Ben Pung

Prof Orduz

Advanced Algorithms

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5.2

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Description automatically generated

a.

t1 = x + 0

t2 = (t1 \* x) -4

t3 = (t2 \* x) +1

t4 = (t3 \* x) + 0

t5 = (t4 \* x ) + 6

b.

t1 = 11x + 0

t2 = (t1 \* x) +0

t3 = (t2 \* x) + 0

t4 = (t3 \* x) + 0

t5 = (t4 \* x ) + 0

t6 = (t5 \*x) + 22

c.

t1 = x + 12

t2 = (t1 \* x) + 22

t3 = (t2 \* x) +11

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Description automatically generated

I will use exponentiation and essentially double the exponent every time

a.

x^2 = x \* x

x^4 = x^2 \* x^2

x^8 = x^4 \* x^4

x^11 = x^8 \* x^2 \* x

total is 5 multiplications

b.

x^2 = x \* x

x^4 = x^2 \* x^2

x^8 = x^4 \* x^4

x^16 = x^ 8 \* x^8

x^32 = x^16 \* x^16

and so on…. The number of multiplications coincides with the power of 2. For example, x^8 has 3 multiplications because it is 2^3 . Therefore, I know:

2^11 = 2048.

I need 2047. So I will multiply by x^-1 (I don’t have this already stored in a variable so I need to create its first instance as well).

X^2047 = X^2048 \* x^-1

For a total of 12 multiplications!

c.

2^5 =- 32 so 5 multiplications based on previous evaluation

X^33 = X^32 \* x for a total of 6 multiplications.

d.2^6 is 64 for 6 multiplications.

X^ 96 = X^64 \*x^32 (which you already have) \* x^4 (which you already have)

For a total of 8 multiplications.