Arithmetic Pipeline

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- Arithmetic pipeline units are usually found in very high speed computers.
- They are used to implement floating point operations, multiplication of fixed point numbers and similar computations.
- Floating point operations are easily decomposed into sub operation.
- The i/p to the floating point adder pipeline are two normalized floating point binary numbers

$$X = A \times 2^{a}$$

$$Y = B \times 2^{b}$$

Where A and B are the fraction that represents mantissa and a & b are the exponent

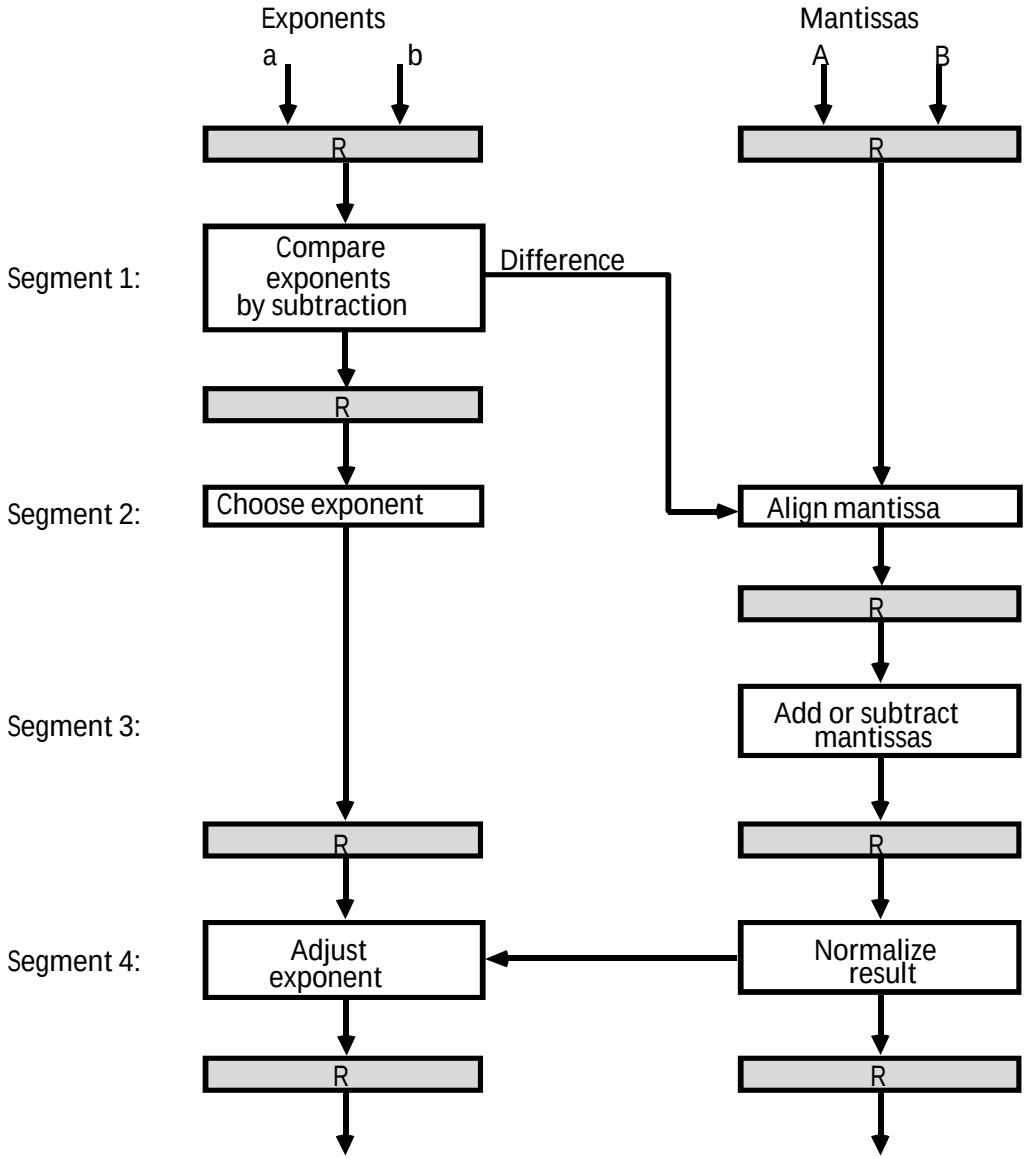
ARITHMETIC PIPELINE

Floating-point adder

[1] Compare the exponents
[2] Align the mantissa
[3] Add/sub the mantissa
[4] Normalize the result

$X = A \times 10^a = 0.9504 \times 10^3$
$Y = B \times 10^b = 0.8200 \times 10^2$

1) Compare exponents :
   $3 - 2 = 1$
2) Align mantissas
   $X = 0.9504 \times 10^3$
   $Y = 0.08200 \times 10^3$
3) Add mantissas
   $Z = 1.0324 \times 10^3$
4) Normalize result
   $Z = 0.10324 \times 10^4$



Arithmetic Pipeline

- The exponents are compared by subtracting them to their difference. The larger exponent is chosen as the exponent of the result.
- The exponent difference determines how many times the mantissa associated with smaller exponent must be shifted to the right.
- The result is normalized in segment 4. when an overflow occurs, the mantissa is shifted right and exponent is incremented by 1.
- If an underflow occurs the number of leading zero's in the mantissa determines number of left shift in the mantissa and the exponent is subtracted accordingly.