:

$$\sum odd = \sum_1 odd + \sum_3 odd + \sum_5 odd + \sum_7 odd + \sum_9 odd + \sum_{11} odd + \sum_{13} odd + \sum_{15} odd + \sum_{17} odd + \ldots\ldots\ldots\ldots\ldots\ldots + \sum_n odd$$

Hence:

$\sum_1 odd$ is the sum of only 1 odd number chosen randomly , $\sum_1 odd$ = odd_a

$\sum_3 odd$ is the sum of 3 odd numbers chosen randomly ,

And $\sum_3 odd$ = (odd_e+ odd_t+ odd_c)= odd_{ddf}

$\sum_5 odd$ is the sum of 5 odd numbers chosen randomly ,

And $\sum_5 odd$ = (odd_b+ odd_g+ odd_r+ odd_n+ odd_d)= odd_{gtr}

$\sum_7 odd$ is the sum of 7 odd numbers chosen randomly ,

And $\sum_7 odd$ =(odd_h+ odd_l+ odd_i+ odd_p+ odd_j+ odd_v+ odd_y) = odd_{jk}

$\sum_9 odd$ is the sum of 9 odd numbers chosen randomly ,

And $\sum_9 odd$ =(odd_q+ odd_z+ odd_u+ odd_s+ odd_o+ odd_{ff}+ odd_{tty}+ odd_{er}+ odd_{sw})= odd_{jk}

$\sum_{11} odd$ is the sum of 11 odd numbers chosen randomly ,

And $\sum_{11} odd$ =(11 odd numbers chosen randomly) = odd_{htfs}

$\sum_{13} odd$ is the sum of 13 odd numbers chosen randomly ,

And $\sum_{13} odd$ =(13 odd numbers chosen randomly) = odd_{ggtr}

$\sum_{15} odd$ is the sum of 15 odd numbers chosen randomly ,

And $\sum_{15} odd$ =(15 odd numbers chosen randomly) = odd_{utdx}

$\sum_n odd$ is the sum of n odd numbers chosen randomly , n is an odd number

And $\sum_n odd$ =(n odd numbers chosen randomly) = odd_m

Therefore:

$$3\sum odd = 3\sum_1 odd + 3\sum_3 odd + 3\sum_5 odd + 3\sum_7 odd + 3\sum_9 odd + 3\sum_{11} odd + 3\sum_{13} odd + 3\sum_{15} odd + 3\sum_{17} odd + \ldots\ldots\ldots\ldots\ldots\ldots + 3\sum_n odd$$

As a result:

$$3\sum odd\ +Z(0) = (3\sum_1 odd +1)+ (3\sum_3 odd +1)+ (3\sum_5 odd +1) +(3\sum_7 odd +1)+ (3\sum_9 odd +1)+ (3\sum_{11} odd +1) +(3\sum_{13} odd +1)+ (3\sum_{15} odd +1)+ (3\sum_{17} odd +1) +(3\sum_{19} odd +1)+\dots\dots+(3\sum_n odd +1)$$

Then:

$$\sum_{n=1}^{\infty} even.p\ -2^1 = (3\sum_1 odd +1)+ (3\sum_3 odd +1)+ (3\sum_5 odd +1) +(3\sum_7 odd +1)+ (3\sum_9 odd +1)+ (3\sum_{11} odd +1) +(3\sum_{13} odd +1)+ (3\sum_{15} odd +1)+ (3\sum_{17} odd +1) +(3\sum_{19} odd +1)+\dots\dots+(3\sum_n odd +1)$$

Consequently:

$$2^2 +2^3 +2^4 +2^5 +2^6 +2^7 +2^8 +2^9 +2^{10} +2^{11} +\dots\dots= (3\sum_1 odd +1) + (3\sum_3 odd +1)+ (3\sum_5 odd +1) +(3\sum_7 odd +1)+ (3\sum_9 odd +1)+ (3\sum_{11} odd +1) +(3\sum_{13} odd +1)+ (3\sum_{15} odd +1)+ (3\sum_{17} odd +1) +(3\sum_{19} odd +1)+\dots\dots+(3\sum_n odd +1)$$

We conclude that:

$\forall$ odd $\in N^*$, $\exists$ odd_x , Where: $(3odd_x+1)=2^m= R_n$ Where: $m\geq1$

Hence : $(3odd+1)=R_1$, we divide R_1 by 2 and we get R_2 ,and if R_2 is odd number ,we multiply by 3 and we add 1 , and if R_2 is an even number ,we divide by 2 . We repeat the same operation until we get R_n as a result.

Once we get $(3odd_x +1)= R_n =2^m$,we divide by 2 untill we get 1 as a result.

Then we multiply 1 by 3 and we add 1 , we get 4 as a result

Once we get 4 , we divide it by 2 we get 2 and we divide again by 2 we get 1

We repeat the same operation until infinity, we get always 1 as a result

As a conclusion

The **Collatz Conjecture** is true for n is an odd number 2n+1 hence n∈ N

CONJECTURE PROOF FOR EVEN NUMBERS 2^N.ODD:

Concerning even numbers that are written like: Even = 2^n.odd , hence odd $\neq 1$

We divide this even number by 2 until we get an odd number as a result

Once we get an odd number as a result , then the **Collatz Conjecture** is true for any Even number that is written like:

Even = 2^n.odd because the **Collatz Conjecture** is true for any odd number

CONJECTURE PROOF FOR EVEN PURE NUMBERS

EVEN.P:

Concerning even pure numbers that are written like: $even.p = 2^n$, hence $n \in N$

We divide the even pure number even.p by 2 until we get 1 as a result

Once we get 1 as a result, we multiply it by 3 and we add 1 : (3*1 +1) = 4

Then we get 4 as a result, we divide by 2 until we get 1

We repeat the same operation until infinity, we get always 1 as a result

We conclude that **Collatz Conjecture** is true for any Even pure number that is written like: $even.p = 2^n$

SIDI ABDESSALAM YASSINE THEOREM :CONJECTURE PROOF FOR ANY NATURAL NUMBER $n \in N$

Depending on conjecture proof for odd numbers, and conjecture proof for even numbers written like $Even = 2^n.odd$

and depending on conjecture proof for even pure numbers written like $even.p = 2^m$

We conclude that **Collatz Conjecture** is true for any natural number

This conjecture proof is **Sidi Abdessalam Yassine Theorem**

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