* Valid perfect Square

16 → 4
9 → 3
14 → X

1 → 1
1+3 → 4
1+3+5 → 9
1+3+5+7 → 16
1+3+5+7+9 → 25

} Not optimal for $2^{31}-1$ larger values.

newton's method

$x = \left(x + n/x\right) >>> 1$

16 → 16 + 16/16 >>> 1 → 8
8 + 16/8 >>> 1 → 5
5 + 16/5 >>> 1 → 4
4 + 16/4 >>> 1 → 4
4 + 16/4 >>> 1 → 4

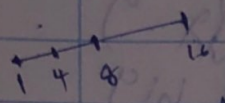
15 → 15 + 15/15 >>> 1 → 8

8 + 15/8 >>> 1 → 4

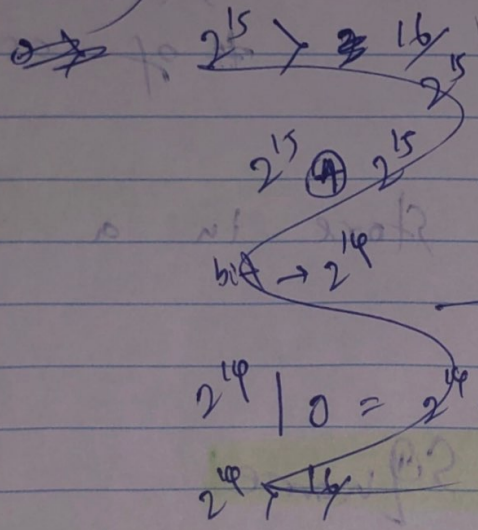
4 + 15/4 >>> 1 → 3

stop.

~~3 + 15/3 >>> 1 →~~



Bit Masking



n = 16

root = 0

bit = 2^{15}

root = 2^{15} → root = 0 → bit = 2^{14}

root = 2^{14} → root = 0 → bit = 2^{13}

root = 2^{13} → root = 0 → bit = 2^{12}

$2^4 \Rightarrow 16$

~~root = 2^4 root = bit = 2^4~~

root = 2^5

n=16

root=0

bit=2^{15}

root = 2^{15}, root=0, bit=2^{14};

root = 1000000000000000, bit=2^{13}

root = 1000000000000000, bit=2^{12}

root = 0, bit=2^{11}

root = 2^{5}, bit=2^{5}

root = 2^{3} ⇒ 100000, bit

root = 2^{3} = 0 bit=2^{2}

root = 2^{2}, bit=2^{1}

root = 110 ⇒ 100, bit=1

root = 101 ⇒ 100, bit=0

n=15

root=0

bit=2^{14}

root=0, bit=2^{14}

root = 2^{3}=0, bit=2^{2}

root = 2^{2}=0, bit=2^{1}

root=2, bit=1

root=3, bit=0

Keep a mask & check for square value. If square value is greater, don't consider that mask value. Otherwise take or with mask & continue.

Scanned with CamScanner